Problem 1   Write a program that asks the user to enter the day of the week. If the day is either *Tuesday* or *Thursday* it should print a message *You have a CS111 class today.* otherwise it prints: *No CS111 today!*

Here is a sample to show how the program runs.

```
What day is it? Thursday
You have a CS111 class today.
```

Answer:

```cpp
int main() {
   string day;
   cout << "What day is it? ";
   cin >> day;
   if (day == "Tuesday" || day == "Thursday")
     cout << "You have a CS111 class today.\n";
   else cout << "No CS111 today!\n";
   return 0;
}
```

Problem 2   The following program asks the user to enter a number n. It then prints a picture showing a triangle that points to the right that has *2n - 1* rows and n columns. For example, if $n = 4$ the program would print:

```
*
**
***
****
***
**
*
```

Some pieces of code have been replaced by **PART (a)**, **PART (b)**, and so on. To answer the 5 parts of this question you should supply the **C++** code that was replaced. Each answer must fit on a single line.

```cpp
int main() {
   int n;
   cout << "What is n?";
   PART (a)
   for (int r = 1; PART (b)) {
      for (int c = 1; PART (c)) {
         if (PART (d)) cout << "*";
      }
      PART (e)
   }
   return 0;
}
```

(a) Give a replacement for PART (a) to read the user's value of n

Answer: PART (a) is   `cin >> n;`

(b) Give a replacement for PART (b) to loop over rows of the picture:

Answer: PART (b) is   `r <= 2*n - 1; r++`

(c) Give a replacement for PART (c) to loop over columns of the picture:

Answer: PART (c) is   `c <= n; c++`

(d) Give a replacement for PART (d) to test whether to print a star

Answer: PART (d) is   `c <= r && c <= 2 * n - r`

(e) Give a replacement for PART (e) to finish each row

Answer: PART (e) is   `cout << endl;`

Problem 3   Consider the following `C++` program.

```cpp
int main() {
   int x = 6, y = 0, z = 3;
   double a = 5.0, b= 4.0;
   cout << x << x * a << endl;                          // line (a)
   cout << (y % z) << "\nn\n" << z / x << endl;         // line (b)
   if ((a < x) && (b > y)) cout << "Hello" << endl;     // line (c)
   for (; x <= 9; x++) cout << x;                       // line (d)
   cout << endl;
   cout << sqrt(b) * sqrt(b) / x * z << endl;           // line (e)
}
```

(a) What is the ouput at line (a)?

Answer:

```
630
```

(b) What is the ouput at line (b)?

Answer:

```
0
n
0
```

(c) What is the ouput at line (c)?

Answer:

```
Hello
```

(d) What is the ouput at line (d)?

Answer:

```
6789
```

(e) What is the ouput at line (e)?

Answer:

```
1.2
```

Problem 4   Write a program that uses a `C++` function to generate a number n between 1000 and 2000 and then prints all out all integers between 1 and n that square to a number ending in 61. For example, 31 would be printed because $31^2 = 961$. (You should make sure that different random numbers are generated each time your program is run.)

Answer:

```cpp
int main() {
   srand(time(0));
   int n = rand() % 1001 + 1000;
   for (int x = 1; x <= n; x++) {
      if (x * x % 100 == 61)
         cout << x << endl;
   }
   return 0;
}
```

Problem 5   Write a program that asks the user to enter the temperature in New York and then asks the user to enter the temperature in Los Angeles. If the temperature in New York is higher, it should print the message *Liar!* otherwise it should print a message *You need to take a vacation.*

Here is a sample to show how the program runs.

```
What is the temperature in New York? 30
What is the temperature in Los Angeles? 75
You need to take a vacation.
```

Answer:

```cpp
int main() {
    int ny, la;
    cout << "What is the temperature in New York? ";
    cin >> ny;
    cout << "What is the temperature in Los Angeles? ";
    cin >> la;
    if (ny > la) cout << "Liar!\n";
    else cout << "You need to take a vacation.\n";
    return 0;
}
```

Problem 6   The following program asks the user to enter a number n. It then prints a picture showing a downward pointing triangle with n rows and $2n$ - 1 columns. For example, if $n = 4$ it would print:

```
*******
 *****
  ***
   *
```

Some pieces of code have been replaced by `PART (a)`, `PART (b)`, and so on. To answer the 5 parts of this question you should supply the `C++` code that was replaced. Each answer must fit on a single line.

```cpp
int main() {
    int n;
    cout << "What is n?";
    cin >> n;
    for (int r = 1; PART (a)) {
        for (int c = 1; PART (b)) {
            if (PART (c)) cout << " ";
            PART (d)
        }
        PART (e)
    }
    return 0;
}
```

(a) Give a replacement for PART (a) to loop over rows of the picture:

Answer: PART (a) is   `r <= n; r++`

(b) Give a replacement for PART (b) to loop over columns of the picture:

Answer: PART (b) is   `c <= 2 * n - 1; c++`

(c) Give a replacement for PART (c) to test whether to print a blank

Answer: PART (c) is   `c < r || c > 2 * n - r`

(d) Give a replacement for PART (d) to print *s

Answer: PART (d) is   `else cout << "*";`

(e) Give a replacement for PART (e) to finish each row

Answer: PART (e) is   `cout << endl;`

Problem 7   Consider the following `C++` program.

```cpp
int main() {
    int x = 3, y = 1, z = 4;
    double a = 4.0, b= 5.0;
    cout << x << x * a << endl;                     // line (a)
    cout << (z % y) << "\n" << z / x << endl;       // line (b)
    if ((a < z) && (b > y)) cout << "Hello" << endl;  // line (c)
    for (; x <= 9; x++) cout << "x";                // line (d)
    cout << endl;
    cout << sqrt(a) / z << endl;                    // line (e)
}
```

(a) What is the ouput at line (a)?

Answer:

```
312
```

(b) What is the ouput at line (b)?

Answer:

```
0
1
```

(c) What is the ouput at line (c)?

Answer:

(d) What is the ouput at line (d)?

Answer:

```
xxxxxxx
```

(e) What is the ouput at line (e)?

Answer:

```
0.5
```

Problem 8   Write a program that prints out all integers between 1 and 1000 for which the square root has a 0 as the first digit after the decimal place. For example, the number 198 should be printed because its square root begins 14.0712 but 199 is not printed because its square root begins 14.1067.

Answer:

```cpp
int main() {
    for (int n = 1; n <= 1000; n++) {
        double y = sqrt(n);
        int z = (int) y;
        if (y - z < 0.1) cout << n << endl;
    }
    return 0;
}
```

Problem 9   Write a complete C++ program that asks the user to type an integer n. It should then ask the user to enter n more numbers and print the average of these numbers.

Partial credit will be given for programs that perform some of the required steps but excessively long or complicated programs will lose credit.

Examples of two sample runs of the program:

```
venus> ./a.out                              venus> ./a.out
Enter an integer: 4                         Enter an integer: 1
Now enter 4 more numbers: 5 6 7 8           Now enter 1 more numbers: 8
Their average is 6.5                        Their average is 8
venus>                                      venus>
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter an integer: ";
   cin >> n;

   cout << "Now enter " << n << " more numbers: ";
   int x, sum = 0;
   for (int c = 1; c <= n; c++) {
      cin >> x;
      sum += x;
   }
   cout << "Their average is " << ((double) sum) / n << endl;
   return 0;
}
```

Problem 10

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line of C++ code. No answer can use more than one line of code. Assume that variables x, y, z with type int have been declared.

(a) Prompt the user to enter values for x, y and z.

Answer:

```cpp
cout << "Enter values for x, y and z:";
```

(b) Read the values of x, y and z given by the user

Answer:

```cpp
cin >> x >> y >> z;
```

(c) If x < y < z, replace z by y - x

Answer:

```cpp
if (x < y && y < z) z = y - x;
```

(d) Set x to be the remainder when y is divided by z

Answer:

```
x = y % z;
```

(e) Print x copies of the word HELLO (each on its own line of output)

Answer:

```
for (int n = 1; n <= x; n++) cout << "HELLO" << endl;
```

Problem 11   Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 2, y = 5, z = 65;
    string qc = "Queens College";
    string cs = "CS111";
    for (int c = x; c < y; c++) cout << cs; cout << endl;      // line (a)
    cout << (z % y) / (y % x) << endl;                          // line (b)
    if ((x > y) && (y > z)) cout << qc << endl;                 // line (c)
    cout << cs << " / " << (y - x) << " = CS1\n";               // line (d)
    cout << x << "%" << y << "=" << "x % y" << "\n";            // line (e)
}
```

(a) What is the output at line (a)?

Answer:

CS111CS111CS111

(b) What is the output at line (b)?

Answer:

0

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

CS111 / 3 = CS1

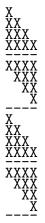(e) What is the output at line (e)?

Answer:

2%5=x % y

Problem 12   Write a complete C++ program that asks the user for a number n of triangles to print. It then prints n triangles made of X symbols, one above another. Each triangle has n rows and every second triangle is upside down. The triangles should be separated by lines of - symbols.

For example, here is the output from the program where the user specifies 4 for n.

Excessively long or poorly presented programs will lose credit. A reasonable solution should not require more than 30 lines of code. Very much shorter solutions are also possible.

```
Enter the number of triangles: 4
X
XX
XXX
XXXX
----
XXXX
 XXX
  XX
   X
----
X
XX
XXX
XXXX
----
XXXX
 XXX
  XX
   X
----
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter the number of triangles: ";
   cin >> n;
   cout << endl;

   for (int t = 1; t <= n; t++)
      for (int r = 1; r <= n + 1; r++) {
         for (int c = 1; c <= n; c++)
            if (r == n + 1) cout << "-";
            else if (t % 2 == 1 && c <= r) cout << "X";
            else if (t % 2 == 0 && c >= r) cout << "X";
            else cout << " ";
         cout << endl;
      }
   return 0;
}
```

Problem 13   Write a complete C++ program that asks the user to type an integer n. It should then ask the user to enter n more numbers and print out how many of these numbers were odd.

Partial credit will be given for programs that perform some of the required steps but excessively long or complicated programs will lose credit.

Examples of two sample runs of the program:

```
venus> ./a.out                            venus> ./a.out
Enter an integer: 4                        Enter an integer: 5
Now enter 4 more numbers: 6 7 8 9          Now enter 5 more numbers: 1 3 5 7 9
2 were odd                                 5 were odd
venus>                                     venus>
```
Answer:

```
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter an integer: ";
   cin >> n;

   cout << "Now enter " << n << " more numbers: ";
   int x, count = 0;
   for (int c = 1; c <= n; c++) {
      cin >> x;
      if (x % 2 == 1) count++;
   }
   cout << count << " were odd\n";
   return 0;
}
```

Problem 14

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line of C++ code. No answer can use more than one line of code. Assume that variables a, b, c with type int have been declared and initialized.

(a) Prompt the user to enter values for b and c.

Answer:

```
cout << "Enter values for b and c:";
```

(b) Read the values of b and c given by the user

Answer:

```
cin >> b >> c;
```

(c) If c > b > 0, set a to be 5.

Answer:

```
if (c > b && b > 0) a = 5;
```

(d) If any of a, b and c is negative set c to be 6.

Answer:

```
if (a < 0 || b < 0 || c < 0) c = 6;
```

(e) Print c copies of b separated by spaces but on one line of output.

Answer:

```
for (int n = 1; n <= c; n++) cout << b << " ";
```

Problem 15 Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 9, y = 4, z = 25;
    string qc = "Quick";
    string cs = "C++";
    for (int c = x; c < y; c++) cout << cs; cout << endl;     // line (a)
    cout << (z % y) / (y % x) << endl;                        // line (b)
    if ((x > y) && (z > y)) cout << qc << endl;               // line (c)
    cout << cs << " / " << (y - x) << " = Java\n";            // line (d)
    cout << x << "%" << y << "=" << "x % y" << "\n";          // line (e)
}
```

(a) What is the output at line (a)?

Answer:

(b) What is the output at line (b)?

Answer:

0

(c) What is the output at line (c)?

Answer:

Quick

(d) What is the output at line (d)?

Answer:

C++ / -5 = Java

(e) What is the output at line (e)?

Answer:

9%4=x % y

Problem 16 Write a complete C++ program that asks the user for a number n of triangles to print. It then prints n triangles made of O symbols, one above another. Each triangle has n rows and the triangles are alternately upside down from each other (in the way shown below). The triangles should be separated by lines of * symbols.

For example, here is the output from the program where the user specifies 4 for n.

Excessively long or poorly presented programs will lose credit. A reasonable solution should not require more than 30 lines of code. Very much shorter solutions are also possible.

```
Enter the number of triangles: 4
OOOO
 OOO
  OO
   O
****
O
OO
OOO
OOOO
****
```

```
OOOO
 OOO
  OO
   O
****
O
OO
OOO
OOOO
****
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter the number of triangles: ";
    cin >> n;
    cout << endl;

    for (int t = 1; t <= n; t++)
        for (int r = 1; r <= n + 1; r++) {
            for (int c = 1; c <= n; c++)
                if (r == n + 1) cout << "*";
                else if (t % 2 == 0 && c <= r) cout << "O";
                else if (t % 2 == 1 && c >= r) cout << "O";
                else cout << " ";
            cout << endl;
        }
    return 0;
}
```

Problem 17   Write a complete C++ program that asks the user to type two positive integers. It should show a horizontal bar of X symbols whose length is given by the shorter of the two integers. (If the two integers are equal, either can be used as the shorter.)

Partial credit will be given for programs that perform some of the required steps but excessively long or complicated programs will lose credit.

Examples of two sample runs of the program:

```
venus> ./a.out                              venus> ./a.out
Enter 2 positive integers: 4 2              Enter 2 positive integers: 4 5
XX                                          XXXX
venus>                                      venus>
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int a, b;
    cout << "Enter 2 positive integers: ";
    cin >> a >> b;

    for (int c = 1; c <= a && c <= b; c++) cout << "X";
    cout << endl;
    return 0;
}
```

Problem 18

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line of C++ code. No answer can use more than one line of code. Assume that variables a, b, c with type double have been declared and initialized.

(a) Prompt the user to enter values for b and c.

Answer:

```
cout << "Enter values for b and c:";
```

(b) Read the values of b and c given by the user

Answer:

```
cin >> b >> c;
```

(c) If c > b > 0 > a, set a to be 2.5.

Answer:

```
if (c > b && b > 0 && 0 > a) a = 2.5;
```

(d) If all of a, b and c are negative set c to be 6.6.

Answer:

```
if (a < 0 && b < 0 && c < 0) c = 6.6;
```

(e) Print 50 copies of a * symbol all on one line of output.

Answer:

```
for (int n = 1; n <= 50; n++) cout << "*";
```

Problem 19   Consider the following C++ program.

```
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    int   x = 2, y = 5, z = 8, w = 11;
    string a = "b", b = "a", c = "a";

    cout << a << c << x << z << endl;              // line (a)

    cout << a << "a" << "x" << a << endl;          // line (b)

    if (x != y) cout << "x" << "==" << y << endl;  // line (c)
```

```
    if ((x == y) || (b == c)) cout << x << "==" << "y" << endl;  // line (d)

    while (x <= w) {x *= 2; cout << x;}  cout << endl;            // line (e)

    cout << endl;
    return 0;
}
```

(a) What is the output at line (a)?

Answer:

ba28

(b) What is the output at line (b)?

Answer:

baxb

(c) What is the output at line (c)?

Answer:

x==5

(d) What is the output at line (d)?

Answer:

2==y

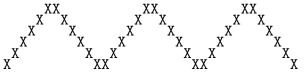(e) What is the output at line (e)?

Answer:

4816

Problem 20   Write a complete C++ program that asks the user for a number n of diagonal lines to print in a large extended type of M figure. It should make a picture using n diagonal lines (each n rows high) that slope upwards and then downwards in sequence. The lines should be made from the symbol X.

For example, here is the output from the program where the user specifies 6 for n.

Excessively long or poorly presented programs will lose credit. A reasonable solution should not require more than 30 lines of code. Very much shorter solutions are also possible.

```
Enter the number of diagonal lines: 6
     XX            XX            XX
    X  X          X  X          X  X
   X    X        X    X        X    X
  X      X      X      X      X      X
 X        X    X        X    X        X
X          XX X          XX X          X
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int n;
```

```
      cout << "Enter the number of diagonal lines: ";
      cin >> n;
      cout << endl;

      for (int r = 1; r <= n; r++) {
         for (int l = 1; l <= n; l++)
            for (int c = 1; c <= n; c++)
               if (l % 2 == 0 && c == r) cout << "X";
               else if (l % 2 == 1 && c + r == n + 1) cout << "X";
               else cout << " ";
         cout << endl;
      }
      return 0;
}
```

Problem 21 Write a complete C++ program that asks the user to type two positive integers. It should show a horizontal bar of $ symbols whose length is given by the longer of the two integers. (If the two integers are equal, either can be used as the longer.)

Partial credit will be given for programs that perform some of the required steps but excessively long or complicated programs will lose credit.

Examples of two sample runs of the program:

```
venus> ./a.out                              venus> ./a.out
Enter 2 positive integers: 4 2             Enter 2 positive integers: 4 5
$$$$                                        $$$$$
venus>                                      venus>
```
Answer:

```
#include <iostream>
using namespace std;

int main() {
   int a, b;
   cout << "Enter 2 positive integers: ";
   cin >> a >> b;

   for (int c = 1; c <= a || c <= b; c++) cout << "$";
   cout << endl;
   return 0;
}
```

Problem 22

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line of C++ code. No answer can use more than one line of code. Assume that variables x, y, z with type double have been declared.

(a) Prompt the user to enter values for x, y and z.
Answer:

```
   cout << "Enter values for x, y and z:";
```

(b) Read the values of x, y and z given by the user
Answer:

```
   cin >> x >> y >> z;
```

(c) If $0 < y^2 - 4xz < y^2$, print NEGATIVE

Answer:

```
   if (y*y -4*x*z > 0 && y*y - 4*x*z < y*y) cout << "NEGATIVE\n";
```

(d) Set x to be the cube of y

Answer:

```
   x = y * y * y;
```

(e) Print 80 copies of the number 5 (all on the same line of output)

Answer:

```
   for (int n = 1; n <= 80; n++) cout << 5;
```

Problem 23 Consider the following C++ program.

```
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    int  a = 5, b = 8, c = 11, d = 2;
    string x = "z", y = "z", z = "x";

    cout << a << c << x << z << endl;                          // line (a)

    cout << a << "a" << "x" << a << endl;                      // line (b)

    if (x != y) cout << "x" << "==" << y << endl;              // line (c)

    if ((x == y) || (b == c)) cout << x << "==" << "y" << endl;  // line (d)

    while (a <= b) {b -= 1; cout << x;}  cout << endl;         // line (e)

    cout << endl;
    return 0;
}
```

(a) What is the output at line (a)?

Answer:

```
511zx
```

(b) What is the output at line (b)?

Answer:

```
5ax5
```

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

```
z==y
```

(e) What is the output at line (e)?

Answer:

```
zzzz
```

Problem 24   Write a complete C++ program that asks the user for a number n of diagonal lines to print in a large extended type of W figure. It should make a picture using n diagonal lines (each n rows high) that slope downwards and then upwards in sequence. The lines should be made from the symbol W.

For example, here is the output from the program where the user specifies 6 for n.

Excessively long or poorly presented programs will lose credit. A reasonable solution should not require more than 30 lines of code. Very much shorter solutions are also possible.

```
Enter the number of diagonal lines: 6
W                   WW                  WW                  W
  W               W    W              W    W              W
    W           W        W          W        W          W
      W       W            W      W            W      W
        W   W                W  W                W  W
          WW                  WW                  WW
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter the number of diagonal lines: ";
    cin >> n;
    cout << endl;

    for (int r = 1; r <= n; r++) {
        for (int l = 1; l <= n; l++)
            for (int c = 1; c <= n; c++)
                if (l % 2 == 1 && c == r) cout << "W";
                else if (l % 2 == 0 && c + r == n + 1) cout << "W";
                else cout << " ";
        cout << endl;
    }
    return 0;
}
```

Problem 25   Write a complete C++ program that asks the user to enter their name and age. If the user is less than 10 or more than 99, the program should terminate with a message of *Too young* or *Too old*. Otherwise, it should say hello to the user and tell them the first and last digits of their age.

Partial credit will be given for programs that perform some of the required steps but excessively long or complicated programs will lose credit.

Examples of two sample runs of the program:

```
venus> ./a.out
Name:   Freddy
Age: 5
Too young.
venus>
```

```
venus> ./a.out
Name:   Freddy
Age: 24
Hello Freddy.
The first digit of your age is 2
and the last digit is 4.
venus>
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int age;
   string name;
   cout << "Name:   ";
   cin >> name;
   cout << "Age:   ";
   cin >> age;
   if (age < 10) cout << "Too young.\n";
   else if (age > 99) cout << "Too old.\n";
   else {
      cout << "Hello " << name << "." << endl;
      cout << "The first digit of your age is " << age / 10 << endl;
      cout << "and the last is " <<  age % 10 << "." << endl;
   }
   return 0;
}
```

Problem 26

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line of C++ code. No answer can use more than one line of code. Assume that integer variables x, y, z have been declared.

(a) Prompt the user to enter values for x and y.
Answer:

```cpp
cout << "Enter values for x and y:";
```

(b) Read the values of x and y given by the user
Answer:

```cpp
cin >> x >> y;
```

(c) If x < y < 10, replace x by 10
Answer:

```cpp
if (x < y && y < 10) x = 10;
```

(d) Set z to be a random number between 20 and 36

Answer:

```
z = rand() % 17 + 20;
```

(e) Print z copies if the square root of x (each on its own line)

Answer:

```
for (int n = 1; n <= z; n++) cout << sqrt(x) << endl;
```

Problem 27   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int x = 5, y = 10, z = 15;
    cout << "x " << x << " x % x" << endl;          // line (a)
    cout << (z % y) << "\n" << x / y << endl;        // line (b)
    if ((x > y) || (y > x)) cout << y % z << endl;   // line (c)
    for (int a = 1; a <= 5; a++) cout << "a";        // line (d)
    cout << endl;
    cout << x % y - 7 << endl;                        // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
x 5 x % x
```

(b) What is the output at line (b)?

Answer:

```
5
0
```

(c) What is the output at line (c)?

Answer:

```
10
```

(d) What is the output at line (d)?

Answer:

```
aaaaa
```

(e) What is the output at line (e)?

Answer:

```
-2
```

Problem 28   Write a complete C++ program that asks the user for a number n and then prints a large grid of small squares. Each small square has size $(n-1) \times (n-1)$ and contains $*$ symbols. The large grid should have n rows each of which contains n small squares, with a blank column separating these squares. The rows of small squares in the large grid should be separated by blank rows.

For example, if the user specified 3 for n, the program would print as follows:

```
** ** **
** ** **

** ** **
** ** **

** ** **
** ** **
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a grid size: ";
   cin >> n;

   for (int r = 1; r < n * n; r++) {
      for (int c = 1; c < n * n; c++)
         if ( r % n != 0 && c % n != 0) cout << "*";
         else cout << " ";
      cout << endl;
   }
   return 0;
}
```

Problem 29   Write a complete C++ program that asks the user to type a big integer n. It should then ask 4 times for the user to type a smaller value of n and then terminate the program. However, if the user ever enters a value that is not smaller it should immediately say *Goodbye* and terminate the program.

Partial credit will be given for programs that perform some of the required steps but excessively long or complicated programs will lose credit.

Examples of two sample runs of the program:

```
venus> ./a.out
Type a big integer n:   100
Type a smaller value of n: 20
Type a smaller value of n: 10
Type a smaller value of n: 2
Type a smaller value of n: 1
venus>
```

```
venus> ./a.out
Type a big integer n:   100
Type a smaller value of n: 0
Type a smaller value of n: 0
Goodbye
venus>
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n, smaller;
   cout << "Type a big integer n:   ";
   cin >> n;
   for (int i = 1; i <= 4; i++) {
```

```
            cout << "Type a smaller value of n: ";
            cin >> smaller;
            if (smaller >= n) {
                cout << "Goodbye" << endl;
                return 0;
            }
            n = smaller;
        }
        return 0;
}
```

Problem 30

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of
C++ code. Most answers need no more than two lines. No solution can use more than four lines. Assume that the
following variables have been declared.

```
    int x, y, age;  double z;  string name, a, b;
```

(a) Print a prompt and then read values from the screen for variables x and y (in this order).

Answer:

```
    cout << "Enter integers x and y: ";
    cin >> x >> y;
```

(b) If x is negative, assign *name* as *Freddy* otherwise as *Jack*

Answer:

```
    if (x < 0) name = "Freddy";
    else name = "Jack";
```

(c) Print *name* a total of y times on different output lines.

Answer:

```
    for (int c = 1; c <= y; c++) cout << name << endl;
```

(d) Until x and y are not equal, repeatedly make the user enter a new value for y

Answer:

```
    while (x == y) {
        cout << "Enter a different value of y: ";
        cin >> y;
    }
```

(e) Print the last digit of the larger of x and y

Answer:

```
    if (x > y) cout << x % 10;
    else cout << y % 10;
```

Problem 31   Consider the following C++ program. Suppose that a user runs the program and enters 10 and then 4 as input.

```cpp
#include <iostream>
using namespace std;

int main() {
    int  a, b, c;
    cout << "Enter two\npositive integers\n";          // line (a)
    cin >> a >> b;

    if ((a > b) && (b > 4)) cout << a - b << endl;      // line (b)
    else cout << b - a << endl;

    c = a + b;
    for (int n = (c / 2); n <= (c * 2); n += 3) cout << n;   // line (c)
    cout << endl;

    cout << c + b / a << endl;                          // line (d)

    cout << (c + b) % a << endl;                        // line (e)

    return 0;
}
```

(a) What is the output at line (a)?

Answer:

```
Enter two
positive integers
```

(b) What is the output from the instruction beginning at line (b)?

Answer:

```
-6
```

(c) What is the output at line (c)?

Answer:

```
710131619222528
```

(d) What is the output at line (d)?

Answer:

```
14
```

(e) What is the output at line (e)?

Answer:

```
8
```

Problem 32   Write a complete C++ program that asks the user for a number n and prints n upward diagonal stripes (each with height n and width n) in a horizontal sequence.

For example, if the user specified 4 for n, the program would print as follows:

```
   *   *   *   *
  *   *   *   *
 *   *   *   *
*   *   *   *
```

(Each stripe should begin in the column after the previous one ends. Do not try to check whether the user input is legal or sensible.)

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter the number n: ";
    cin >> n;

    for (int r = n; r >= 1; r--) {
        for (int stripe = 1; stripe <= n; stripe++) {
            for (int c = 1; c <=n; c++) {
                if (r == c) cout << "*";
                else cout << " ";
            }
        }
        cout << endl;
    }
    return 0;
}
```

Problem 33   Write a complete C++ program that asks the user to type a big integer n. It should then ask 5 times for the user to type a bigger value of n and then thank the user. However, if the user ever enters a value that is not bigger it should immediately exit with no message.

Partial credit will be given for programs that perform some of the required steps but excessively long or complicated programs will lose credit.

Examples of two sample runs of the program:

```
venus> ./a.out
Type a big integer n:   100
Type a bigger value of n: 200          venus> ./a.out
Type a bigger value of n: 300          Type a big integer n:   100
Type a bigger value of n: 400          Type a bigger value of n: 200
Type a bigger value of n: 500          Type a bigger value of n: 150
Type a bigger value of n: 600          venus>
Thank you
venus>
```
Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n, bigger;
    cout << "Type a big integer n:   ";
    cin >> n;
    for (int i = 1; i <= 5; i++) {
        cout << "Type a bigger value of n: ";
        cin >> bigger;
        if (bigger <= n) return 0;
```

```
      n = bigger;
    }
    cout << "Thank you\n";
    return 0;
}
```

Problem 34

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Most answers need no more than two lines. No solution can use more than four lines. Assume that the following variables have been declared.

```
int x, y, age;  double z;  string name, a, b;
```

(a) Print a prompt and read the value of *name* and of *age* from the screen (in this order).

Answer:

```
cout << "Enter name and age: ";
cin >> name >> age;
```

(b) Until *age* is between 10 and 110, repeatedly make the user enter a new value for *age*

Answer:

```
while ((age < 10) || (age > 110)) {
    cout <<"Enter your real age: ";
    cin >> age;
}
```

(c) Print the tens and units digits of *age* (on two lines, in this order):

Answer:

```
cout << (age / 10) % 10 << endl << age % 10 << endl;
```

(d) if the user's *name* is Freddy set *x* to 4 otherwise set *x* to 5

Answer:

```
if (name == "Freddy") x = 4;
else x = 5;
```

(e) Print the user's *name* a total of *x* times separated by spaces

Answer:

```
for (int c = 1; c <= x; c++) cout << name << " ";
```

Problem 35   Consider the following C++ program. Suppose that a user runs the program and enters 6 and then 5 as input.

```
#include <iostream>
using namespace std;

int main() {
    int  a, b, c;
    cout << "Enter two\npositive integers\n";              // line (a)
    cin >> a >> b;

    if ((a > b) && (b > 4)) cout << a - b << endl;         // line (b)
    else cout << b - a << endl;

    c = a + b;
    for (int n = (c / 2); n <= (c * 2); n += 3) cout << n;  // line (c)
    cout << endl;

    cout << c + b / a << endl;                             // line (d)

    cout << (c + b) % a << endl;                           // line (e)

    return 0;
}
```

(a) What is the output at line (a)?

Answer:

Enter two
positive integers

(b) What is the output from the instruction beginning at line (b)?

Answer:

1

(c) What is the output at line (c)?

Answer:

5811141720

(d) What is the output at line (d)?

Answer:

11

(e) What is the output at line (e)?

Answer:

4

Problem 36   Write a complete C++ program that asks the user for an odd number n and prints n large X patterns (each with height n and width n) in a horizontal sequence.

For example, if the user specified 5 for n, the program would print as follows:

```
*    **    **    **    **    *
 * *   * *   * *   * *   * *
  *     *     *     *     *
 * *   * *   * *   * *   * *
*    **    **    **    **    *
```

(Each X should begin in the column after the previous one ends. Do not try to check whether the user input is legal or sensible.)

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter an odd number n: ";
    cin >> n;

    for (int r = 1; r <= n; r++) {
        for (int cross = 1; cross <= n; cross++) {
            for (int c = 1; c <= n; c++) {
                if ((r == c) || ((r + c) == (n + 1))) cout << "*";
                else cout << " ";
            }
        }
        cout << endl;
    }
    return 0;
}
```

Problem 37   Write a complete C++ program that asks the user 5 questions. The first question asks the user to think of a multiple of 1, the second question asks for a multiple of 2, and so on. However, if the user ever enters a value that is not a multiple as required the program should immediately say *Wrong* and terminate.

Partial credit will be given for programs that perform some of the required steps but excessively long or complicated programs will lose credit.

Examples of two sample runs of the program:

```
venus> ./a.out
Think of a multiple of 1: 4
Think of a multiple of 2: 4
Think of a multiple of 3: 6
Think of a multiple of 4: 4
Think of a multiple of 5: 5
venus>
```

```
venus> ./a.out
Think of a multiple of 1: 4
Think of a multiple of 2: 4
Think of a multiple of 3: 4
Wrong
venus>
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    for (int i = 1; i <= 5; i++) {
        cout << "Think of a multiple of " << i << ": ";
        cin >> n;
        if ((n % i) != 0) {
            cout << "Wrong" << endl;
            return 0;
        }
    }
    return 0;
}
```

Problem 38

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Most answers need no more than two lines. No solution can use more than four lines. Assume that the following variables have been declared.

```
int x, y, age;   double z;   string name, a, b;
```

(a) Print a prompt and read values from the screen for y and x (in this order).

Answer:

```
cout << "Enter integers y and x: ";
cin >> y >> x;
```

(b) If y is an even number , assign *name* as Freddy otherwise as Jack

Answer:

```
if ((y % 2) == 0) name = "Freddy";
else name = "Jack";
```

(c) Print *name* a total of x times on one line, separted by spaces

Answer:

```
for (int c = 1; c <= x; c++) cout << name << " ";
```

(d) Until x and y are not equal, repeatedly subtract 1 from x and divide y by 2

Answer:

```
while (x == y) {
    x -= 1;
    y = y / 2;
}
```

(e) Print the last digit of the larger of x and y.

Answer:

```
if (x > y) cout << x % 10;
else cout << y % 10;
```

Problem 39   Consider the following C++ program. Suppose that a user runs the program and enters 10 and then 4 as input.

```
#include <iostream>
using namespace std;

int main() {
    int  a, b, c;
    cout << "Enter two\npositive integers\n";           // line (a)
    cin >> a >> b;
```

```
      if ((a > b) && (b > 2)) cout << a - b << endl;          // line (b)
      else cout << b - a << endl;

      c = a + b;
      for (int n = (c / 2); n <= (c * 2); n *= 2) cout << n;   // line (c)
      cout << endl;

      cout << c + b / a << endl;                               // line (d)

      cout << (c + b) % a << endl;                             // line (e)

      return 0;
}
```

(a) What is the output at line (a)?

Answer:

```
Enter two
positive integers
```

(b) What is the output from the instruction beginning at line (b)?

Answer:

```
6
```

(c) What is the output at line (c)?

Answer:

```
71428
```

(d) What is the output at line (d)?

Answer:

```
14
```

(e) What is the output at line (e)?

Answer:

```
8
```

Problem 40   Write a complete C++ program that asks the user for a number n and prints n squares made of ∗ symbols each with an upward diagonal stripe made of O symbols. Each square has height n and width n and the squares form a horizontal sequence.

For example, if the user specified 4 for n, the program would print as follows:

```
***O ***O ***O ***O
**O* **O* **O* **O*
*O** *O** *O** *O**
O*** O*** O*** O***
```

(Between each pair of squares leave a gap of one blank column.)

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter the number n: ";
   cin >> n;

   for (int r = n; r >= 1; r--) {
      for (int square = 1; square <= n; square++) {
         for (int c = 1; c <=n; c++) {
            if (r == c) cout << "O";
            else cout << "*";
         }
         cout << " ";
      }
      cout << endl;
   }
   return 0;
}
```

Problem 41   Write a complete C++ program that asks the user 4 questions. The first question asks the user to think of a number that ends in 1, the second question asks for a number ending in 2, and so on. If the user correctly answers all 4 questions the program should print a message *Well done.* However, if the user ever enters a value with the wrong last digit the program should immediately terminate.

Partial credit will be given for programs that perform some of the required steps but excessively long or complicated programs will lose credit.

Examples of two sample runs of the program:
```
venus> ./a.out
Think of a number that ends in 1: 11
Think of a number that ends in 2: 12
Think of a number that ends in 3: 13
Think of a number that ends in 4: 14
Well done
venus>
```
```
venus> ./a.out
Think of a number that ends in 1: 11
Think of a number that ends in 2: 10
venus>
```
Answer:
```
#include <iostream>
using namespace std;

int main() {
   int n;
   for (int i = 1; i <= 4; i++) {
      cout << "Think of a number that ends in " << i << ": ";
      cin >> n;
      if ((n % 10) != i) return 0;
   }
   cout << "Well done" << endl;
   return 0;
}
```

Problem 42

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Most answers need no more than two lines. No solution can use more than four lines. Assume that the following variables have been declared.

```
int x, y, age;  double z;  string name, a, b;
```

(a) Print a prompt and read the value of *age* and *name* from the screen (in this order).

Answer:

```
cout << "Enter age and name: ";
cin >> age >> name;
```

(b) Until *age* is between 10 and 120, repeatedly make the user enter a new value for *age*

Answer:

```
while ((age < 10) || (age > 120)) {
    cout <<"Enter your real age: ";
    cin >> age;
}
```

(c) Set x as the tens digit and y as the units digit of *age*

Answer:

```
x = (age / 10) % 10;
y = age % 10;
```

(d) if the user's *name* is Freddy set x to y otherwise set y to x

Answer:

```
if (name == "Freddy") x = y;
else y = x;
```

(e) Print a 2 digit number whose first digit is x and second digit is y

Answer:

```
cout << x << y;
```

Problem 43   Consider the following C++ program. Suppose that a user runs the program and enters 4 and then 7 as input.

```
#include <iostream>
using namespace std;

int main() {
    int  a, b, c;
    cout << "Enter two\npositive integers\n";            // line (a)
    cin >> a >> b;

    if ((a > b) && (b > 2)) cout << a - b << endl;       // line (b)
    else cout << b - a << endl;

    c = a + b;
    for (int n = (c / 2); n <= (c * 2); n *= 2) cout << n;   // line (c)
    cout << endl;
```

```
    cout << c + b / a << endl;                              // line (d)

    cout << (c + b) % a << endl;                            // line (e)

    return 0;
}
```

(a) What is the output at line (a)?

Answer:

```
Enter two
positive integers
```

(b) What is the output from the instruction beginning at line (b)?

Answer:

```
3
```

(c) What is the output at line (c)?

Answer:

```
51020
```

(d) What is the output at line (d)?

Answer:

```
12
```

(e) What is the output at line (e)?

Answer:

```
2
```

Problem 44   Write a complete C++ program that asks the user for a number n and prints n squares made of $*$ symbols each with an downward diagonal stripe made of Z symbols. Each square has height n and width n and the squares form a horizontal sequence.

For example, if the user specified 4 for n, the program would print as follows:

```
Z*** Z*** Z*** Z***
*Z** *Z** *Z** *Z**
**Z* **Z* **Z* **Z*
***Z ***Z ***Z ***Z
```

(Between each pair of squares leave a gap of one blank column.)

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter the number n: ";
    cin >> n;

    for (int r = 1; r <= n; r++) {
```

```
        for (int square = 1; square <= n; square++) {
            for (int c = 1; c <=n; c++) {
                if (r == c) cout << "Z";
                else cout << "*";
            }
            cout << " ";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 45   The following C++ program has errors at the lines marked a,b,c,d, and e. For each answer write a single line of C++ that fixes all errors in the corresponding line. Do not change anything that is correct.

```
#Include <iostream>                // line a
using namespace std;

int main{                          // line b

    int x = 1, y = 2;

    for (int x == 1; x < 10; x++);    // line c

    cout << y % y  endl;              // line d

    return;                           // line e
}
```

(a) Correct line (a):

Answer:

```
#include <iostream>
```

(b) Correct line (b):

Answer:

```
int main() {
```

(c) Correct line (c):

Answer:

```
    for (int x = 1; x < 10; x++);
```

(d) Correct line (d):

Answer:

```
    cout << y % y << endl;
```

(e) Correct line (e):

Answer:

```
    return 0;
```

Problem 46

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume that x and y have been declared.

```
    int x;   double y;
```

(a) Read a value of x typed on the screen by the user

Answer:

```
   cin >> x;
```

(b) If x is negative, replace x by the 4th power of its value

Answer:

```
   if (x < 0) x = x * x * x * x;
```

(c) Print on the screen the last 2 digits of x.

Answer:

```
   cout << x % 100 << endl;
```

(d) Print on the screen a random number between 1 and x (inclusive).

Answer:

```
   cout << 1 + rand() % x << endl;
```

(e) Set y to the exact value of the quotient of x by 100.

Answer:

```
   y = x / 100.0;
```

Problem 47   Consider the following C++ program. Suppose that a user runs the program and enters -10 as input.

```
#include <iostream>
using namespace std;

int main() {
    int  a;
    cout << "Enter a\npositive integer\n";                   // line (a)
    cin >> a;

    cout << a << - a << a - a << endl;                       // line (b)

    for (int n = a; n <= 0; n += 4) cout << n;               // line (c)
    cout << endl;

    cout << a + 20 / 3 << endl;                              // line (d)

    cout << (a + 20) % 3 << endl;                            // line (e)

    return 0;
}
```

(a) What is the output at line (a)?

Answer:

```
Enter a
positive integer
```

(b) What is the output at line (b)?

Answer:

```
-10100
```

(c) What is the output at line (c)?

Answer:

```
-10-6-2
```

(d) What is the output at line (d)?

Answer:

```
-4
```

(e) What is the output at line (e)?

Answer:

```
1
```

Problem 48   Write a complete C++ program that asks the user to enter a positive integer n. If n is not positive the program should print a message *Not positive. Enter another:* and continue to do this until the user enters a positive integer. Then the program should print n squares of *s with decreasing size that begin with an $n \times n$ square and end with a 1×1 square. The right hand edges of the squares should line up. (Partial credit will be given for the parts of the program that you complete successfully.) Excessively long solutions lines might lose some credit.

For example, here is a sample run of the program:

```
Enter a positive integer n: -3
Not positive. Enter another: 4
****
****
****
****
 ***
 ***
 ***
  **
  **
   *
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a positive integer n: ";
   cin >> n;
   while (n <= 0) {
      cout << "Not positive. Enter another: ";
      cin >> n;
   }
   for (int s = n; s>= 1; s--) {
```

```
        for (int r = 1; r <= s; r++) {
            for (int c = 1; c <= n; c++)
                if (c > n - s) cout << "*";
                else cout << " ";
            cout << endl;
        }
    }
    return 0;
}
```

Problem 49   The following C++ program has errors at the lines marked a,b,c,d, and e. For each answer write a single line of C++ that fixes all errors in the corresponding line. Do not change anything that is correct.

```
#include <IOstream>              // line a
using namespace std;

Int main()                      // line b

    int z = 5; double y = 12.0;

    for (z = 1; z < 10; z--);   // line c

    cout << y % z << endl;      // line d

    return z                    // line e
}
```

(a) Correct line (a):

Answer:

```
#include <iostream>
```

(b) Correct line (b):

Answer:

```
int main() {
```

(c) Correct line (c):

Answer:

```
    for (z = 1; z < 10; z++);
```

(d) Correct line (d):

Answer:

```
    cout << ((int) y) % z << endl;
```

(e) Correct line (e):

Answer:

```
    return z;
```

Problem 50

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume that x and y have been declared.

```
      int y;   double x;
```

(a) Read a value of x typed on the screen by the user.

Answer:

```
   cin >> x;
```

(b) If x is negative, replace x by the 2nd power of its value.

Answer:

```
   if (x < 0) x = x * x;
```

(c) Make y be the closest integer to x (round up half).

Answer:

```
   y = (int) (x + 0.5);
```

(d) Print to the screen a random number between 0 and y (inclusive).

Answer:

```
   cout << rand() % (y + 1) << endl;
```

(e) Set x to the exact value of the quotient of y by 13.

Answer:

```
   x = y / 13.0;
```

Problem 51   Consider the following C++ program. Suppose that a user runs the program and enters 6 as input.

```
#include <iostream>
using namespace std;

int main() {
    int  a;
    cout << "Enter a\npositive integer\n";                  // line (a)
    cin >> a;

    cout << a << - a << a - a << endl;                      // line (b)

    for (int n = a; n <= 0; n += 4) cout << n;              // line (c)
    cout << endl;

    cout << a + 20 / 3 << endl;                             // line (d)

    cout << (a + 20) % 3 << endl;                           // line (e)

    return 0;
}
```

(a) What is the output at line (a)?

Answer:

```
Enter a
positive integer
```

(b) What is the output at line (b)?

Answer:

```
6-60
```

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

```
12
```

(e) What is the output at line (e)?

Answer:

```
2
```

Problem 52   Write a complete C++ program that asks the user to enter an odd positive integer n. If n is illegal the program must terminate at once. Otherwise the program should print squares of *s. that begin with an $n \times n$ square and end with a 1×1 square and such that the sizes of squares decrease by 2 as they go down the page. The right hand edges of the squares should line up. (Partial credit will be given for the parts of the program that you complete successfully.) Excessively long solutions lines might lose some credit.

For example, here is a sample run of the program:

```
Enter an odd positive integer n: 5
*****
*****
*****
*****
*****
  ***
  ***
  ***
    *
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter an odd positive integer n: ";
   cin >> n;
   if (n <= 0 || n % 2 == 0) return 0;
   for (int s = n; s>= 1; s-=2) {
      for (int r = 1; r <= s; r++) {
         for (int c = 1; c <= n; c++)
            if (c > n - s) cout << "*";
            else cout << " ";
         cout << endl;
      }
   }
   return 0;
}
```

Problem 53   The following C++ program has errors at the lines marked a,b,c,d, and e. For each answer write a single line of C++ that fixes all errors in the corresponding line. Do not change anything that is correct.

```
#INCLUDE <iostream>.                // line a
using namespace std;

int main{}({                        // line b

    int x = 1; y = 2;               // line c

    for (int x == 1; x == 1; x++);   // line d

    cout << y % y << endl;

    Return 10;                      // line e
}
```

(a) Correct line (a):
Answer:

```
#include <iostream>.
```

(b) Correct line (b):
Answer:

```
int main() {
```

(c) Correct line (c):
Answer:

```
    int x = 1, y = 2;
```

(d) Correct line (d):
Answer:

```
    for (int x = 1; x == 1; x++);
```

(e) Correct line (e):
Answer:

```
    return 10;
```

Problem 54

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume that *name* and *age* have been declared.

```
    int age;   string name;
```

(a) Read values of name and age typed on the screen by the user
Answer:

```
    cin >> name >> age;
```

(b) If the name is Freddy, divide the age by 10 and use that as age.
Answer:

```
    if (name == "Freddy") age = age / 10;
```

(c) Print on the screen the last 2 digits of the age.

Answer:

```
    cout << age % 100 << endl;
```

(d) Print on the screen a random number between 1 and age (inclusive).

Answer:

```
    cout << 1 + rand() % age << endl;
```

(e) Print the users name 5 times on 5 lines of the screen.

Answer:

```
    for (int i = 1; i <= 5; i++)
    cout << name << endl;
```

Problem 55   Consider the following C++ program. Suppose that a user runs the program and enters -20 as input.

```
#include <iostream>
using namespace std;

int main() {
    int  a;
    cout << "Enter a\npositive integer\n";            // line (a)
    cin >> a;

    cout << a << - a << a - a << endl;                // line (b)

    for (int n = a; n <= 0; n += 4) cout << n;        // line (c)
    cout << endl;

    cout << a + 20 / 3 << endl;                       // line (d)

    cout << (a + 20) % 3 << endl;                     // line (e)

    return 0;
}
```

(a) What is the output at line (a)?

Answer:

```
Enter a
positive integer
```

(b) What is the output at line (b)?

Answer:

```
-20200
```

(c) What is the output at line (c)?

Answer:

```
-20-16-12-8-40
```

(d) What is the output at line (d)?

Answer:

```
-14
```

(e) What is the output at line (e)?

Answer:

```
0
```

Problem 56   Write a complete C++ program that asks the user to enter a positive integer n. If n is not positive the program should print a message *Not positive. Enter another:* and continue to do this until the user enters a positive integer. Then the program should print a square of side n that is made up from a large letter L made of #'s in the left column and bottom row, then a slightly smaller L made made of o's inside it, then a smaller L made of #'s and so on. (Partial credit will be given for the parts of the program that you complete successfully.) Excessively long solutions lines might lose some credit.

For example, here is a sample run of the program:

```
Enter a positive integer n: -5
Not positive. Enter another: 7
#o#o#o#
#o#o#oo
#o#o###
#o#oooo
#o#####
#oooooo
#######
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer n: ";
    cin >> n;
    while (n <= 0) {
        cout << "Not positive. Enter another: ";
        cin >> n;
    }
    for (int r = n; r >= 1; r--) {
        for (int c = 1; c <= n; c++) {
            int x = r;
            if (c <= r) x = c;
            if (x % 2 == 0) cout << "o";
            else cout << "#";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 57   The following C++ program has errors at the lines marked a,b,c,d, and e. For each answer write a single line of C++ that fixes all errors in the corresponding line. Do not change anything that is correct.

```
include <iostream>                    // line a
using namespace std;

int main() {

    int z = 5, double y = 12.0;       // line b

    for (z = 1; z !> 10; z++);        // line c

    cout  (int) y % z  endl;          // line d

    Return z.                         // line e
}
```

(a) Correct line (a):

Answer:

```
#include <iostream>
```

(b) Correct line (b):

Answer:

```
    int z = 5; double y = 12.0;
```

(c) Correct line (c):

Answer:

```
    for (z = 1; z <= 10; z++);
```

(d) Correct line (d):

Answer:

```
    cout << (int) y % z << endl;
```

(e) Correct line (e):

Answer:

```
    return z;
```

Problem 58

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume that *score* and *name* have been declared.

```
    string name;  double score;
```

(a) Read the score and name typed on the screen by the user.

Answer:

```
    cin >> score >> name;
```

(b) If the name is not Freddy add a bonus of 10 to the score.

Answer:

```
        if (name != "Freddy") score += 10;
```

(c) Print the closest integer to the score (round up half).

Answer:

```
    cout << (int) (score + 0.5);
```

(d) Print to the screen a random integer between 1 and score.

Answer:

```
    cout << 1 + rand() % ((int) score) << endl;
```

(e) Print the user's name 20 times on one line of output.

Answer:

```
    for (int i = 1; i <= 20; i++) cout << name << " ";
    cout << endl;
```

Problem 59   Consider the following C++ program. Suppose that a user runs the program and enters 20 as input.

```
#include <iostream>
using namespace std;

int main() {
    int  a;
    cout << "Enter a\npositive integer\n";                  // line (a)
    cin >> a;

    cout << a << - a << a - a << endl;                      // line (b)

    for (int n = a; n <= 0; n += 4) cout << n;              // line (c)
    cout << endl;

    cout << a + 20 / 3 << endl;                             // line (d)

    cout << (a + 20) % 3 << endl;                           // line (e)

    return 0;
}
```

(a) What is the output at line (a)?

Answer:

```
Enter a
positive integer
```

(b) What is the output at line (b)?

Answer:

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

26

(e) What is the output at line (e)?

Answer:

1

Problem 60 Write a complete C++ program that asks the user to enter a positive integer n. If n is not positive the program must terminate at once. Then the program should print a square of side n that is made up from a large backwards letter L made of #'s in the right column and bottom row, then a slightly smaller reversed L made made of o's inside it, then a smaller reversed L made of #'s and so on. (Partial credit will be given for the parts of the program that you complete successfully.) Excessively long solutions lines might lose some credit.

For example, here is a sample run of the program:

```
Enter a positive integer n: 7
#o#o#o#
oo#o#o#
###o#o#
oooo#o#
#####o#
oooooo#
#######
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer n: ";
    cin >> n;
    if (n <= 0) return 0;
    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= n; c++) {
            int x = r;
            if (c >= r) x = c;
            if (x % 2 == n % 2) cout << "#";
            else cout << "o";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 61 The following C++ program has errors at the lines marked a,b,c,d, and e. For each answer write a single line of C++ that fixes the errors in the corresponding line.

```
#include <iostream>
      using namespace std              // line a

int main();                           // line b

{    int x = 1;

     while (0 < x < 5) {              // line c

         cout >> x % x >> "\n\n"      // line d

         x = x++;                     // line e

     }
     return 0;
}
```

(a) Correct line (a):

Answer:

```
using namespace std;                  // line a
```

(b) Correct line (b):

Answer:

```
int main()                           // line b
```

(c) Correct line (c):

Answer:

```
     while (0 < x && x < 5) {         // line c
```

(d) Correct line (d):

Answer:

```
        cout << x % x << "\n\n";      // line d
```

(e) Correct line (e):

Answer:

```
        x++;                         // line e
```

Problem 62

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume that an integer variable x has been declared.

(a) Prompt the user to enter a value for x.

Answer:

```
   cout << "Enter a value for x:";
```

(b) Read the value of x given by the user

Answer:

```
    cin >> x;
```

(c) If x is negative, replace x by the value of 5 - x

Answer:

```
    if (x < 0) x = 5 - x;
```

(d) Print the square root of x.

Answer:

```
    cout << sqrt(x) << endl;
```

(e) On one output line, print x random numbers in the range 10 to 17 (inclusive)

Answer:

```
    for (int n = 1; n <= x; n++) cout << 10 + rand() % 8 << " ";
```

Problem 63   Consider the following C++ program.

```
#include <iostream>
using namespace std;

string fun(int x) {
   if (x < 0) return "Negative ";
   if ((x > 10) && (x < 100)) return "Big ";
   return "x + x ";
}

int main() {
   int  a = 4, b = 3;

   cout << a << b << a << "b" << endl;                        // line (a)

   cout << (a * b) % 10 << endl;                              // line (b)

   for (int n = 4; n <= 6; n++)   cout << n + b;              // line (c)
   cout << endl;

   cout << fun(-1) << endl;                                   // line (d)

   cout << fun(200) << endl;                                  // line (e)

   return 0;
}
```

(a) What is the output at line (a)?

Answer:

434b

(b) What is the output at line (b)?

Answer:

2

(c) What is the output at line (c)?

Answer:

789

(d) What is the output at line (d)?

Answer:

Negative

(e) What is the output at line (e)?

Answer:

x + x

Problem 64   Write a complete C++ program that asks the user to enter a positive integer n. If n is not positive the program should exit immediately. Otherwise the program should print a square with n rows that is cut by its diagonal (from upper left to lower right) into a lower triangle showing the symbol $ and an upper triangle showing the symbol $=$.

For example, if the user specified 5 for n, the program would print as follows:

```
$====
$$===
$$$==
$$$$=
$$$$$
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer n: ";
    cin >> n;
    if (n <= 0) return 0;
    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= n; c++)
            if (c <= r) cout << "$";
            else cout << "=";
        cout << endl;
    }
    return 0;
}
```


Problem 65   The following C++ program has errors at the lines marked a,b,c,d, and e. For each answer write a single line of C++ that fixes the errors in the corresponding line.


```cpp
#include <iostream>
Using      namespace std;              // line a
```

```
int main{}                              // line b

{    int x = 5;

     while (0 < x - 1 < 5) {            // line c

         cout >> x / (x + x % 1)  endl  // line d

         x = x--;                       // line e

     }
     return 0;
}
```

(a) Correct line (a):

Answer:

```
using namespace std;                    // line a
```

(b) Correct line (b):

Answer:

```
int main()                              // line b
```

(c) Correct line (c):

Answer:

```
     while (0 < x - 1 && x - 1 < 5) {   // line c
```

(d) Correct line (d):

Answer:

```
         cout << x / (x + x % 1) << "\n\n"; // line d
```

(e) Correct line (e):

Answer:

```
     x--;                               // line e
```

Problem 66

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume that an integer variables x and y have been declared.

(a) Prompt the user to enter positive values for x and y.

Answer:

```
   cout << "Enter values for x and y:";
```

(b) Read the values of x and y given by the user

Answer:

```
    cin >> x >> y;
```

(c) If x or y is not positive, exit the program

Answer:

```
    if ((x <= 0) || (y <= 0)) return 0;
```

(d) Print the square root of x + y.

Answer:

```
    cout << sqrt(x + y) << endl;
```

(e) On one output line, print x random numbers in the range 1 to y (inclusive)

Answer:

```
    for (int n = 1; n <= x; n++) cout << 1 + rand() % y << " ";
```

Problem 67   Consider the following C++ program.

```
#include <iostream>
using namespace std;

string fun(int x) {
   if (x < 0) return "Negative ";
   if ((x > 5) || (x < 1)) return "Big ";
   return "x % x";
}

int main() {
    int  a = 4, b = 3;

    cout << "a" << "b"  << endl;                              // line (a)

    cout << (a + b) % 10 << endl;                            // line (b)

    for (int n = 6; n >= 4; n--)  cout << n - b;             // line (c)
    cout << endl;

    cout << fun(-1) << endl;                                 // line (d)

    cout << fun(20) << endl;                                 // line (e)

    return 0;
}
```

(a) What is the output at line (a)?

Answer:

```
ab
```

(b) What is the output at line (b)?

Answer:

```
7
```

(c) What is the output at line (c)?

Answer:

```
321
```

(d) What is the output at line (d)?

Answer:

```
Negative
```

(e) What is the output at line (e)?

Answer:

```
Big
```

Problem 68   Write a complete C++ program that asks the user to enter a positive integer n. If n is not positive the program should exit immediately. Otherwise the program should print a square with n rows. The square is cut by the diagonal (from lower left to upper right) into two triangles. The lower triangle should be made from the symbol $ and an upper triangle from the symbol =.

For example, if the user specified 5 for n, the program would print as follows:

```
=====
====$
===$$
==$$$
=$$$$
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a positive integer n: ";
   cin >> n;
   if (n <= 0) return 0;
   for (int r = n; r >= 1; r--) {
      for (int c = 1; c <= n; c++)
         if (c <= r) cout << "=";
         else cout << "$";
      cout << endl;
   }
   return 0;
}
```

Problem 69   Write a complete C++ program that asks the user to enter a positive integer that leaves a remainder of either 3 or 4 when it is divided by 7. If the user gives incorrect input, the program should ask the user to try again as often as necessary. When the user succeeds, the program should report how many attempts were needed.

Sample output might be:

```
Enter a positive integer that is 3 or 4 modulo 7:    -3
Wrong.   Try again: 9
Wrong.   Try again: 10
Good.   You passed after 3 attempts.
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int x, attempts = 1;
    cout <<  "Enter a positive number that is 3 or 4 modulo 7: ";
    cin >> x;
    while(x <= 0 || x % 7 < 3 || x % 7 > 4) {
        cout << "Wrong.   Try again: ";
        cin >> x;
        attempts++;
    }
    cout << "Good you passed after " << attempts << " attempts.\n";
    return 0;
}
```

Problem 70

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume that int variables x, y, z have been declared and have legal values

(a) Print to the user's screen the word: *Hello*

Answer:

```cpp
cout << "Hello" << endl;
```

(b) Print the (integer) quotient that is found when y is divided by the product of x and z.

Answer:

```cpp
cout << y / (x * z) << endl;
```

(c) Print the exact value of $1/z$.

Answer:

```cpp
cout << 1.0 / z << endl;
```

(d) Change z so that it stores the last digit of y.

Answer:

```cpp
z = y % 10;
```

(e) Print all the numbers from 1 to z. (Put all numbers on the same line. Put spaces between numbers).

Answer:

```
for (int n = 1; n <= z; n++) cout << n << " ";
```

Problem 71   Consider the following C++ program.

```
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    int  x = 4, y = 4, z = 11, w = 7;
    string a = "x", b = "y", c = "a";

    cout << a << c << x << z << endl;                          // line (a)

    cout << a << "a" << "x" << a << endl;                      // line (b)

    if (x == y) cout << "x" << "==" << y << endl;              // line (c)

    if ((x == y) || (a == b)) cout << x << "==" << "y" << endl;  // line (d)

    while (x <= w) {x++; cout << x;}  cout << endl;            // line (e)

    cout << endl;
    return 0;
}
```

(a) What is the output at line (a)?

Answer:

xa411

(b) What is the output at line (b)?

Answer:

xaxx

(c) What is the output at line (c)?

Answer:

x==4

(d) What is the output at line (d)?

Answer:

4==y

(e) What is the output at line (e)?

Answer:

5678

Problem 72   Write a complete C++ program that asks the user to enter an odd positive integer n. If n is even or negative the program should exit. Otherwise the program should print a triangle with n rows and $(n+1)/2$ columns that points to the right.

For example, if the user specified 9 for n, the program would print as follows:

```
*
**
***
****
*****
****
***
**
*
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Type an odd positive integer: ";
   cin >> n;
   if (n <= 0 || n % 2 == 0) return 0;
   for (int r = 1; r <= n; r++) {
      for (int c = 1; c <= (n + 1)/2; c++) {
         if (c <= r &&  c + r <= (n + 1)) cout << "*";
         else cout << " ";
      }
      cout << endl;
   }
   return 0;
}
```

Problem 73   Write a complete C++ program that asks the user to enter a positive integer x. If the user enters a non-positive number the program should ask the user to try again as often as necessary. After the user has entered a positive value, the program should find (but not print) the remainders when x is divided by 7 and 8. It should then print the larger of these two remainders. (In case the two remainders are equal either can be printed.)

Sample output might be:

```
Enter a positive number: -4
Not positive.  Try again: 0
Not positive.  Try again: -2
Not positive.  Try again: 20
Bigger remainder is:  6
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int x;
   cout <<  "Enter a positive number: ";
   cin >> x;
   while(x <= 0) {
      cout << "Not positive.  Try again: ";
      cin >> x;
   }
   cout << "Bigger remainder is:  ";
   if (x % 7 > x % 8) cout << x % 7;
```

```
    else cout << x % 8;
    cout << endl;
    return 0;
}
```

Problem 74

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume that int variables x, y, z have been declared and have legal values

(a) Print z copies of the word *Hello*. Make each copy on its own line of output.

Answer:

```
    for (int i = 1; i <= z; i++) cout << "Hello" << endl;
```

(b) Print the (integer) quotient that is found when y is divided by z.

Answer:

```
    cout << y / z << endl;
```

(c) Print the exact value of $1/xyz$.

Answer:

```
    cout << 1.0 / (x * y * z) << endl;
```

(d) Change z so that it stores the quotient of y by x.

Answer:

```
    z = y / x;
```

(e) If $x \leq y \leq z$ then print x, otherwise print z.

Answer:

```
    if (x <= y && y <= z) cout << x << endl;
    else cout << z << endl;
```

Problem 75   Consider the following C++ program.

```
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    int  x = 7, y = 7, z = 11, w = 1;
```

```
        string a = "b", b = "a", c = "y";

        cout << a << c << x << z << endl;                          // line (a)

        cout << a << "a" << "x" << a << endl;                      // line (b)

        if (x == y) cout << "x" << "==" << y << endl;              // line (c)

        if ((x == y) && (a == b)) cout << x << "==" << "y" << endl;  // line (d)

        while (x >= w) {x -= 2; cout << x;}  cout << endl;         // line (e)

        cout << endl;
        return 0;
}
```

(a) What is the output at line (a)?

Answer:

by711

(b) What is the output at line (b)?

Answer:

baxb

(c) What is the output at line (c)?

Answer:

x==7

(d) What is the output at line (d)?

Answer:

(e) What is the output at line (e)?

Answer:

531-1

Problem 76 Write a complete C++ program that asks the user to enter a positive integer n. If n is not positive the program should exit. Otherwise the program should print n triangles in a vertical stack. Each triangle should have $2n - 1$ columns and n rows and should points upwards.

For example, if the user specified 3 for n, the program should print as follows:

```
  *
 ***
*****
  *
 ***
*****
  *
 ***
*****
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Type a positive integer: ";
   cin >> n;
   if (n <= 0) return 0;
   for (int triangle = 1; triangle <= n; triangle ++) {
      for (int r = n; r >= 1; r--) {
         for (int c = 1; c <= 2*n -1; c++) {
            if (c < r ||  c + r > 2*n) cout << " ";
            else cout << "*";
         }
         cout << endl;
      }
   }
   return 0;
}
```

Problem 77 Write a complete C++ program that asks the user to enter an odd positive integer n. If n is even or negative the program should exit. Otherwise the program should print a triangle with n columns and $(n+1)/2$ rows that points upwards.

For example, if the user specified 9 for n, the program would print as follows:

```
    *
   ***
  *****
 *******
*********
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Type an odd positive integer: ";
   cin >> n;
   if (n <= 0 || n % 2 == 0) return 0;
   for (int r = (n + 1) / 2; r >= 1; r--) {
      for (int c = 1; c <= n; c++) {
         if (c < r ||  c + r > (n + 1)) cout << " ";
         else cout << "*";
      }
      cout << endl;
   }
   return 0;
}
```

Problem 78 Write a complete C++ program that prints the numbers from 28 to 387 with 10 numbers (separated by spaces) on each line.

The output from your program should begin

```
28 29 30 31 32 33 34 35 36 37
38 39 40 41 42 43 44 45 46 47
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    for (int n = 28; n < 388; n++) {
        cout << n << " ";
        if (n % 10 == 7) cout << endl;
    }
    return 0;
}
```

Problem 79

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume the following variables have been declared and have legal values

```
int x = 18;
```

(a) Print to the user's screen the sentence: *In C++ an endl makes a new line.*
Answer:

```
cout << "In C++ an endl makes a new line." << endl;
```

(b) Print the square of x.
Answer:

```
cout << x * x << endl;
```

(c) Print a random number with 4 digits.
Answer:

```
cout << rand() % 9000  + 1000 << endl;
```

(d) Print all numbers less that 1000 that are either divisible 7 or are even and greater than 400.
Answer:

```
for (int n = 1; n < 1000; n++)
    if ((n % 7 == 0) || ((n % 2 == 0) && (n > 400))) cout << n << endl;
```

(e) Print the square root of $3/8$.
Answer:

```
cout << sqrt(3.0 / 8) << endl;
```

Problem 80   Consider the following C++ program.

```cpp
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    double x = 9.0, y = 16.0, z = 25.0;
    string a = "b", b = "a";
    cout << sqrt(z) << endl;                        // line (a)
    cout << sqrt(sqrt(y)) << endl;                  // line (b)
    if ((x + y) != z) cout << b << endl;            // line (c)
    cout << a << "a" << "b" << b << endl;           // line (d)
    if (a == "b") cout << z; else cout << x;        // line (e)
    cout << endl;
}
```

(a) What is the output at line (a)?

Answer:

5

(b) What is the output at line (b)?

Answer:

2

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

baba

(e) What is the output at line (e)?

Answer:

25

Problem 81   Write a complete C++ program that asks the user for a number n and prints 2 large copies of an X pattern (each with height n) in a horizontal sequence.

For example, if the user specified 5 for n, the program would print as follows:

```
*   **   *
 * * * *
  *   *
 * * * *
*   **   *
```

(Each X pattern should begin in the column after the previous one ends. Do not try to check whether the user input is legal or sensible.)

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a number: ";
   cin >> n;

   for (int row = 1; row <= n; row++) {
      for (int pattern = 1; pattern <= 2; pattern++) {
         for (int c = 1; c <= n; c++) {
            if (row == c || (row + c) == (n + 1))
               cout << "*";
            else cout << " ";
         }
      }
      cout << endl;
   }
   return 0;
}
```

Problem 82   Write a complete C++ program that prints the numbers from 980 down to 666 with 6 numbers (separated by spaces) on each line.

The output from your program should begin

```
980 979 978 977 976 975
974 973 972 971 970 969
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   for (int n = 980; n >= 666; n--) {
      cout << n << " ";
      if (n % 6 == 3) cout << endl;
   }
   cout << endl;
   return 0;
}
```

Problem 83

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume the following variables have been declared and have legal values

```
int y = 12;
```

(a) Print to the user's screen the sentence: *C++ output uses cout.*

Answer:

```
cout << "C++ output uses cout." << endl;
```

(b) Print the square root of y.

Answer:

```
cout << sqrt((double) y) << endl;
```

(c) Print a random 3 digit even number.

Answer:

```
cout << 2 * (rand() % 450)  + 100 << endl;
```

(d) Print all numbers less that 1000 that end in a 7 and are divisible by 3.

Answer:

```
for (int n = 1; n < 1000; n++)
   if ((n % 10 == 7) && (n % 3 == 0)) cout << n << endl;
```

(e) Print the square of 3/8.

Answer:

```
cout << (3.0 / 8) * (3.0 / 8) << endl;
```

Problem 84   Consider the following C++ program.

```
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    double x = 9.0, y = 16.0, z = 25.0;
    string a = "a", b = "a";
    cout << sqrt(y) << endl;                              // line (a)
    cout << sqrt(y) + sqrt(x) << endl;                    // line (b)
    if ((x + y) == z) cout << b << endl;                  // line (c)
    cout << a << "a" << "b" << b << endl;                 // line (d)
    if (a == "b") cout << z; else cout << x;              // line (e)
    cout << endl;
}
```

(a) What is the output at line (a)?

Answer:

4

(b) What is the output at line (b)?

Answer:

7

(c) What is the output at line (c)?

Answer:

a

(d) What is the output at line (d)?

Answer:

aaba

(e) What is the output at line (e)?

Answer:

9

Problem 85   Write a complete C++ program that asks the user for a number n and prints 3 large copies of an L pattern (each with height n) in a horizontal sequence.

For example, if the user specified 4 for n, the program would print as follows:

```
*    *    *
*    *    *
*    *    *
**** **** ****
```

(Each L pattern should begin after a gap of one column after the previous one ends. Do not try to check whether the user input is legal or sensible.)

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a number: ";
   cin >> n;

   for (int row = 1; row <= n; row++) {
      for (int pattern = 1; pattern <= 3; pattern++) {
         for (int c = 1; c <= n; c++) {
            if (c == 1 || row == n)
               cout << "*";
            else cout << " ";
         }
         cout << " ";
      }
      cout << endl;
   }
   return 0;
}
```

Problem 86   Write a complete C++ program that prints the numbers from 28 to 387 with 10 numbers (separated by commas) on each line.

The output from your program should begin

```
28,29,30,31,32,33,34,35,36,37
38,39,40,41,42,43,44,45,46,47
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    for (int n = 28; n < 388; n++) {
        cout << n;
        if (n % 10 == 7) cout << endl;
        else cout << ",";
    }
    return 0;
}
```

Problem 87

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume the following variables have been declared and have legal values

```
int z = 5;
```

(a) Print to the user's screen the words: *endl makes a line and for makes a loop*

Answer:

```
cout << "endl makes a line and for makes a loop" << endl;
```

(b) Print the cube of $z + 1$.

Answer:

```
cout << (z + 1) * (z + 1) * (z + 1) << endl;
```

(c) Print a random 2 digit number to the user's screen.

Answer:

```
cout << rand() % 90 + 10 << endl;
```

(d) Print all three digit numbers that either end in a 7 or are even and divisible by 7.

Answer:

```
for (int n = 100; n < 1000; n++)
    if ((n % 10 == 7) || ((n % 2 == 0) && (n % 7 == 0))) cout << n << endl;
```

(e) Print the square root of 3/7.

Answer:

```
cout << sqrt(3.0/7) << endl;
```

Problem 88   Consider the following C++ program.

```cpp
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    double x = 49.0, y = 81.0, z = 25.0;
    string a = "ab", b = "ba";
    cout << sqrt(x) << endl;                      // line (a)
    cout << sqrt(sqrt(y)) << endl;                // line (b)
    if ((x + y) != z) cout << a << endl;          // line (c)
    cout << a << "a" << "b" << b << endl;         // line (d)
    if (a == "b") cout << x; else cout << y;      // line (e)
    cout << endl;
}
```

(a) What is the output at line (a)?

Answer:

7

(b) What is the output at line (b)?

Answer:

3

(c) What is the output at line (c)?

Answer:

ab

(d) What is the output at line (d)?

Answer:

ababba

(e) What is the output at line (e)?

Answer:

81

Problem 89   Write a complete C++ program that asks the user for a number n and prints 2 large copies of an E pattern (each with height n that is odd) in a horizontal sequence.

For example, if the user specified 5 for n, the program would print as follows:

```
***** *****
*     *
***** *****
*     *
***** *****
```

(Each E pattern should begin after a gap of one column after the previous one ends. Do not try to check whether the user input is legal or sensible.)

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter an odd number: ";
   cin >> n;

   for (int row = 1; row <= n; row++) {
      for (int pattern = 1; pattern <= 2; pattern++) {
         for (int c = 1; c <= n; c++) {
            if (c == 1 || row == 1 || row == n || row == (n + 1) / 2)
               cout << "*";
            else cout << " ";
         }
         cout << " ";
      }
      cout << endl;
   }
   return 0;
}
```

Problem 90   Write a complete C++ program that prints the numbers from 980 down to 669 with 6 numbers
(separated by periods) on each line.

The output from your program should begin

```
980.979.978.977.976.975
974.973.972.971.970.969
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   for (int n = 980; n >= 669; n--) {
      cout << n;
      if (n % 6 == 3) cout << endl;
      else cout << ".";
   }
   cout << endl;
   return 0;
}
```

Problem 91

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of
C++ code. No answer can use more than two lines. Assume the following variables have been declared and have
legal values

```cpp
int y = 12;
```

(a) Print to the user's screen the sentence: *Quote Hello but do not quote cout.*

Answer:

```cpp
cout << "Quote Hello but do not quote cout." << endl;
```

(b) Print the square root of the square root of y.

Answer:

```
cout << sqrt(sqrt((double) y)) << endl;
```

(c) Print a random 3 digit number that is divisible by 3.

Answer:

```
cout << 3 * (rand() % 300)  + 102 << endl;
```

(d) Print all numbers less that 1000 that end in a 7 and are divisible by 7.

Answer:

```
for (int n = 1; n < 1000; n++)
   if ((n % 10 == 7) && ((n % 7) == 0)) cout << n << endl;
```

(e) Print the square of 5/8.

Answer:

```
cout << (5.0 / 8) * (5.0 / 8) << endl;
```

Problem 92   Consider the following C++ program.

```
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    double x = 81.0, y = 49.0, z = 36.0;
    string a = "az", b = "za";
    cout << sqrt(y) << endl;                        // line (a)
    cout << sqrt(y) + sqrt(x) << endl;              // line (b)
    if ((x + y) == z) cout << b << endl;            // line (c)
    cout << a << "a" << "b" << b << endl;           // line (d)
    if (a == "b") cout << z; else cout << x;        // line (e)
    cout << endl;
}
```

(a) What is the output at line (a)?

Answer:

7

(b) What is the output at line (b)?

Answer:

16

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

```
azabza
```

(e) What is the output at line (e)?

Answer:

```
81
```

Problem 93 Write a complete C++ program that asks the user for a number n and prints 3 large copies of a T pattern (each with height n that is odd) in a horizontal sequence.

For example, if the user specified 5 for n, the program would print as follows:

```
***** ***** *****
  *     *     *
  *     *     *
  *     *     *
  *     *     *
```

(Each T pattern should begin after a gap of one column after the previous one ends. Do not try to check whether the user input is legal or sensible.)

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter an odd number: ";
    cin >> n;

    for (int row = 1; row <= n; row++) {
        for (int pattern = 1; pattern <= 3; pattern++) {
            for (int c = 1; c <= n; c++) {
                if (row == 1 || c == (n + 1) / 2)
                    cout << "*";
                else cout << " ";
            }
            cout << " ";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 94 Write a complete C++ program that does the following.

1. It asks the user to enter a temperature in degrees celsius.

2. If the temperature is greater than 40, the program should once ask the user to enter a different value.

3. The program calculates and prints the fahrenheit value of temperature using the formula:

$$Fahrenheit = \frac{9}{5}Celsius + 32$$

Here is an example of how the program should work:

```
Enter the temperature in degrees celsius:    60
Enter a different value:   60
Fahrenheit: 140.0
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   double celsius, fahrenheit;

   cout << "Enter the temperature in degrees celsius: ";
   cin >> celsius;
   if (celsius > 40) {
      cout << "Enter a different value: ";
      cin >> celsius;
   }
   fahrenheit = 9.0 / 5 * celsius + 32;
   cout << "Fahrenheit: " << fahrenheit << endl;
   return 0;
}
```

Problem 95

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume the following variables have been declared and have legal values

```cpp
int a, b;
string word, second;
```

(a) Ask for, and read the value for *second* from the user.

Answer:

```cpp
cout << "Enter second: ";
cin >> second;
```

(b) Print the cube of b.

Answer:

```cpp
cout << b * b * b << endl;
```

(c) Print the number a without its last digit.

Answer:

```cpp
cout << a / 10 << endl;
```

(d) If *word* and *second* are equal print the value of a, otherwise print the value of b.

Answer:

```
    if (word == second) cout << a << endl;
    else cout << b << endl;
```

(e) Print *a* copies of the value of *word* on one line separated by single spaces.

Answer:

```
    for (int x = 1; x <= a; x++) cout << word << " ";
    cout << endl;
```

Problem 96   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int p = 36, q = 49, r = 25;
    string a = "yes";
    string x = "no";
    if (a == x) cout << p; else cout << q;              // line (a)
    cout << endl;
    if ((p <= q) && (r <= q)) cout << "ok" << endl;     // line (b)
    if ((a == x) || ("x" == "x")) r+=5; cout << r << endl;  // line (c)
    if (!((p % 2) < (q % 2))) cout << "gg";  else cout << "ll";  // line (d)
    cout << endl;
    while (p > r) p--; cout << p << "\n";               // line (e)
}
```

(a) What is the output at line (a)?

Answer:

49

(b) What is the output at line (b)?

Answer:

ok

(c) What is the output at line (c)?

Answer:

30

(d) What is the output at line (d)?

Answer:

ll

(e) What is the output at line (e)?

Answer:

30

Problem 97   Write a complete C++ program that does the following.

1. It asks the user to enter a temperature in degrees fahrenheit.

2. If the temperature f does not satisfy $0 \leq f \leq 100$ the program should print the message *Out of range* and terminate.

3. The program calculates and prints the celsius value of temperature using the formula:

$$Celsius = \frac{5}{9}(Fahrenheit - 32)$$

Here is an example of how the program should work:

```
Enter the temperature in degrees fahrenheit:   68
Celsius: 20.0
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   double celsius, fahrenheit;

   cout << "Enter the temperature in degrees fahrenheit: ";
   cin >> fahrenheit;
   if (!((fahrenheit >= 0) && (fahrenheit <= 100))) {
      cout << "Out of range." << endl;
      return 0;
   }
   celsius = 5.0 / 9 * (fahrenheit - 32);
   cout << "Celsius: " << celsius << endl;
   return 0;
}
```

Problem 98

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume the following variables have been declared and have legal values

```cpp
int x, y;
string name, message;
```

(a) Ask for, and read the value for *name* from the user.

Answer:

```cpp
cout << "Enter your name: ";
cin >> name;
```

(b) Print the square of y.

Answer:

```cpp
cout << y * y << endl;
```

(c) Print the last digit of $x + y$.

Answer:

```
cout << (x + y) % 10 << endl;
```

(d) If x is not greater than y print the value of *name*, otherwise print the value of *message*.

Answer:

```
if (!(x > y)) cout << name<< endl;
else cout << message << endl;
```

(e) Print x copies of the value of x followed by y copies of the value of *message*.

Answer:

```
for (int a = 1; a <= x; a++) cout << x;
for (int a = 1; a <= y; a++) cout << message;
```

Problem 99   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int p = 31, q = 23, r = 15;
    string a = "abc";
    string x = "abc";
    if (a == x) cout << p; else cout << q;                  // line (a)
    cout << endl;
    if ((p <= q) && (p <= r)) cout << "a" << endl;          // line (b)
    if ((a == x) || ("a" == "x")) r++; cout << r << endl;   // line (c)
    if (!((p % 2) < (q % 2))) cout << "no";  else cout << "yes"; // line (d)
    cout << endl;
    while (p < r) p++; cout << p << "\n";                   // line (e)
}
```

(a) What is the output at line (a)?

Answer:

31

(b) What is the output at line (b)?

Answer:

(c) What is the output at line (c)?

Answer:

16

(d) What is the output at line (d)?

Answer:

```
no
```

(e) What is the output at line (e)?

Answer:

```
31
```

Problem 100   Write a complete C++ program that asks the user for a number n and prints n diagonal stripes (each with height n and width n) in a horizontal sequence.

For example, if the user specified 4 for n, the program would print as follows:

```
*   *   *   *
 *   *   *   *
  *   *   *   *
   *   *   *   *
```

(Each stripe should begin in the column after the previous one ends. Do not try to check whether the user input is legal or sensible.)

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter the number n: ";
    cin >> n;

    for (int r = 1; r <= n; r++) {
        for (int stripe = 1; stripe <= n; stripe++) {
            for (int c = 1; c <=n; c++) {
                if (r == c) cout << "*";
                else cout << " ";
            }
        }
        cout << endl;
    }
    return 0;
}
```

Problem 101   Write a complete C++ program that does the following.

1. It asks the user to enter the base and height of a triangle.

2. If either the base or height is less than or equal to 0, the program should immediately terminate.

3. The program calculates and prints the area of the triangle using the formula:

$$Area = \frac{1}{2}Base \times Height$$

Here is an example of how the program should work:

```
Enter the base and height of a triangle:   8 10
Area: 40.0
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   double base, height;
   double area;

   cout << "Enter the base and height of a triangle:";
   cin >> base >> height;
   if ((base <= 0) || (height <= 0))
      return 0;
   area = base * height / 2.0;
   cout << "Area: " << area << endl;
   return 0;
}
```

Problem 102

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. No answer can use more than two lines. Assume the following variables have been declared and have legal values

```
int x, y;
string name, message;
```

(a) Ask for, and read the value for *name* from the user.

Answer:

```
cout << "Enter your name: ";
cin >> name;
```

(b) Print the cube of x.

Answer:

```
cout << x * x * x << endl;
```

(c) Print the last digit of y.

Answer:

```
cout << y % 10 << endl;
```

(d) If x is greater than y print the value of x, otherwise print the value of *message*.

Answer:

```
if (x > y) cout << x << endl;
else cout << message << endl;
```

(e) Print x copies of the value of *name* followed by y copies of the value of *message*.

Answer:

```
    for (int a = 1; a <= x; a++) cout << name;
    for (int a = 1; a <= y; a++) cout << message;
```

Problem 103   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int p = 11, q = 13, r = 15;
    string a = "x";
    string x = "xx";
    if (a == x) cout << p; else cout << q;                        // line (a)
    cout << endl;
    if ((p <= q) && (p <= r)) cout << "a" << endl;                // line (b)
    if ((a == x) || ("a" == "x")) r++; cout << r << endl;         // line (c)
    if (!((p % 2) < (q % 2))) cout << "no";   else cout << "yes"; // line (d)
    cout << endl;
    while (p < r) p++; cout << p << "\n";                         // line (e)
}
```

(a) What is the output at line (a)?

Answer:

13

(b) What is the output at line (b)?

Answer:

a

(c) What is the output at line (c)?

Answer:

15

(d) What is the output at line (d)?

Answer:

no

(e) What is the output at line (e)?

Answer:

15

Problem 104   Write a complete C++ program that asks the user for a number n and prints n triangles (each with height n) in a horizontal sequence.

For example, if the user specified 4 for n, the program would print as follows:

```
*   *   *   *
**  **  **  **
*** *** *** ***
****************
```

(Each triangle should begin in the column after the previous one ends. Do not try to check whether the user input is legal or sensible.)

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter the number n: ";
    cin >> n;

    for (int r = 1; r <= n; r++) {
        for (int triangle = 1; triangle <= n; triangle++) {
            for (int c = 1; c <=n; c++) {
                if (r >= c) cout << "*";
                else cout << " ";
            }
        }
        cout << endl;
    }
    return 0;
}
```

Problem 105   Write a complete C++ program that does the following.

1. It asks the user to enter an integer between 100 and 9999.

2. If the entered number is out of range, the program forces the user to enter more numbers until one in the correct range is given.

3. Then the program prints the digits in the number (in reverse) on separate lines.

Here is an example of how the program should work:

```
Enter an integer between 100 and 9999:    8976
6
7
9
8
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter an integer between 100 and 9999: ";
    cin >> n;
    while (n < 100 || n > 9999) {
        cout << "Out of range. Try again: ";
        cin >> n;
    }
    while (n > 0) {
        cout << n % 10 << endl;
        n = n / 10;
    }
    return 0;
}
```

Problem 106

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Your answers must be short and must fit in the spaces provided. Assume the following variables have been declared

```
int x, y;
```

(a) Prompt for, and read values for x and y from the user.

Answer:

```
cout << "Enter 2 integers: ";
cin >> x >> y;
```

(b) Print x copies of the number y, without spaces on one line of output.

Answer:

```
for (int c = 1; c <= x; c++) cout << y;    cout << endl;
```

(c) Print the remainder when x is divided by y

Answer:

```
cout << x % y << endl;
```

(d) If x and y are both between 10 and 99 print 6 copies of the word "Hello" on a single line.

Answer:

```
if (x > 9 && x < 100 && y > 9 && y < 100)
   for (int c = 1; c <= 6; c++) cout << "Hello ";
cout << endl;
```

(e) Print the average of x and y

Answer:

```
cout << (x + y) / 2.0 << endl;
```

Problem 107   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int x = 7, y = 10, z = 65;
    string freddy = "fred";
    string fred = "freddy";
    cout << "fred" << " " << fred << endl;        // line (a)
    cout << (z % y) / x << endl;                  // line (b)
    if ((x > y) && (y > x)) cout << fred << endl; // line (c)
    cout << fred << freddy << endl;               // line (d)
    cout << x << "*" << y << "=" << z << "\n";    // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
fred freddy
```

(b) What is the output at line (b)?

Answer:

```
0
```

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

```
freddyfred
```

(e) What is the output at line (e)?

Answer:

```
7*10=65
```

Problem 108   Write a complete C++ program that asks the user for a height h and prints a white X pattern (made of spaces) against a dark background made of Xs.

For example, if the user specified 7 for h, the program would print as follows:

```
 XXXXX
X XXX X
XX X XX
XXX XXX
XX X XX
X XXX X
 XXXXX
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int h;
   cout << "Enter a height h: ";
   cin >> h;
   for (int r = 1; r <= h; r++) {
      for (int c = 1; c <= h; c++) {
         if ((r == c) || ((r + c) == (h + 1))) cout << " ";
         else cout << "X";
      }
      cout << endl;
   }
   return 0;
}
```

Problem 109   Write a complete C++ program that does the following.

1. It asks the user to enter a 2-digit integer.

2. If the entered number does not have 2 digits, the program forces the user to enter further integers until one with 2 digits is given.

3. The program then prints the bigger of the 2 digits in the user's number (either digit in case they are the same).

Here is an example of how the program should work:

```
Enter a 2-digit integer:   123
That does not have 2 digits. Try again: 35
The bigger digit is 5
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a 2-digit integer: ";
   cin >> n;
   while (n < 10 || n > 99) {
      cout << "That does not have 2 digits. Try again: ";
      cin >> n;
   }
   int a = n % 10, b = n / 10;
   cout << "The bigger digit is ";
   if (a > b) cout << a;
   else cout << b;
   cout << endl;
   return 0;
}
```

Problem 110

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Your answers must be short and must fit in the spaces provided. Assume the following variables have been declared

```cpp
int x, y;   string name;
```

(a) Prompt for, and read values for x, y and name from the user.

Answer:

```cpp
cout << "Enter 2 integers and your name. ";
cin >> x >> y >> name;
```

(b) If y is 0 print **"Illegal Division"** otherwise the exact value of x divided by y is printed

Answer:

```cpp
if (y == 0) cout << "Illegal division" << endl;
else cout << ((double) x) / y << endl;
```

(c) Drop any minus sign in x or y to make sure they are both positive.

Answer:

```
if (x < 0) x = -x;
if (y < 0) y = -y;
```

(d) Say Hello to the user (eg `"Hello Freddy"`) x times on x different lines.

Answer:

```
for (int c = 1; c <= x; c++) cout << "Hello " << name << endl;
```

(e) Print the bigger of x and y followed by the smaller.

Answer:

```
if (x >= y) cout << x << " " << y << endl;
else cout << y << " " << x << endl;
```

Problem 111   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int x = 7, y = 10, z = 65;
    string freddy = "fred";
    string fred = "freddy";
    for (int c = x; c < y; c++) cout << freddy; cout << endl; // line (a)
    cout << (z % y) / (y % x) << endl;                        // line (b)
    if ((x > y) || (y > x)) cout << fred << endl;             // line (c)
    cout << fred << " * " << (y - x) << endl;                 // line (d)
    cout << x << "%" << y << "=" << "x % y" << "\n";          // line (e)
}
```

(a) What is the output at line (a)?

Answer:

fredfredfred

(b) What is the output at line (b)?

Answer:

1

(c) What is the output at line (c)?

Answer:

freddy

(d) What is the output at line (d)?

Answer:

```
freddy * 3
```

(e) What is the output at line (e)?

Answer:

```
7%10=x % y
```

Problem 112   Write a complete C++ program that asks the user for a width w and prints a white arrow pattern (made of spaces) against a dark background made of Xs.

For example, if the user specified 5 for w, the program would print as follows:

```
 XXXX
X XXX
XX XX
XXX X
XXXX
XXX X
XX XX
X XXX
 XXXX
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int w;
    cout << "Enter a width w: ";
    cin >> w;
    for (int r = 1; r < 2*w; r++) {
        for (int c = 1; c <= w; c++) {
            if ((r == c) || ((r + c) == (2 * w))) cout << " ";
            else cout << "X";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 113   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is between 1 and 21.

2. It repeatedly reads n from the user until the supplied value of n is legal.

3. It prints out a picture of an $n \times n$ square formed of X characters except that a diagonal stripe, formed by the diagonal and any position immediately to its right, is printed using an O character.

Here is an example of how the program should work:

```
Give me an integer between 1 and 21:    5
OOXXX
XOOXX
XXOOX
XXXOO
XXXXO
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Give me an integer between 1 and 21:";
   cin >> n;

   while (n < 1 || n > 21) {
      cout << "Illegal.  Try again: ";
      cin >> n;
   }

   for (int r = 1; r <= n; r++) {
      for (int c = 1; c <= n; c++)
         if ((c == r) || (c == r + 1)) cout << "O";
         else cout << "X";
      cout << endl;
   }
   return 0;
}
```

Problem 114   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is between 1 and 15.

2. It terminates at once if the user enters an illegal value for n.

3. It prints out a picture using (+ signs) of a diagonal line that extends over n rows and has a width of 3 characters in each row.

Here is an example of how the program should work:

```
Give me an integer between 1 and 15:    6
+++
 +++
  +++
   +++
    +++
     +++
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Give me an integer between 1 and 15:";
   cin >> n;

   if (n < 1 || n > 15) return 0;

   for (int r = 1; r <= n; r++) {
      for (int c = 1; c <= n + 2; c++)
         if ((c >= r) && (c <= (r + 2))) cout << "+";
         else cout << " ";
      cout << endl;
   }
   return 0;
}
```

Problem 115   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is between 1 and 15.

2. It repeatedly reads n from the user until the supplied value of n is legal.

3. It prints out a picture of an $n \times n$ square formed of O characters except that a diagonal stripe, formed by the diagonal and any position immediately to its left, is left blank.

Here is an example of how the program should work:

```
Give me an integer between 1 and 15:    6
 OOOOO
  OOOO
O  OOO
OO  OO
OOO  O
OOOO
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Give me an integer between 1 and 15:";
   cin >> n;

   while (n < 1 || n > 15) {
      cout << "Illegal.  Try again: ";
      cin >> n;
   }

   for (int r = 1; r <= n; r++) {
      for (int c = 1; c <= n; c++)
         if ((c == r) || (c == r - 1)) cout << " ";
         else cout << "O";
      cout << endl;
   }
   return 0;
}
```

Problem 116   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is between 1 and 21.

2. It terminates at once if the user enters an illegal value for n.

3. It prints out a picture using (+ signs) of left sloping diagonal line with length n.

Here is an example of how the program should work:

```
Give me an integer between 1 and 21:    5
    +
   +
  +
 +
+
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Give me an integer between 1 and 21:";
    cin >> n;

    if (n < 1 || n > 21) return 0;

    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= n; c++)
            if ( (c + r) == (n + 1)) cout << "+";
            else cout << " ";
        cout << endl;
    }
    return 0;
}
```

Problem 117   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is between 1 and 9.

2. It repeatedly reads n from the user until the supplied value of n is legal.

3. It prints out a picture of a triangle with n rows, in which the symbol used to print each row is the row's number.

Here is an example of how the program should work:

```
Give me an integer between 1 and 9:    5
1
22
333
4444
55555
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Give me an integer between 1 and 9:";
    cin >> n;

    while (n < 1 || n > 9) {
        cout << "Illegal.  Try again: ";
        cin >> n;
    }

    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= r; c++) cout << r;
        cout << endl;
    }
    return 0;
}
```

Problem 118   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is between 1 and 9.

2. It exits immediately if n is illegal.

3. It prints out a picture of a triangle with n rows, in which the symbol used to print each column is the column's number.

Here is an example of how the program should work:

```
Give me an integer between 1 and 9:    5
1
12
123
1234
12345
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Give me an integer between 1 and 9:";
    cin >> n;

    if (n < 1 || n > 9) return 0;

    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= r; c++) cout << c;
        cout << endl;
    }
    return 0;
}
```

Problem 119   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is between 1 and 9.

2. It repeatedly reads n from the user until the supplied value of n is legal.

3. It prints out a picture of an upside down triangle with n rows, in which the symbol used to print each row is the row's number.

Here is an example of how the program should work:

```
Give me an integer between 1 and 9:    5
11111
2222
333
44
5
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Give me an integer between 1 and 9:";
    cin >> n;
```

```
   while (n < 1 || n > 9) {
      cout << "Illegal.  Try again: ";
      cin >> n;
   }

   for (int r = n; r >= 1; r--) {
      for (int c = 1; c <= r; c++) cout << n + 1 - r;
      cout << endl;
   }
   return 0;
}
```

Problem 120   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is between 1 and 9.

2. It exits immediately if n is illegal.

3. It prints out a picture of an upside down triangle with n rows, in which the symbol used to print each column is the column's number.

Here is an example of how the program should work:

```
Give me an integer between 1 and 9:   5
12345
1234
123
12
1
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Give me an integer between 1 and 9:";
   cin >> n;

   if (n < 1 || n > 9) return 0;

   for (int r = n; r >= 1; r--) {
      for (int c = 1; c <= r; c++) cout << c;
      cout << endl;
   }
   return 0;
}
```

Problem 121   A number is called *upward* if its last digit is greater than the previous digit. Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is greater than 9.

2. It terminates when given illegal input.

3. It prints out whether n is upward.

Here is an example of how the program should work:

```
Give me an integer greater than 9:  95424

Upward
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Give me an integer greater than 9:";
    cin >> n;

    if (n < 10) return 0;
    int lastDigit = n % 10;
    n = n / 10;
    int nextLast = n % 10;
    if (lastDigit > nextLast) cout << "Upward\n";
    else cout << "Not upward\n";
    return 0;
}
```

Problem 122   A number is called *evil* if its last two digits add to 13. Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is greater than 666.

2. It terminates when given illegal input.

3. It prints out whether n is evil.

Here is an example of how the program should work:

```
Give me an integer greater than 666: 667

Evil
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Give me an integer greater than 666:";
    cin >> n;

    if (n <= 666) return 0;
    int lastDigit = n % 10;
    n = n / 10;
    int nextLast = n % 10;
    if ((lastDigit + nextLast) == 13) cout << "Evil\n";
    else cout << "Not evil\n";
    return 0;
}
```

Problem 123   A number is called *flat* if its last two digits are equal. Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is greater than 9.

2. It terminates when given illegal input.

3. It prints out whether n is flat.

Here is an example of how the program should work:

```
Give me an integer greater than 9:  95424

Not flat
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Give me an integer greater than 9:";
   cin >> n;

   if (n < 10) return 0;
   int lastDigit = n % 10;
   n = n / 10;
   int nextLast = n % 10;
   if (lastDigit == nextLast) cout << "Flat\n";
   else cout << "Not flat\n";
   return 0;
}
```

Problem 124   A number is called *lucky* if the product of its last two digits ends in a 3. Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is greater than 666.

2. It terminates when given illegal input.

3. It prints out whether n is lucky.

Here is an example of how the program should work:

```
Give me an integer greater than 666: 697

Lucky
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Give me an integer greater than 666:";
   cin >> n;

   if (n <= 666) return 0;
   int lastDigit = n % 10;
   n = n / 10;
   int nextLast = n % 10;
   if ((lastDigit * nextLast) % 10 == 3)
     cout << "Lucky\n";
   else cout << "Not lucky\n";
   return 0;
}
```

Problem 125   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is greater than 9.

2. It terminates when given illegal input.

3. It prints out the first 2 digits of n (in order, on one line).

Here is an example of how the program should work:

```
Give me an integer greater than 9:   95424

95
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Give me an integer greater than 9:";
   cin >> n;

   if (n < 10) return 0;
   while (n > 99) n = n / 10;
   cout << n << endl;
   return 0;
}
```

Problem 126   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer n.

2. It terminates when given illegal input.

3. It prints out the product of the digits of n.

Here is an example of how the program should work:

```
Give me a positive integer:   41311

12
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Give me a positive integer:";
   cin >> n;

   if (n <= 0) return 0;
   int product = 1;
   while (n > 0) {
      product = product * (n % 10);
      n = n / 10;
   }
   cout << product << endl;
   return 0;
}
```

Problem 127   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer n that is greater than 99.

2. It terminates when given illegal input.

3. It prints out the first 3 digits of n (in order, on one line).

Here is an example of how the program should work:

```
Give me an integer greater than 99:  95424

954
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Give me an integer greater than 99:";
   cin >> n;

   if (n < 100) return 0;
   while (n > 999) n = n / 10;
   cout << n << endl;
   return 0;
}
```

Problem 128   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer n.

2. It terminates when given illegal input.

3. It prints out the sum of those digits of n that are even numbers.

Here is an example of how the program should work:

```
Give me a positive integer:  41815

12
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Give me a positive integer:";
   cin >> n;

   if (n <= 0) return 0;
   int sum = 0;
   while (n > 0) {
      int digit = n % 10;
      if (digit % 2 == 0) sum = sum + digit;
      n = n / 10;
   }
   cout << sum << endl;
   return 0;
}
```

Problem 129   Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 123;
    cout << x % 10 << endl;              // line (a)
    cout << x / 10 << endl;              // line (b)
    if (x > 50) cout << "Big" << endl;   // line (c)
    cout << endl;
    while (x > 0) { cout << "1";  x /= 10;}  // line (d)
    cout << endl;
    cout << x << endl;                   // line (e)
}
```

(a) What is the output at line (a)?

Answer:

3

(b) What is the output at line (b)?

Answer:

12

(c) What is the output at line (c)?

Answer:

Big

(d) What is the output at line (d)?

Answer:

111

(e) What is the output at line (e)?

Answer:

0

Problem 130   Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 2345;
    cout << x % 10 << endl;              // line (a)
    cout << x / 10 << endl;              // line (b)
    if (x > 5000) cout << "Big" << endl; // line (c)
    cout << endl;
    while (x > 0) { cout << "*";  x /= 10;}  // line (d)
    cout << endl;
    cout << x + 5 << endl;               // line (e)
}
```

(a) What is the output at line (a)?

Answer:

5

(b) What is the output at line (b)?

Answer:

234

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

****

(e) What is the output at line (e)?

Answer:

5

Problem 131   Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 31;
    cout << x % 10 << endl;                 // line (a)
    cout << x / 10 << endl;                 // line (b)
    if (x > 50) cout << "Big" << endl;      // line (c)
    cout << endl;
    while (x > 0) { cout << "1";  x /= 10;} // line (d)
    cout << endl;
    cout << x * x << endl;                  // line (e)
}
```

(a) What is the output at line (a)?

Answer:

1

(b) What is the output at line (b)?

Answer:

3

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

```
11
```

(e) What is the output at line (e)?

Answer:

```
0
```

Problem 132   Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 5432;
    cout << x % 10 << endl;                // line (a)
    cout << x / 10 << endl;                // line (b)
    if (x > 5000) cout << "Big" << endl;   // line (c)
    cout << endl;
    while (x > 0) { cout << "A";  x /= 10;}  // line (d)
    cout << endl;
    cout << x - 5 << endl;                 // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
2
```

(b) What is the output at line (b)?

Answer:

```
543
```

(c) What is the output at line (c)?

Answer:

```
Big
```

(d) What is the output at line (d)?

Answer:

```
AAAA
```

(e) What is the output at line (e)?

Answer:

```
-5
```

Problem 133   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int y,x = 12;
    cout << x + x * 10 << endl;                 // line (a)
    cout << x / 100 << endl;                     // line (b)
    for (y = 10; y < x; y++) cout << y;          // line (c)
    cout << endl;
    if (x > 50) cout << x; else cout << 2 * x;   // line (d)
    cout << endl;
    cout << x << "*" << x << endl;               // line (e)
}
```

(a) What is the output at line (a)?

Answer:

132

(b) What is the output at line (b)?

Answer:

0

(c) What is the output at line (c)?

Answer:

1011

(d) What is the output at line (d)?

Answer:

24

(e) What is the output at line (e)?

Answer:

12*12

Problem 134   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int y,x = 210;
    cout << x + x * 10 << endl;                 // line (a)
    cout << x / 100 << endl;                     // line (b)
    for (y = 210; y < x; y++) cout << y;         // line (c)
    cout << endl;
    if (x > 50) cout << x; else cout << 2 * x;   // line (d)
    cout << endl;
    cout << x << "*" << x << endl;               // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
2310
```

(b) What is the output at line (b)?

Answer:

```
2
```

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

```
210
```

(e) What is the output at line (e)?

Answer:

```
210*210
```

Problem 135   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int y,x = 13;
    cout << x + x * 10 << endl;              // line (a)
    cout << x / 100 << endl;                 // line (b)
    for (y = 10; y < x; y++) cout << y;      // line (c)
    cout << endl;
    if (x > 50) cout << x; else cout << 2 * x; // line (d)
    cout << endl;
    cout << x << "*" << x << endl;           // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
143
```

(b) What is the output at line (b)?

Answer:

```
0
```

(c) What is the output at line (c)?

Answer:

```
101112
```

(d) What is the output at line (d)?

Answer:

(e) What is the output at line (e)?

Answer:

```
13*13
```

Problem 136   Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

int main() {
    int y,x = 211;
    cout << x + x * 10 << endl;            // line (a)
    cout << x / 100 << endl;               // line (b)
    for (y = 210; y < x; y++) cout << y;    // line (c)
    cout << endl;
    if (x > 50) cout << x; else cout << 2 * x; // line (d)
    cout << endl;
    cout << x << "*" << x << endl;         // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
2321
```

(b) What is the output at line (b)?

Answer:

```
2
```

(c) What is the output at line (c)?

Answer:

```
210
```

(d) What is the output at line (d)?

Answer:

```
211
```

(e) What is the output at line (e)?

Answer:

```
211*211
```

Problem 137

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```cpp
    int x, y;
```

(a) Print y copies of the word Hello on a single line of output.

Answer:

```
for (int c = 1; c <= y; c++) cout << "Hello ";
cout << endl;
```

(b) Print the value of x as a percentage of y, with output like 75.0%.

Answer:

```
cout << 100.0 * x / y << "%" << endl;
```

(c) Read new values for x and y from the user.

Answer:

```
cin >> x >> y;
```

(d) Replace y by its absolute value.

Answer:

```
if (y < 0) y = -y;
```

(e) Print the first digit of y

Answer:

```
while (y >= 10) {
    y = y / 10;
}
cout << y << endl;
```

Problem 138

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```
int x, y;
```

(a) Print x copies of the number y on a single line of output.

Answer:

```
for (int c = 1; c <= x; c++) cout << y;
cout << endl;
```

(b) Print the value of y as a percentage of x, with output like 75.0%.

Answer:

```
cout << 100.0 * y / x << "%" << endl;
```

(c) Read a new value for y and then for x from the user.

Answer:

```
cin >> y >> x;
```

(d) Replace y by the absolute value of x - y.

Answer:

```
y = x - y;
if (y < 0) y = -y;
```

(e) If y is greater than 10, print the second digit of y

Answer:

```
while (y > 100) {
    y = y / 10;
}
if (y > 10) cout << y % 10 << endl;
```

Problem 139

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```
int x, y;
```

(a) Read new values for x and y from the user.

Answer:

```
cin >> x >> y;
```

(b) Print the value of x as a percentage of y, with output like 75.0%.

Answer:

```
cout << 100.0 * x / y << "%" << endl;
```

(c) Print x copies of the word *cin* on a single line of output.

Answer:

```
for (int c = 1; c <= x; c++) cout << "cin";
cout << endl;
```

(d) Replace y by the absolute value of x.

Answer:

```
if (x < 0) y = -x;
else y = x;
```

(e) Print the first digit of y

Answer:

```
while (y >= 10) {
    y = y / 10;
}
cout << y << endl;
```

Problem 140

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```
int x, y;
```

(a) Read a new value for y and then for x from the user.

Answer:

```
cin >> y >> x;
```

(b) Print y copies of the number x on a single line of output.

Answer:

```
for (int c = 1; c <= y; c++) cout << x;
cout << endl;
```

(c) Print 75.0% on a single line.

Answer:

```
cout << "75.0%" << endl;
```

(d) Replace y by the absolute value of - x - y.

Answer:

```
y = - x - y;
if (y < 0) y = -y;
```

(e) If y is greater than 10, print the second digit of y

Answer:

```
    while (y > 100) {
        y = y / 10;
    }
    if (y > 10) cout << y % 10 << endl;
```

Problem 141

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of
C++ code. Assume the following variables have been declared and initialized, and x is positive

```
    int x, y;
```

(a) Print x copies of the last digit of x on a single line of output.

Answer:

```
    for (int c = 1; c <= x; c++) cout << x % 10;
    cout << endl;
```

(b) Print the exact value the quotient of x by y, as a decimal

Answer:

```
    cout << (1.0 * x) / y << endl;
```

(c) Exit the program if y is negative

Answer:

```
    if (y < 0) return 0;
```

(d) Replace y by its absolute value.

Answer:

```
    if (y < 0) y = -y;
```

(e) Print the first digit of x

Answer:

```
    while (x >= 10) {
        x = x / 10;
    }
    cout << x << endl;
```

Problem 142

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of
C++ code. Assume the following variables have been declared and initialized, and x is positive

```
int x, y;
```

(a) Exit the program if y is positive

Answer:

```
if (y > 0) return 0;
```

(b) Print -y copies of the the string `"y >= 0; "`

Answer:

```
for (int c = 1; c <= -y; c++) cout << "y >= 0; " <<  endl;
```

(c) Print the exact value the quotient of y by x, as a decimal

Answer:

```
cout << (1.0 * y) / x << endl;
```

(d) Replace y by the absolute value of x + y.

Answer:

```
y = x + y;
if (y < 0) y = -y;
```

(e) Print the first digit of y

Answer:

```
while (y >= 10) {
    y = y / 10;
}
cout << y << endl;
```

Problem 143

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized, and x is positive

```
int x, y;
```

(a) Exit the program if y is negative

Answer:

```
if (y < 0) return 0;
```

(b) Print x copies of the last digit of y on a single line of output.

Answer:

```
for (int c = 1; c <= x; c++) cout << y % 10;
cout << endl;
```

(c) Print the exact value the quotient of x by y, as a decimal

Answer:

```
cout << (1.0 * x) / y << endl;
```

(d) Replace y by its absolute value.

Answer:

```
if (y < 0) y = -y;
```

(e) Print the first digit of x followed by the last digit of y

Answer:

```
while (x >= 10) {
    x = x / 10;
}
cout << x << y% 10 << endl;
```

Problem 144

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized, and x is positive

```
int x, y;
```

(a) Print the exact value the quotient of y by x, as a decimal

Answer:

```
cout << (1.0 * y) / x << endl;
```

(b) Exit the program if y is positive

Answer:

```
if (y > 0) return 0;
```

(c) Print -y copies of the the string "y >= 0; "

Answer:

```
        for (int c = 1; c <= -y; c++) cout << "y >= 0; " <<   endl;
```

(d) Replace y by the absolute value of x - y.

Answer:

```
    y = x - y;
    if (y < 0) y = -y;
```

(e) Print the first digit of y followed by the last digit of x

Answer:

```
    while (y >= 10) {
        y = y / 10;
    }
    cout << y << x % 10 << endl;
```

Problem 145   Write a complete C++ program that does the following. The program prints a rectangular pattern of Os and Xs. The pattern has 200 rows and 50 columns. Every third row is made of Os and the other rows are made of Xs.

For example, a similar pattern with 7 rows and 5 columns would appear as follows.

```
XXXXX
XXXXX
00000
XXXXX
XXXXX
00000
XXXXX
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    for (int r = 1; r <= 200; r++) {
        for (int c = 1; c <= 50; c++) {
            if ((r % 3) == 0) cout << "O";
            else cout << "X";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 146   Write a complete C++ program that does the following. The program prints a rectangular pattern of Os and Xs. The pattern has 50 rows and 60 columns. Every fourth column is made of Os and the other columns are made of Xs.

For example, a similar pattern with 7 rows and 9 columns would appear as follows.

```
XXXOXXXOX
XXXOXXXOX
XXXOXXXOX
XXXOXXXOX
XXXOXXXOX
XXXOXXXOX
XXXOXXXOX
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   for (int r = 1; r <= 50; r++) {
      for (int c = 1; c <= 60; c++) {
         if ((c % 4) == 0) cout << "O";
         else cout << "X";
      }
      cout << endl;
   }
   return 0;
}
```

Problem 147   Write a complete C++ program that does the following. The program prints a rectangular pattern of Os and Xs. The pattern has 101 rows and 51 columns. The middle row and column are made of Os but all other entries in the pattern are Xs.

For example, a similar pattern with 7 rows and 5 columns would appear as follows.

```
XXOXX
XXOXX
XXOXX
OOOOO
XXOXX
XXOXX
XXOXX
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   for (int r = 1; r <= 101; r++) {
      for (int c = 1; c <= 51; c++) {
         if ((r == 51) || (c == 26)) cout << "O";
         else cout << "X";
      }
      cout << endl;
   }
   return 0;
}
```

Problem 148   Write a complete C++ program that does the following. The program prints a square pattern of Os and Xs. The pattern has 52 rows and 52 columns. The entries on the two diagonals of the square are made of Os but all other entries in the pattern are Xs.

For example, a similar pattern with 7 rows and 7 columns would appear as follows.

```
OXXXXXO
XOXXXOX
XXOXOXX
XXXOXXX
XXOXOXX
XOXXXOX
OXXXXXO
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   for (int r = 1; r <= 52; r++) {
      for (int c = 1; c <= 52; c++) {
         if ((r == c) || ((c + r) == 53)) cout << "O";
         else cout << "X";
      }
      cout << endl;
   }
   return 0;
}
```

Problem 149   Write a complete C++ program that does the following. The user is given 3 chances to enter a secret password which is FRED. If the user fails the program terminates, otherwise it says Hello. Here is a sample run.

```
What is the password?  Freddy
Wrong. Try again: Fred
Wrong. Try again: FRED
Hello.
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   string guess;
   int strikes = 0;
   cout << "What is the password? ";
   cin >> guess;
   while (guess != "FRED") {
      strikes++;
      if (strikes >= 3) return 0;
      cout << "Wrong. Try again: ";
      cin >> guess;
   }
   cout << "Hello." << endl;
   return 0;
}
```

Problem 150   Write a complete C++ program that does the following. The user is given 3 chances to guess a secret number, which is 7. Whenever the user makes an incorrect guess, the program announces whether the guess was too big or too small. If the user succeeds, the program says "Congratulations!" otherwise it says "Sorry. The secret number is 7." Here is a sample run.

```
Can you guess my number?   10
Too big. Try again: 5
Too small. Try again: 8
Sorry. The secret number is 7.
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int guess;
   int strikes = 0;
   cout << "Can you guess my number? ";
   cin >> guess;
   while (guess != 7) {
      strikes++;
      if (strikes >= 3) {
         cout << "Sorry. The secret number is 7." << endl;
         return 0;
      }
      if (guess > 7) cout << "Too big. ";
      else cout << "Too small. ";
      cout << "Try again:";
      cin >> guess;
   }
   cout << "Congratulations." << endl;
   return 0;
}
```

Problem 151   Write a complete C++ program that does the following. The user is given 5 chances to enter a secret password which is 007. If the user fails the program says Goodbye, otherwise it says Hello. Here is a sample run.

```
What is the password?   7
Wrong. Try again: 700
Wrong. Try again: 007
Hello.
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   string guess;
   int strikes = 0;
   cout << "What is the password? ";
   cin >> guess;
   while (guess != "007") {
      strikes++;
      if (strikes >= 5) {
         cout << "Goodbye." << endl;
         return 0;
      }
      cout << "Wrong. Try again: ";
      cin >> guess;
   }
```

```
      cout << "Hello." << endl;
      return 0;
}
```

Problem 152   Write a complete C++ program that does the following. The user is given 5 chances to guess a secret number, which is 7. Whenever the user makes an incorrect guess, the program announces whether the guess was too big or too small. If the user succeeds, the program says "Congratulations!" otherwise it says "Sorry. The secret number is 7." Here is a sample run.

```
Can you guess my number?  10
Too big. Try again: 5
Too small. Try again: 7
Congratulations!
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int guess;
   int strikes = 0;
   cout << "Can you guess my number? ";
   cin >> guess;
   while (guess != 7) {
      strikes++;
      if (strikes >= 5) {
         cout << "Sorry. The secret number is 7." << endl;
         return 0;
      }
      if (guess > 7) cout << "Too big. ";
      else cout << "Too small. ";
      cout << "Try again:";
      cin >> guess;
   }
   cout << "Congratulations." << endl;
   return 0;
}
```

Problem 153

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```
   int x, y;
```

(a) Print 12 copies of the word Hello on a single line of output.

Answer:

```
   for (int c = 1; c <= 12; c++) cout << "Hello ";
   cout << endl;
```

(b) Print the remainder when variable x is divided by variable y.

Answer:

```
cout << x % y << endl;
```

(c) Print the square root of 19. Use a C++ function for the calculation.

Answer:

```
cout << sqrt(19.0) << endl;
```

(d) Print a random number in the range 23 to 34, inclusive. Use a C++ function.

Answer:

```
cout << rand() % 12 + 23 << endl;
```

(e) Print the digits of the variable x backwards. So if x is 25, print 52.

Answer:

```
while (x > 0) {
    cout << x % 10;
    x = x / 10;
}
cout << endl;
```

Problem 154

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```
int a, b;
```

(a) Print the quotient when variable b is divided by variable a.

Answer:

```
cout << b / a << endl;
```

(b) Print b copies of the word Hi on a single line of output.

Answer:

```
for (int c = 1; c <= b; c++) cout << "Hi ";
cout << endl;
```

(c) Print a random number in the range 33 to 53, inclusive. Use a C++ function.

Answer:

```
cout << rand() % 21 + 33 << endl;
```

(d) Print the square root of 91. Use a C++ function for the calculation.

Answer:

```
cout << sqrt(91.0) << endl;
```

(e) Print the digits of a + b backwards. So if a + b is 25, print 52.

Answer:

```
a = a + b;
while (a > 0) {
    cout << a % 10;
    a = a / 10;
}
cout << endl;
```

Problem 155

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```
int x, y;
```

(a) Print y copies of the word Hello on a single line of output.

Answer:

```
for (int c = 1; c <= y; c++) cout << "Hello ";
cout << endl;
```

(b) Print the remainder when variable x is divided by variable y.

Answer:

```
cout << x % y << endl;
```

(c) Print the square root of the square root of 19. Use a C++ function for the calculation.

Answer:

```
cout << sqrt(sqrt(19.0)) << endl;
```

(d) Print a random number in the range 123 to 126, inclusive. Use a C++ function.

Answer:

```
cout << rand() % 4 + 123 << endl;
```

(e) Print the digits of the variable y backwards. So if y is 25, print 52.

Answer:

```
    while (y > 0) {
        cout << y % 10;
        y = y / 10;
    }
    cout << endl;
```

Problem 156

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```
    int a, b;
```

(a) Print the exact quotient when variable b is divided by the sum of a and b.

Answer:

```
    cout << ((double) b) / (a + b) << endl;
```

(b) Print b copies of the word Hi on a single line of output.

Answer:

```
    for (int c = 1; c <= b; c++) cout << "Hi ";
    cout << endl;
```

(c) Print a random number in the range 33 to 153, inclusive. Use a C++ function.

Answer:

```
    cout << rand() % 121 + 33 << endl;
```

(d) Print the square root of the cube of 91. Use a C++ function for the calculation.

Answer:

```
    cout << sqrt(91.0 * 91 * 91) << endl;
```

(e) Print the digits of a * b backwards. So if a * b is 25, print 52.

Answer:

```
    a = a * b;
    while (a > 0) {
        cout << a % 10;
        a = a / 10;
    }
    cout << endl;
```

Problem 157

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```
int x, y, z;
```

(a) Print x copies of the number y on a single line of output.

Answer:

```
for (int c = 1; c <= x; c++) cout << y << " ";
cout << endl;
```

(b) Print the exact average of x, y and z.

Answer:

```
cout << (x + y + z) / 3.0 << endl;
```

(c) Print the square root of 5. Use a C++ function for the calculation.

Answer:

```
cout << sqrt(5.0) << endl;
```

(d) Print a random number in the range 1 to 6, inclusive. Use a C++ function.

Answer:

```
cout << rand() % 6 + 1 << endl;
```

(e) Print the first digit of the variable x.

Answer:

```
while (x >= 10) {
   x = x / 10;
}
cout << x << endl;
```

Problem 158

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```
int x, y, z;
```

(a) Print the bigger of x and y.

Answer:

```
if (x > y) cout << x << endl;
else cout << y << endl;
```

(b) Print x copies of the exact average of y and z on a single line of output.

Answer:

```
for (int c = 1; c <= x; c++) cout << (y + z) / 2.0 << " ";
cout << endl;
```

(c) Print a random number in the range 11 to 16, inclusive. Use a C++ function.

Answer:

```
cout << rand() % 6 + 11 << endl;
```

(d) Print the square root of 8. Use a C++ function for the calculation.

Answer:

```
cout << sqrt(8.0) << endl;
```

(e) Print the first digit of the sum x + y.

Answer:

```
x = x + y;
while (x >= 10) {
    x = x / 10;
}
cout << x << endl;
```

Problem 159

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```
int x, y, z;
```

(a) Print y copies of the number x on a single line of output.

Answer:

```
for (int c = 1; c <= y; c++) cout << x << " ";
cout << endl;
```

(b) Print the exact average of y and z.

Answer:

```
cout << (y + z) / 2.0 << endl;
```

(c) Print the square root of 50. Use a C++ function for the calculation.

Answer:

```
cout << sqrt(50.0) << endl;
```

(d) Print a random number in the range 3 to 8, inclusive. Use a C++ function.

Answer:

```
cout << rand() % 6 + 3 << endl;
```

(e) Print the first digit of the variable z.

Answer:

```
while (z >= 10) {
    z = z / 10;
}
cout << z << endl;
```

Problem 160

Write C++ statements to carry out the following tasks. Do not write complete programs, just give a few lines of C++ code. Assume the following variables have been declared and initialized with positive values.

```
int x, y, z;
```

(a) Print the smaller of x and y.

Answer:

```
if (x < y) cout << x << endl;
else cout << y << endl;
```

(b) Print z copies of the exact average of x and y on a single line of output.

Answer:

```
for (int c = 1; c <= z; c++) cout << (x + y) / 2.0 << " ";
cout << endl;
```

(c) Print a random number in the range 13 to 18, inclusive. Use a C++ function.

Answer:

```
cout << rand() % 6 + 13 << endl;
```

(d) Print the square root of 80. Use a C++ function for the calculation.

Answer:

```
cout << sqrt(80.0) << endl;
```

(e) Print the first digit of the sum y + z.

Answer:

```
x = y + z;
while (x >= 10) {
    x = x / 10;
}
cout << x << endl;
```

Problem 161   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int x = 4, y = 11, z = 91;
    string freddy = "Fred";
    string fred = "Freddy";
    cout << "fred" << endl;                          // line (a)
    cout << z / y << endl;                           // line (b)
    if ((y > x) && (y > z)) cout << fred << endl;    // line (c)
    cout << fred << freddy << endl;                  // line (d)
    cout << x << "x" << fred << "=" << z << "\n";    // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
fred
```

(b) What is the output at line (b)?

Answer:

```
8
```

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

```
FreddyFred
```

(e) What is the output at line (e)?

Answer:

```
4xFreddy=91
```

Problem 162   Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 12, y = 11, z = 9;
    string freddy = "Freddy";
    string fred = "Fred";
    cout << z % y << endl;                              // line (a)
    cout << fred << endl;                               // line (b)
    cout << "fred" << freddy << endl;                   // line (c)
    if ((x > y) && (y > z)) cout << freddy << endl;     // line (d)
    cout << x << y << "+" << z << "=" << x*y+z << "\n"; // line (e)
}
```

(a) What is the output at line (a)?

Answer:

9

(b) What is the output at line (b)?

Answer:

Fred

(c) What is the output at line (c)?

Answer:

fredFreddy

(d) What is the output at line (d)?

Answer:

Freddy

(e) What is the output at line (e)?

Answer:

1211+9=141

Problem 163   Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 4, y = 11, z = 9;
    string freddy = "Fred";
    string fred = "Freddy";
    cout << "freddy" << endl;                           // line (a)
    cout << (double) (z / x) << endl;                   // line (b)
    if ((y > x) && (y > z)) cout << fred << endl;       // line (c)
    cout << fred << fred << endl;                        // line (d)
    cout << x << "x" << fred << "=" << z << "\n";       // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
freddy
```

(b) What is the output at line (b)?

Answer:

```
2
```

(c) What is the output at line (c)?

Answer:

```
Freddy
```

(d) What is the output at line (d)?

Answer:

```
FreddyFreddy
```

(e) What is the output at line (e)?

Answer:

```
4xFreddy=9
```

Problem 164   Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 12, y = 11, z = 19;
    string freddy = "Freddy";
    string fred = "Fred";
    cout << (double) (z % y) << endl;                // line (a)
    cout << fred << endl;                            // line (b)
    cout << "freddy" << freddy << endl;              // line (c)
    if ((x > y) && (y > z)) cout << freddy << endl;  // line (d)
    cout << x << y << "+" << z << "=" << x*y+z << "\n";  // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
8
```

(b) What is the output at line (b)?

Answer:

```
Fred
```

(c) What is the output at line (c)?

Answer:

```
freddyFreddy
```

(d) What is the output at line (d)?

Answer:

(e) What is the output at line (e)?

Answer:

```
1211+19=151
```

Problem 165   Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 14, y = 11, z = 9;
    string freddy = "Freddy";
    string fred = "Fred";
    cout << "fred" << endl;                          // line (a)
    cout << z / y << endl;                           // line (b)
    if ((y > x) && (y > z)) cout << fred << endl;    // line (c)
    cout << fred << freddy << endl;                  // line (d)
    cout << x << "x" << fred << "=" << z << "\n";    // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
fred
```

(b) What is the output at line (b)?

Answer:

```
0
```

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

```
FredFreddy
```

(e) What is the output at line (e)?

Answer:

```
14xFred=9
```


Problem 166   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int x = 12, y = 11, z = 19;
    string freddy = "Fred";
    string fred = "Freddy";
    cout << z % y << endl;                              // line (a)
    cout << fred << endl;                               // line (b)
    cout << "fred" << freddy << endl;                   // line (c)
    if ((x > y) && (y > z)) cout << freddy << endl;     // line (d)
    cout << x << y << "+" << z << "=" << x*y+z << "\n"; // line (e)
}
```

(a) What is the output at line (a)?

Answer:

8

(b) What is the output at line (b)?

Answer:

Freddy

(c) What is the output at line (c)?

Answer:

fredFred

(d) What is the output at line (d)?

Answer:

(e) What is the output at line (e)?

Answer:

1211+19=151

Problem 167   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int x = 14, y = 11, z = 9;
    string freddy = "Freddy";
    string fred = "Freddy";
    cout << "freddy" << endl;                       // line (a)
    cout << (double) (z / x) << endl;               // line (b)
    if ((y > x) && (y > z)) cout << fred << endl;    // line (c)
    cout << fred << fred << endl;                   // line (d)
    cout << x << "x" << fred << "=" << z << "\n";   // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
freddy
```

(b) What is the output at line (b)?

Answer:

```
0
```

(c) What is the output at line (c)?

Answer:

(d) What is the output at line (d)?

Answer:

```
FreddyFreddy
```

(e) What is the output at line (e)?

Answer:

```
14xFreddy=9
```

Problem 168   Consider the following C++ program.

```
#include <iostream>
using namespace std;

int main() {
    int x = 19, y = 12, z = 11;
    string freddy = "Fred";
    string fred = "Fred";
    cout << (double) (z % y) << endl;                      // line (a)
    cout << fred << endl;                                  // line (b)
    cout << "freddy" << freddy << endl;                    // line (c)
    if ((x > y) && (y > z)) cout << freddy << endl;        // line (d)
    cout << x << y << "+" << z << "=" << x*y+z << "\n";    // line (e)
}
```

(a) What is the output at line (a)?

Answer:

```
11
```

(b) What is the output at line (b)?

Answer:

```
Fred
```

(c) What is the output at line (c)?

Answer:

```
freddyFred
```

(d) What is the output at line (d)?

Answer:

```
Fred
```

(e) What is the output at line (e)?

Answer:

```
1912+11=239
```

Problem 169   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter an integer between 1 and 20.

(2) If the user enters an illegal number, the program repeatedly asks the user to correct their number.

(3) If the user has not entered a correct number after 10 attempts, the program chooses 10 as the user's number.

(4) The program prints the cube of the user's number.

An example run of the program follows.

```
Enter an integer between 1 and 20: 100
Out of range.  Enter an integer between 1 and 20: -1
Out of range.  Enter an integer between 1 and 20: 5
The cube of your number is 125.
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter an integer between 1 and 20: ";
   cin >> n;
   int strikes = 0;
   while ( (n < 1) || (n > 20)) {
      strikes++;
      if (strikes >= 10) n = 10;
      else {
         cout << "Out of range.  Enter an integer between 1 and 20: ";
         cin >> n;
      }
   }
   cout << "The cube of your number is " << n * n * n << endl;
   return 0;
}
```

Problem 170   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter an integer between 100 and 200.

(2) If the user enters an illegal number, the program repeatedly asks the user to correct their number.

(3) If the user has not entered a correct number after 3 attempts, the program exits.

(4) The program repeatedly generates and prints random numbers between 1 and 1000 until it generates the user's number when it stops.

An example run of the program follows.

```
Enter an integer between 100 and 200: 100
Random numbers:  7 873 924 428 100
```

Answer:

```cpp
#include <iostream>
#include <cstdlib>
using namespace std;

int main() {
    int n;
    cout << "Enter an integer between 100 and 200: ";
    cin >> n;
    int strikes = 0;
    while ( (n < 100) || (n > 200)) {
        strikes++;
        if (strikes >= 3) return 0;
        cout << "Out of range.  Enter an integer between 100 and 200: ";
        cin >> n;
    }
    int random = 1000;
    while (n != random) {
        random = rand() % 1000 + 1;
        cout << random << " ";
    }
    cout << endl;
    return 0;
}
```

Problem 171   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter an integer between 10 and 100.

(2) If the user enters an illegal number, the program repeatedly asks the user to correct their number.

(3) If the user has not entered a correct number after 5 attempts, the program chooses 10 as the user's number.

(4) The program prints the square root of the user's number.

An example run of the program follows.

```
Enter an integer between 10 and 100: 1
Out of range.  Enter an integer between 10 and 100: 25
The square root of your number is 5.
```

Answer:

```cpp
#include <iostream>
#include <cmath>
using namespace std;

int main() {
    int n;
    cout << "Enter an integer between 10 and 100: ";
    cin >> n;
    int strikes = 0;
    while ( (n < 10) || (n > 100)) {
        strikes++;
        if (strikes >= 5) n = 10;
        else {
            cout << "Out of range.  Enter an integer between 10 and 100: ";
            cin >> n;
        }
    }
```

```
    cout << "The square root of your number is " << sqrt(n) << endl;
    return 0;
}
```

Problem 172   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter an integer between 50 and 100.

(2) If the user enters an illegal number, the program repeatedly asks the user to correct their number.

(3) If the user has not entered a correct number after 4 attempts, the program exits.

(4) The program repeatedly generates and prints random numbers between 1 and 1000 until it generates an exact divisor of the user's number when it stops.

An example run of the program follows.

```
Enter an integer between 50 and 100: 60
Random numbers:  7 873 924 428 100 30
```

Answer:

```
#include <iostream>
#include <cstdlib>
using namespace std;

int main() {
    int n;
    cout << "Enter an integer between 50 and 100: ";
    cin >> n;
    int strikes = 0;
    while ( (n < 50) || (n > 100)) {
        strikes++;
        if (strikes >= 4) return 0;
        cout << "Out of range.  Enter an integer between 50 and 100: ";
        cin >> n;
    }
    int random = 1000;
    while (n % random != 0) {
        random = rand() % 1000 + 1;
        cout << random << " ";
    }
    cout << endl;
    return 0;
}
```

Problem 173   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter two integers a and b with values between 1 and 20.

(2) If either of the user's numbers is illegal the program asks the user to reenter both numbers. This continues until two legal numbers have been entered.

(3) The program prints an $a \times a$ square of Xs and an adjacent $b \times b$ square of Ys. The squares should use top edges that lie in the same line.

An example run of the program follows.

```
Enter two integers between 1 and 20: 5 3

XXXXXYYY
```

```
XXXXXYYY
XXXXXYYY
XXXXX
XXXXX
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int a, b;
    cout << "Enter two integers between 1 and 20: ";
    cin >> a >> b;
    while ( (a < 1) || (a > 20) || (b < 1) || ( b > 20)) {
        cout << "Out of range.  Enter two integers between 1 and 20: ";
        cin >> a >> b;
    }
    int max = a;
    if (b > a) max = b;
    for (int r = 1; r <= max; r++) {
        for (int c = 1; c <= (a + b); c++) {
            if (c <= a) {
                if (r <= a) cout << "X";
                else cout << " ";
            }
            if ((c > a) && (r <= b)) cout << "Y";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 174   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter two integers a and b with values between 4 and 14.

(2) If either of the user's numbers is illegal the program terminates.

(3) The program prints an $a \times a$ square of Xs right on top of a $b \times b$ square of Ys. The squares should line up so that their left edges lie on the same line.

An example run of the program follows.

```
Enter two integers between 1 and 20: 5 4

XXXXX
XXXXX
XXXXX
XXXXX
XXXXX
YYYY
YYYY
YYYY
YYYY
```

Answer:

```cpp
#include <iostream>
using namespace std;
```

```
int main() {
    int a, b;
    cout << "Enter two integers between 4 and 14: ";
    cin >> a >> b;
    if ((a < 4) || (a > 14) || (b < 4) || ( b > 14))
        return 0;
    int max = a;
    if (b > a) max = b;
    for (int r = 1; r <= (a + b); r++) {
        for (int c = 1; c <= max; c++) {
            if (r <= a) {
                if (c <= a) cout << "X";
                else cout << " ";
            }
            if ((r > a) && (c <= b)) cout << "Y";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 175   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter two integers a and b with values between 1 and 10.

(2) If either of the user's numbers is illegal the program asks the user to reenter both numbers. This continues until two legal numbers have been entered.

(3) The program prints an $a \times a$ square of Xs and an adjacent $b \times b$ square of Ys. The squares should use bottom edges that lie in the same line.

An example run of the program follows.

```
Enter two integers between 1 and 10: 5 3

XXXXX
XXXXX
XXXXXYYY
XXXXXYYY
XXXXXYYY
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int a, b;
    cout << "Enter two integers between 1 and 10: ";
    cin >> a >> b;
    while ( (a < 1) || (a > 10) || (b < 1) || ( b > 10)) {
        cout << "Out of range.  Enter two integers between 1 and 10: ";
        cin >> a >> b;
    }
    int max = a;
    if (b > a) max = b;
    for (int r = max; r >= 1; r--) {
        for (int c = 1; c <= (a + b); c++) {
            if (c <= a) {
```

```
            if (r <= a) cout << "X";
            else cout << " ";
          }
          if ((c > a) && (r <= b)) cout << "Y";
        }
        cout << endl;
      }
      return 0;
    }
```

Problem 176   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter two integers a and b with values between 4 and 14.

(2) If either of the user's numbers is illegal the program terminates.

(3) The program prints an $a \times a$ square of Xs right on top of a $b \times b$ square of Ys. The squares should be lined up so that their right edges lie on the same line.

An example run of the program follows.

```
Enter two integers between 4 and 14: 5 4

XXXXX
XXXXX
XXXXX
XXXXX
XXXXX
 YYYY
 YYYY
 YYYY
 YYYY
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int a, b;
    cout << "Enter two integers between 4 and 14: ";
    cin >> a >> b;
    if ((a < 4) || (a > 14) || (b < 4) || ( b > 14))
        return 0;
    int max = a;
    if (b > a) max = b;
    for (int r = 1; r <= (a + b); r++) {
        for (int c = max; c >= 1; c--) {
            if (r <= a) {
                if (c <= a) cout << "X";
                else cout << " ";
            }
            if ((r > a) && (c <= b)) cout << "Y";
            if ((r > a) && (c > b)) cout << " ";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 177   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter two integers a and b with values between 1 and 20.

(2) If either of the user's numbers is illegal the program asks the user to reenter both numbers. This continues until two legal numbers have been entered.

(3) The program prints a rows each of which contains a columns of Xs, but each pair of rows is separated by b blank lines.

An example run of the program follows.

```
Enter two integers between 1 and 20: 4 2
XXXX


XXXX


XXXX


XXXX
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int a, b;
   cout << "Enter two integers between 1 and 20: ";
   cin >> a >> b;
   while ( (a < 1) || (a > 20) || (b < 1) || ( b > 20)) {
      cout << "Out of range.  Enter two integers between 1 and 20: ";
      cin >> a >> b;
   }
   for (int r = 1; r <= a; r++) {
      for (int c = 1; c <= a; c++) cout << "X";
      for (int blank = 0; blank <= b; blank++) cout << endl;
   }
   return 0;
}
```

Problem 178   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter two integers a and b with values between 2 and 10.

(2) If either of the user's numbers is illegal the program terminates at once.

(3) The program prints $a + b$ rows each of which contains a columns of Xs, but each pair of columns is separated by b blank columns.

An example run of the program follows.

```
Enter two integers between 2 and 10: 3 2
X  X  X
X  X  X
X  X  X
X  X  X
X  X  X
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int a, b;
    cout << "Enter two integers between 2 and 10: ";
    cin >> a >> b;
    if( (a < 2) || (a > 10) || (b < 2) || ( b > 10)) return 0;
    for (int r = 1; r <= (a + b); r++) {
        for (int c = 1; c <= a; c++) {
            cout << "X";
            for (int blank = 1; blank <= b; blank++) cout << " ";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 179   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter two integers a and b with values between 1 and 15.

(2) If either of the user's numbers is illegal the program asks the user to reenter both numbers. This continues until two legal numbers have been entered.

(3) The program prints a rows each of which contains $a * b$ columns of Xs, but after every b complete rows it inserts an extra blank line.

An example run of the program follows.

```
Enter two integers between 1 and 15: 5 2
XXXXXXXXXX
XXXXXXXXXX

XXXXXXXXXX
XXXXXXXXXX

XXXXXXXXXX
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int a, b;
    cout << "Enter two integers between 1 and 15: ";
    cin >> a >> b;
    while ( (a < 1) || (a > 15) || (b < 1) || ( b > 15)) {
        cout << "Out of range.  Enter two integers between 1 and 15: ";
        cin >> a >> b;
    }
    for (int r = 1; r <= a; r++) {
        for (int c = 1; c <= a * b; c++) cout << "X";
        cout << endl;
        if (r % b == 0) cout << endl;
    }
    return 0;
}
```

Problem 180   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter two integers a and b with values between 3 and 12.

(2) If either of the user's numbers is illegal the program terminates at once.

(3) The program prints $a + b$ rows each of which contains $a * b$ columns of Xs, but after each group of b complete columns the program prints a | symbol.

An example run of the program follows.

```
Enter two integers between 3 and 12: 4 5
XXXXX|XXXXX|XXXXX|XXXXX|
XXXXX|XXXXX|XXXXX|XXXXX|
XXXXX|XXXXX|XXXXX|XXXXX|
XXXXX|XXXXX|XXXXX|XXXXX|
XXXXX|XXXXX|XXXXX|XXXXX|
XXXXX|XXXXX|XXXXX|XXXXX|
XXXXX|XXXXX|XXXXX|XXXXX|
XXXXX|XXXXX|XXXXX|XXXXX|
XXXXX|XXXXX|XXXXX|XXXXX|
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int a, b;
    cout << "Enter two integers between 3 and 12: ";
    cin >> a >> b;
    if( (a < 3) || (a > 12) || (b < 3) || ( b > 12)) return 0;
    for (int r = 1; r <= (a + b); r++) {
        for (int c = 1; c <= a * b; c++) {
            cout << "X";
            if (c % b == 0) cout << "|";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 181   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n.

(2) If the user enters an illegal integer for n, the program terminates.

(3) The program prints all positive integers less than n that are multiples of 5 (one number per line).

For example if the user enters 23 for n the program would output

```
5
10
15
20
```

Answer:

```cpp
#include <iostream>
using namespace std;
int main() {
```

```
      int n;
      cout << "Enter a positive integer n: ";
      cin >> n;
      if (n <= 0) return 0;
      for (int i = 1; i < n; i++)
        if (i % 5 == 0) cout << i << endl;
      return 0;
}
```

Problem 182   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following declarations have been made and the declared variables have been set to have legal values.

```
string firstName, lastName;
int x, y, z;
double pi;
```

(i) Print to the screen the message:

```
pi is 22/7
```

Answer:

```
   cout << "pi is 22/7" << endl;
```

(ii) Print to the screen the value of x + y + z.
Answer:

```
   cout << x + y + z << endl;
```

(iii) Read in the values of x, y, and z (in this order).
Answer:

```
   cout << "Enter x,y and z: ";
   cin >> x >> y >> z;
```

(iv) If the value of firstName is Freddy, print the message Goodbye. Otherwise print Hello.
Answer:

```
   if (firstName == "Freddy") cout << "Goodbye" << endl;
   else cout << "Hello" << endl;
```

(v) Prompt the user to enter a first name and last name and read their response to appropriate variables.
Answer:

```
   cout << "Enter first name and last name:";
   cin >> firstName >> lastName;
```

Problem 183   Consider the following C++ program. What is the exact output from the program in response to each of the following user inputs?

```
#include <iostream>
using namespace std;
int main() {
   int x, y;
```

```
        cout << "Please enter two positive integers: ";
        cin >> x >> y;
        if (x <= 0) cout << "Illegal ";
        if (y <= 0) {
            cout << "Goodbye! " << endl;
            return 0;
        }
        if ((x % 2 == 0) || (y % 2 == 0)) cout << x * y << " ";
        if ((x <= 0) && (y > 10)) cout << -x << " ";
        if (!(y > x)) cout << y;
        cout << endl;
        return 0;
}
```

(a) The user enters: -5 4

```
Illegal -20
```

(b) The user enters: 4 -5

```
Goodbye!
```

(c) The user enters: 10 1

```
10 1
```

(d) The user enters: 1 10

```
10
```

(e) The user enters: 1 1

```
1
```

Problem 184   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. The program asks the user to enter a positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of n has been entered.

3. The program prints a triangular pattern with side n. Its horizontal side is at the top and its vertical side is at the right.

For example, if the user enters 4 for n the program should print the following picture.

```
****
 ***
  **
   *
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer: ";
    cin >> n;
    while (n <= 0) {
```

```
        cout << "That is not positive. Try again: ";
        cin >> n;
    }
    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= n; c++) {
            if (c >= r) cout << "*";
            else cout << " ";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 185   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter an integer n greater than 10.

(2) If the user enters an illegal integer for n, the program terminates.

(3) The program prints all positive integers between n and $2n$ (inclusive) that are multiples of 5 (one number per line).

For example if the user enters 13 for n the program would output

```
15
20
25
```

Answer:

```
#include <iostream>
using namespace std;
int main() {
    int n;
    cout << "Enter an integer n greater than 10: ";
    cin >> n;
    if (n <= 10) return 0;
    for (int i = n; i <= 2*n; i++)
        if (i % 5 == 0) cout << i << endl;
    return 0;
}
```

Problem 186   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following declarations have been made and the declared variables have been set to have legal values.

```
string firstName, lastName;
int x, y, z;
double pi;
```

(i) Print to the screen the message:

```
x is greater than y
```

Answer:

```
    cout << "x is greater than y" << endl;
```

(ii) Print to the screen the value of xy + z.

Answer:

```
   cout << x * y + z << endl;
```

(iii) Read in the values of z, y, and x (in this order).

Answer:

```
   cout << "Enter z,y and x: ";
   cin >> z >> y >> x;
```

(iv) If the value of firstName is Freddy, print the message No. Otherwise print the value of x.

Answer:

```
   if (firstName == "Freddy") cout << "No" << endl;
   else cout << x << endl;
```

(v) Use the approximation 22/7 to set the value of pi.

Answer:

```
   pi = 22.0 / 7;
```

Problem 187   Consider the following C++ program. What is the exact output from the program in response to each of the following user inputs?

```cpp
#include <iostream>
using namespace std;
int main() {
   int x, y;
   cout << "Please enter two positive integers: ";
   cin >> x >> y;
   if (x <= 3) cout << "Error ";
   if (y <= 3) {
       cout << "Aha! " << endl;
       return 0;
   }
   if ((x % 2 != 0) && (y % 2 == 0)) cout << x * y << " ";
   if ((x <= 0) || (y > 10)) cout << -x << " ";
   if (!(y == x)) cout << y;
   cout << endl;
   return 0;
}
```

(a) The user enters: -5 4

```
Error -20 5 4
```

(b) The user enters: 4 -5

```
Aha!
```

(c) The user enters: 10 1

```
Aha!
```

(d) The user enters: 1 10

```
Error 10 10
```

(e) The user enters: 10 10

Problem 188   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. The program asks the user to enter a positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program should terminate immediately.

3. The program prints two copies of a triangular pattern with side n. Each triangle has a horizontal side at the top and a vertical side at the right. The second copy is underneath the first.

For example, if the user enters 3 for n the program should print the following picture.

```
***
 **
  *
***
 **
  *
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a positive integer: ";
   cin >> n;
   if (n <= 0) return 0;
   for (int copy = 1; copy <= 2; copy++) {
      for (int r = 1; r <= n; r++) {
         for (int c = 1; c <= n; c++) {
            if (c >= r) cout << "*";
            else cout << " ";
         }
         cout << endl;
      }
   }
   return 0;
}
```

Problem 189   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter an integer n that is between 20 and 40 (inclusive).

(2) If the user enters an illegal integer for n, the program terminates.

(3) The program prints all positive integers less than or equal to $n/5$ (one number per line).

For example if the user enters 28 for n the program would output

```
1
2
3
4
5
```

Answer:

```cpp
#include <iostream>
using namespace std;
int main() {
```

```
   int n;
   cout << "Enter an integer n between 20 and 40: ";
   cin >> n;
   if (n < 20 || n > 40) return 0;
   for (int i = 1; i <= n/5; i++)
     cout << i << endl;
   return 0;
}
```

Problem 190   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following declarations have been made and the declared variables have been set to have legal values.

```
string firstName, lastName;
int x, y, z;
double pi;
```

(i) Print to the screen the message:

```
Your firstName is x
```

Answer:

```
   cout << "Your firstName is x" << endl;
```

(ii) Print to the screen the remainder when x + y is divided by z.
Answer:

```
   cout << (x + y) % z << endl;
```

(iii) Read in the values of firstName and lastName (in this order).
Answer:

```
   cout << "Enter first name and last name:";
   cin >> firstName >> lastName;
```

(iv) If the value of firstName is not Freddy, print the message Hello. Otherwise end the program.
Answer:

```
   if (firstName != "Freddy") cout << "Hello" << endl;
   else return 0;
```

(v) Prompt the user to enter values for x, y and z and read their response to appropriate variables.
Answer:

```
   cout << "Enter x,y and z: ";
   cin >> x >> y >> z;
```

Problem 191   Consider the following C++ program. What is the exact output from the program in response to each of the following user inputs?

```
#include <iostream>
using namespace std;
int main() {
   int x, y;
   cout << "Please enter two positive integers: ";
   cin >> x >> y;
```

```
    if (x <= 0) cout << "Illegal ";
    if (y <= 0) {
        cout << "Goodbye! " << endl;
        return 0;
    }
    if ((x % 2 == 0) || (y % 2 == 0)) cout << x * y << " ";
    if ((x <= 0) && (y > 10)) cout << -x << " ";
    if (!(y > x)) cout << y;
    cout << endl;
    return 0;
}
```

(a) The user enters: -12 -12

```
Illegal Goodbye!
```

(b) The user enters: -12 12

```
Illegal -144 12
```

(c) The user enters: 1 12

```
12
```

(d) The user enters: 1 13

(e) The user enters: 12 12

```
144 12
```


Problem 192   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. The program asks the user to enter a positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of n has been entered.

3. The program prints a triangular pattern with side n. Its horizontal side is at the bottom and its vertical side is at the right.

For example, if the user enters 4 for n the program should print the following picture.

```
   *
  **
 ***
****
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer: ";
    cin >> n;
    while (n <= 0) {
        cout << "That is not positive. Try again: ";
        cin >> n;
```

```
      }
      for (int r = n; r >= 1; r--) {
         for (int c = 1; c <= n; c++) {
            if (c >= r) cout << "*";
            else cout << " ";
         }
         cout << endl;
      }
      return 0;
}
```

Problem 193   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n that is less than 40.

(2) If the user enters an illegal integer for n, the program terminates.

(3) The program prints all even positive integers less than n (one number per line).

For example if the user enters 9 for n the program would output

```
2
4
6
8
```

Answer:

```
#include <iostream>
using namespace std;
int main() {
   int n;
   cout << "Enter a positive integer n less than 40: ";
   cin >> n;
   if (n <= 0 || n >= 40) return 0;
   for (int i = 1; i < n; i++)
     if (i % 2 == 0) cout << i << endl;
   return 0;
}
```

Problem 194   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following declarations have been made and the declared variables have been set to have legal values.

```
string firstName, lastName;
int x, y, z;
double pi;
```

(i) Print to the screen the message:

```
x + y + z is positive
```

Answer:

```
   cout << "x + y + z is positive" << endl;
```

(ii) Print to the screen the quotient of x + z by y. (Use integer division.)

Answer:

```
cout << (x + z) / y << endl;
```

(iii) Read in the values of x and pi (in this order).

Answer:

```
cout << "Enter x and pi: ";
cin >> x >> pi;
```

(iv) If the value of firstName is Freddy, print the value of pi. Otherwise print Hello.

Answer:

```
if (firstName == "Freddy") cout << pi << endl;
else cout << "Hello" << endl;
```

(v) If x is positive and z is negative print the value of y.

Answer:

```
if (x > 0 && z < 0) cout << y << endl;
```

Problem 195   Consider the following C++ program. What is the exact output from the program in response to each of the following user inputs?

```
#include <iostream>
using namespace std;
int main() {
   int x, y;
   cout << "Please enter two positive integers: ";
   cin >> x >> y;
   if (x <= 3) cout << "Error ";
   if (y <= 3) {
      cout << "Aha! " << endl;
      return 0;
   }
   if ((x % 2 != 0) && (y % 2 == 0)) cout << x * y << " ";
   if ((x <= 0) || (y > 10)) cout << -x << " ";
   if (!(y == x)) cout << y;
   cout << endl;
   return 0;
}
```

(a) The user enters: -6 5

```
Error 6 5
```

(b) The user enters: 5 -6

```
Aha!
```

(c) The user enters: 11 2

```
Aha!
```

(d) The user enters: 2 11

```
Error -2 11
```

(e) The user enters: 11 11

```
-11
```

Problem 196   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. The program asks the user to enter a positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program should terminate immediately.

3. The program prints two copies of a triangular pattern with side n. Each triangle has a horizontal side at the bottom and a vertical side at the right. The second copy is underneath the first.

For example, if the user enters 3 for n the program should print the following picture.

```
  *
 **
***
  *
 **
***
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a positive integer: ";
   cin >> n;
   if (n <= 0) return 0;
   for (int copy = 1; copy <= 2; copy++) {
      for (int r = n; r >= 1; r--) {
         for (int c = 1; c <= n; c++) {
            if (c >= r) cout << "*";
            else cout << " ";
         }
         cout << endl;
      }
   }
   return 0;
}
```

Problem 197   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n.

(2) If the user enters an illegal integer for n, the program terminates.

(3) The program prints all positive integers less than n that leave a remainder of 2 when they are divided by 5 (one number per line).

For example if the user enters 23 for n the program would output

```
2
7
12
17
22
```

Answer:

```
#include <iostream>
using namespace std;
int main() {
   int n;
   cout << "Enter a positive integer n: ";
   cin >> n;
   if (n <= 0) return 0;
   for (int i = 1; i < n; i++)
     if (i % 5 == 2) cout << i << endl;
   return 0;
}
```

Problem 198   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following declarations have been made and the declared variables have been set to have legal values.

```
string firstName, lastName;
int x, y, z;
double pi;
```

(i) Print to the screen the message:

```
PI is 22/7
```

Answer:

```
   cout << "PI is 22/7" << endl;
```

(ii) Print to the screen the value of $x/y + z$ (use integer division).
Answer:

```
   cout << x / y + z << endl;
```

(iii) Read in the values of x and y (in this order).
Answer:

```
   cout << "Enter x and y: ";
   cin >> x >> y;
```

(iv) If the value of firstName is Freddy, exit the program. Otherwise print Hello.
Answer:

```
   if (firstName == "Freddy") return 0;
   else cout << "Hello" << endl;
```

(v) Prompt the user to enter a last name and first name and read their response to appropriate variables.
Answer:

```
   cout << "Enter last name and first name:";
   cin >> lastName >> firstName;
```

Problem 199   Consider the following C++ program. What is the exact output from the program in response to each of the following user inputs?

```
#include <iostream>
using namespace std;
int main() {
```

```
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (x <= 0) cout << "Illegal ";
    if (y <= 0) {
        cout << "Goodbye! " << endl;
        return 0;
    }
    if ((x % 2 == 0) || (y % 2 == 0)) cout << x * y << " ";
    if ((x <= 0) && (y > 10)) cout << -x << " ";
    if (!(y > x)) cout << y;
    cout << endl;
    return 0;
}
```

(a) The user enters: -4 5

```
Illegal -20
```

(b) The user enters: 5 -4

```
Goodbye!
```

(c) The user enters: 11 2

```
22 2
```

(d) The user enters: 2 11

```
22
```

(e) The user enters: 2 2

```
4 2
```

Problem 200   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. The program asks the user to enter a positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of n has been entered.

3. The program prints two adjacent triangular patterns with side n. Each triangle has a horizontal side at the top and a vertical side at the right.

For example, if the user enters 4 for n the program should print the following picture.

```
**** ****
 ***  ***
  **   **
   *    *
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer: ";
    cin >> n;
```

```
    while (n <= 0) {
        cout << "That is not positive. Try again: ";
        cin >> n;
    }
    for (int r = 1; r <= n; r++) {
        for (int copy = 1; copy <= 2; copy++) {
            for (int c = 1; c <= n; c++) {
                if (c >= r) cout << "*";
                else cout << " ";
            }
            cout << " ";
        }
        cout << endl;
    }
    return 0;
}
```

Problem 201   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter an integer n greater than 10.

(2) If the user enters an illegal integer for n, the program terminates.

(3) The program prints all positive integers between n and $2n$ (inclusive) that leave a remainder of 1 when divided by 5 (one number per line).

For example if the user enters 13 for n the program would output

```
16
21
26
```

Answer:

```
#include <iostream>
using namespace std;
int main() {
    int n;
    cout << "Enter an integer n greater than 10: ";
    cin >> n;
    if (n <= 10) return 0;
    for (int i = n; i <= 2*n; i++)
        if (i % 5 == 1) cout << i << endl;
    return 0;
}
```

Problem 202   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following declarations have been made and the declared variables have been set to have legal values.

```
string firstName, lastName;
int x, y, z;
double pi;
```

(i) Print to the screen the message:

```
x + y = 7
```

Answer:

```
cout << "x + y = 7" << endl;
```

(ii) Print to the screen quotient when xy is divided by z. (Use integer division.)

Answer:

```
cout << x * y / z << endl;
```

(iii) Read in the values of z, y, and x (in this order).

Answer:

```
cout << "Enter z,y and x: ";
cin >> z >> y >> x;
```

(iv) Use the approximation 22/7 to set the value of pi.

Answer:

```
pi = 22 / 7.0;
```

(v) If the value of firstName is not Freddy, print the message No. Otherwise print the value of x.

Answer:

```
if (firstName != "Freddy") cout << "No" << endl;
else cout << x << endl;
```

Problem 203   Consider the following C++ program. What is the exact output from the program in response to each of the following user inputs?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (x <= 3) cout << "Error ";
    if (y <= 3) {
        cout << "Aha! " << endl;
        return 0;
    }
    if ((x % 2 != 0) && (y % 2 == 0)) cout << x * y << " ";
    if ((x <= 0) || (y > 10)) cout << -x << " ";
    if (!(y == x)) cout << y;
    cout << endl;
    return 0;
}
```

(a) The user enters: 4 -5

Aha!

(b) The user enters: -5 4

Error -20 5 4

(c) The user enters: 10 10

(d) The user enters: 5 10

```
50 10
```

(e) The user enters: 10 5

```
5
```

Problem 204   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. The program asks the user to enter a positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program should terminate immediately.

3. The program prints two copies of a triangular pattern with side n. Each triangle has a horizontal side at the top and a vertical side at the right. The second copy should be underneath and to the right of the first.

For example, if the user enters 3 for n the program should print the following picture.

```
***
 **
  *
   ***
    **
     *
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a positive integer: ";
   cin >> n;
   if (n <= 0) return 0;
   for (int copy = 1; copy <= 2; copy++) {
      for (int r = 1; r <= n; r++) {
         for (int skip = 1; skip <= (copy - 1) *n; skip++)
            cout << " ";
         for (int c = 1; c <= n; c++) {
            if (c >= r) cout << "*";
            else cout << " ";
         }
         cout << endl;
      }
   }
   return 0;
}
```

Problem 205   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter an integer n that is between 20 and 40 (inclusive).

(2) If the user enters an illegal integer for n, the program terminates.

(3) The program prints all positive odd integers that are less than or equal to $n/5$ (one number per line).

For example if the user enters 28 for n the program would output

```
1
3
5
```

Answer:

```cpp
#include <iostream>
using namespace std;
int main() {
    int n;
    cout << "Enter an integer n between 20 and 40: ";
    cin >> n;
    if (n < 20 || n > 40) return 0;
    for (int i = 1; i <= n/5; i++)
        if (i % 2 == 1) cout << i << endl;
    return 0;
}
```

Problem 206 Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following declarations have been made and the declared variables have been set to have legal values.

```cpp
string firstName, lastName;
int x, y, z;
double pi;
```

(i) Print to the screen the message:

```
Your name is x
```

Answer:

```cpp
cout << "Your name is x" << endl;
```

(ii) Print to the screen the quotient when x is divided by yz (use integer division).

Answer:

```cpp
cout << x / (y * z) << endl;
```

(iii) Read in the values of firstName and lastName (in this order).

Answer:

```cpp
cout << "Enter first name and last name:";
cin >> firstName >> lastName;
```

(iv) If the value of x is 5 or firstName is not Freddy, print the message Hello. Otherwise end the program.

Answer:

```cpp
if ((x == 5) || (firstName != "Freddy")) cout << "Hello" << endl;
else return 0;
```

(v) Prompt the user to enter values for x, y and z and read their response for x only.

Answer:

```cpp
cout << "Enter x,y and z: ";
cin >> x;
```

Problem 207 Consider the following C++ program. What is the exact output from the program in response to each of the following user inputs?

```cpp
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (x <= 0) cout << "Illegal ";
    if (y <= 0) {
        cout << "Goodbye! " << endl;
        return 0;
    }
    if ((x % 2 == 0) || (y % 2 == 0)) cout << x * y << " ";
    if ((x <= 0) && (y > 10)) cout << -x << " ";
    if (!(y > x)) cout << y;
    cout << endl;
    return 0;
}
```

(a) The user enters: -12 -12

```
Illegal Goodbye!
```

(b) The user enters: 12 -12

```
Goodbye!
```

(c) The user enters: 12 12

```
144 12
```

(d) The user enters: 1 12

```
12
```

(e) The user enters: 1 13

Problem 208   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. The program asks the user to enter a positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of n has been entered.

3. The program prints two adjacent triangular patterns with side n. Each triangle has a horizontal side at the bottom and a vertical side at the right.

For example, if the user enters 4 for n the program should print the following picture.

```
   *      *
  **     **
 ***    ***
**** ****
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
```

```
    int n;
    cout << "Enter a positive integer: ";
    cin >> n;
    while (n <= 0) {
       cout << "That is not positive. Try again: ";
       cin >> n;
    }
    for (int r = n; r >= 1; r--) {
       for (int copy = 1; copy <= 2; copy++) {
          for (int c = 1; c <= n; c++) {
             if (c >= r) cout << "*";
             else cout << " ";
          }
          cout << " ";
       }
       cout << endl;
    }
    return 0;
}
```

Problem 209   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n that is less than 40.

(2) If the user enters an illegal integer for n, the program terminates.

(3) The program prints all positive integers that square to a number less than n (one number per line).

For example if the user enters 9 for n the program would output

```
1
2
```

Answer:

```
#include <iostream>
using namespace std;
int main() {
    int n;
    cout << "Enter a positive integer n less than 40: ";
    cin >> n;
    if (n <= 0 || n >= 40) return 0;
    for (int i = 1; i*i < n; i++)
      cout << i << endl;
    return 0;
}
```

Problem 210   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following declarations have been made and the declared variables have been set to have legal values.

```
string firstName, lastName;
int x, y, z;
double pi;
```

(i) Print to the screen the message:

```
x % y + z is positive
```

Answer:

```
cout << "x % y + z is positive" << endl;
```

(ii) Print to the screen the quotient of x + z by x + y (use integer division).

Answer:

```
cout << (x + z) / (x + y) << endl;
```

(iii) Read in the values of pi and y (in this order).

Answer:

```
cout << "Enter pi and y: ";
cin >> pi >> y;
```

(iv) If the value of firstName is Freddy and y is equal to z, print the value of pi. Otherwise print No.

Answer:

```
if ((firstName == "Freddy") && (y == z)) cout << pi << endl;
else cout << "No" << endl;
```

(v) If x is positive and z is not even print the value of y.

Answer:

```
if ((x > 0) && (z % 2 != 0)) cout << y;
```

Problem 211   Consider the following C++ program. What is the exact output from the program in response to each of the following user inputs?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (x <= 3) cout << "Error ";
    if (y <= 3) {
        cout << "Aha! " << endl;
        return 0;
    }
    if ((x % 2 != 0) && (y % 2 == 0)) cout << x * y << " ";
    if ((x <= 0) || (y > 10)) cout << -x << " ";
    if (!(y == x)) cout << y;
    cout << endl;
    return 0;
}
```

(a) The user enters: 5 -6

```
Aha!
```

(b) The user enters: -6 5

```
Error 6 5
```

(c) The user enters: 11 11

```
-11
```

(d) The user enters: 3 11

```
Error -3 11
```

(e) The user enters: 11 5

```
5
```

Problem 212   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. The program asks the user to enter a positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program should terminate immediately.

3. The program prints two copies of a triangular pattern with side n. Each triangle has a horizontal side at the bottom and a vertical side at the right. The second copy should be underneath and to the right of the first.

For example, if the user enters 3 for n the program should print the following picture.

```
  *
 **
***
     *
    **
   ***
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a positive integer: ";
   cin >> n;
   if (n <= 0) return 0;
   for (int copy = 1; copy <= 2; copy++) {
      for (int r = n; r >= 1; r--) {
         for (int skip = 1; skip <= (copy - 1) *n; skip++)
            cout << " ";
         for (int c = 1; c <= n; c++) {
            if (c >= r) cout << "*";
            else cout << " ";
         }
         cout << endl;
      }
   }
   return 0;
}
```

Problem 213   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n.

(2) If the user enters a non-positive integer for n, the program terminates.

(3) The program prints a triangle with n rows using the number r to make the characters on row number r.

For example, if the user enters 4 for n the output is as follows:

```
1
22
333
4444
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer n: ";
    cin >> n;
    if (n <= 0) return 0;
    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= r; c++) cout << r;
        cout << endl;
    }
    return 0;
}
```

Problem 214   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print to the screen the message:

```
2 + 2 = 3
```

Answer:

```cpp
cout << "2 + 2 = 3";
```

(ii) Print the square root of 10.

Answer:

```cpp
cout << sqrt(10.0);
```

(iii) Print a random number r with $7 \leq r \leq 27$. (An appropriate C++ function must be used to make the random number.)

Answer:

```cpp
cout << rand() % 21 + 7;
```

(iv) Ask the user to enter their age. If their answer does not satisfy $5 \leq age \leq 99$ exit the program immediately.

Answer:

```cpp
cout << "Enter your age: ";
int age;
cin >> age;
if (age < 5 || age > 99) return 0;
```

(v) Print to the screen every two digit number n that is an exact multiple of 3. Print one number per line. (For example 15 would be printed but 14 would not be printed since $15 = 5 \times 3$.)

Answer:

```cpp
for (int n = 10; n <= 99; n++)
    if (n % 3 == 0) cout << n << endl;
```

Problem 215   Consider the following C++ program. What is the output from the program in response to the following user input?

```cpp
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (y <= 0)
        cout << "Are you positive?\n";
    while (y < 10) {
        cout << y;
        y = y + x;
    }
    cout << y << endl;
    return 0;
}
```

(a) The user enters: -5 5

```
Illegal
```

(b) The user enters: 5 -5

```
Are you positive?
-50510
```

(c) The user enters: 10 1

```
111
```

(d) The user enters: 1 10

```
10
```

(e) The user enters: 1 1

```
12345678910
```

Problem 216   Write a complete C++ program that does the following.

1. It asks the user to enter a positive integer less than 1000.

2. If the entered number is out of range, the message "Wrong!" is printed and the program terminates.

3. Otherwise the program prints the product of the digits in the number that was entered.

Here is an example of how the program should work:

```
Enter a positive integer less than 1000:    89
Product of digits: 72
```

Answer:

```cpp
#include <iostream>
using namespace std;
```

```
int main() {
    int n;
    cout << "Enter a positive integer less than 1000: ";
    cin >> n;
    if (n <= 0 || n >= 1000) {
        cout << "Wrong!" << endl;
        return 0;
    }
    int ans = 1;
    while (n > 0) {
        ans = ans * (n % 10);
        n = n / 10;
    }
    cout << "Product of digits: " << ans << endl;
    return 0;
}
```

Problem 217   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n.

(2) Until the user enters a positive integer for n, the program makes the user enter another choice for n.

(3) The program prints a triangle with n rows, where the rows are formed by using the characters X and O in sequence.

For example, if the user enters 4 for n the output is as follows:

```
X
OO
XXX
OOOO
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer n: ";
    cin >> n;
    while (n <= 0) {
        cout << "Not positive. Try again: ";
        cin >> n;
    }
    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= r; c++)
            if (r % 2 == 1) cout << "X";
            else cout << "O";
        cout << endl;
    }
    return 0;
}
```

Problem 218   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print to the screen the message:

```
1 x 2 x 3 x 4 = 24
```

Answer:

```
cout << "1 x 2 x 3 x 4 = 24";
```

(ii) Print a random number r with $11 \leq r \leq 29$. (An appropriate C++ function must be used to make the random number.)

Answer:

```
cout << rand() % 19 + 11;
```

(iii) Print the sum of the square roots of 11 and 12.

Answer:

```
cout << sqrt(11.0) + sqrt(12.0);
```

(iv) Ask the user to enter their age. If their answer does not satisfy $0 \leq age \leq 1000$ exit the program immediately.

Answer:

```
cout << "Enter your age: ";
int age;
cin >> age;
if (age < 0 || age > 1000) return 0;
```

(v) Print to the screen every four digit number n that is divisible by both 6 and 10. Print one number per line. (For example 6000 would be printed but 5999 would not be printed since $6000 = 6 \times 1000 = 10 \times 600$.)

Answer:

```
for (int i = 1000; i <= 9999; i++)
    if (i % 6 == 0 && i % 10 == 0) cout << i << endl;
```

Problem 219   Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (y <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (x <= 0)
        cout << "Are you positive?\n";
    while (x < 10) {
        cout << x;
        x = y + x;
    }
    cout << y << endl;
    return 0;
}
```

(a) The user enters: -5 5

```
Are you positive?
-5055
```

(b) The user enters: 5 -5

```
Illegal
```

(c) The user enters: 10 1

```
1
```

(d) The user enters: 1 10

```
110
```

(e) The user enters: 1 1

```
1234567891
```

Problem 220   Write a complete C++ program that does the following.
1. It asks the user to enter a positive integer less than 5000.
2. If the entered number is out of range, the message "Wrong!" is printed and the program terminates.
3. Otherwise the program prints the sum of the square roots of the digits in the number that was entered.
Here is an example of how the program should work:

```
Enter a positive integer less than 5000:    994
Sum of square roots of digits: 8
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer less than 5000: ";
    cin >> n;
    if (n <= 0 || n >= 5000) {
        cout << "Wrong!" << endl;
        return 0;
    }
    double ans = 0.0;
    while (n > 0) {
        ans = ans + sqrt((double) (n % 10));
        n = n / 10;
    }
    cout << "Sum of square roots of digits: " << ans << endl;
    return 0;
}
```

Problem 221   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
(1) The program asks the user to enter a positive integer n.
(2) If the user enters a non-positive integer for n, the program terminates.
(3) The program prints a triangle with n rows using the number c to make the characters in column number c.
For example, if the user enters 4 for n the output is as follows:

```
1
12
123
1234
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer n: ";
    cin >> n;
    if (n <= 0) return 0;
    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= r; c++) cout << c;
        cout << endl;
    }
    return 0;
}
```

Problem 222   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print to the screen the message:

```
Hello
Hello Hello
```

Answer:

```cpp
cout << "Hello\nHello Hello\n";
```

(ii) Print the square root of 2.

Answer:

```cpp
cout << sqrt(2.0);
```

(iii) Print a random number r with $-7 \le r \le 0$. (An appropriate C++ function must be used to make the random number.)

Answer:

```cpp
cout << rand() % 8 - 7;
```

(iv) Ask the user to enter their age. If their answer does not satisfy $5 \le age \le 99$ print the word "Illegal".

Answer:

```cpp
cout << "Enter your age: ";
int age;
cin >> age;
if (age < 5 || age > 99) cout << "Illegal";
```

(v) Print to the screen every two digit number n that ends in the digit 4. Print one number per line. (For example 14 would be printed but 15 would not be printed.)

Answer:

```cpp
for (int i = 10; i <= 99; i++)
    if (i % 10 == 4) cout << i << endl;
```

Problem 223   Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (y <= 0)
        cout << "Are you positive?\n";
    while (y < 20) {
        cout << y;
        y = y + 2 * x;
    }
    cout << y << endl;
    return 0;
}
```

(a) The user enters: -5 5

```
Illegal
```

(b) The user enters: 5 -5

```
Are you positive?
-551525
```

(c) The user enters: 10 1

```
121
```

(d) The user enters: 1 10

```
101214161820
```

(e) The user enters: 1 1

```
13579111315171921
```

Problem 224   Write a complete C++ program that does the following.

1. It asks the user to enter an integer between 1000 and 9999.

2. If the entered number is out of range, the message "Wrong!" is printed and the program terminates.

3. Otherwise the program prints the two two digit number made from the first pair and last pair of digits (one number per line).

Here is an example of how the program should work:

```
Enter an integer between 1000 and 9999:   4567
45
67
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
```

```
    int n;
    cout << "Enter a positive integer between 1000 and 9999: ";
    cin >> n;
    if (n < 1000 || n > 9999) {
        cout << "Wrong!" << endl;
        return 0;
    }
    cout << n / 100 << endl << n % 100 << endl;
    return 0;
}
```

Problem 225   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n.

(2) Until the user enters a positive integer for n, the program makes the user enter another choice for n.

(3) The program prints a triangle with n rows, where the columns are formed by using the characters X and O in sequence.

For example, if the user enters 4 for n the output is as follows:

```
X
XO
XOX
XOXO
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer n: ";
    cin >> n;
    while (n <= 0) {
        cout << "Not positive. Try again: ";
        cin >> n;
    }
    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= r; c++)
            if (c % 2 == 1) cout << "X";
            else cout << "O";
        cout << endl;
    }
    return 0;
}
```

Problem 226   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print to the screen the message:

```
2 x 2 = 22
```

Answer:

```
cout << "2 x 2 = 22";
```

(iii) Print a random number r with $0 \le r \le 10$. (An appropriate C++ function must be used to make the random number.)

Answer:

```
cout << rand() % 11;
```

(ii) Print twice the square root of 17.

Answer:

```
cout << 2 * sqrt(17);
```

(iv) Ask the user to enter their age. If their answer does not satisfy $1 \le age \le 90$ make them try exactly one more time.

Answer:

```
cout << "Enter your age: ";
int age;
cin >> age;
if (age < 1 || age > 90) {
   cout << "Illegal, try again: ";
   cin >> age;
}
```

(v) Print to the screen every four digit number n that is a perfect square (of an integer). Print one number per line. (For example 1600 would be printed but 1599 would not be printed since $1600 = 40 \times 40$.)

Answer:

```
for (int i = 1; i < 100; i++)
   if (i * i >= 1000 && i * i <= 9999)
       cout << i * i << endl;
```

Problem 227   Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
   int x, y;
   cout << "Please enter two positive integers: ";
   cin >> x >> y;
   if (y <= 0) {
       cout << "Illegal" << endl;
       exit (1);
   }
   if (x <= 0)
       cout << "Are you positive?\n";
   while (x < 20) {
       cout << y;
       x = x + 2 * y;
   }
   cout << x << endl;
   return 0;
}
```

(a) The user enters: -5 5

```
Are you positive?
55525
```

(b) The user enters: 5 -5

```
Illegal
```

(c) The user enters: 10 1

```
1111120
```

(d) The user enters: 1 10

```
1021
```

(e) The user enters: 1 1

```
111111111121
```

Problem 228 Write a complete C++ program that does the following.

1. It asks the user to enter a positive integer less than 5000.

2. If the entered number is out of range, the message "Wrong!" is printed and the program terminates.

3. Otherwise the program prints the squares of the individual digits in the number number that was entered. (Pront one square per line).

Here is an example of how the program should work:

```
Enter a positive integer less than 5000:    994
16
81
81
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a positive integer less than 5000: ";
   cin >> n;
   if (n <= 0 || n >= 5000) {
      cout << "Wrong!" << endl;
      return 0;
   }
   while (n > 0) {
      cout << (n % 10) * ( n % 10) << endl;
      n = n / 10;
   }
   return 0;
}
```

Problem 229 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n.

(2) If the user enters a non-positive integer for n, the program terminates.

(3) The program prints a square with n rows and n columns using the letter X on or above the main diagonal and the letter O below it.

For example, if the user enters 4 for n the output is as follows:

```
XXXX
OXXX
OOXX
OOOX
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer n:";
    cin >> n;
    if (n <= 0) return 0;

    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= n; c++)
            if (c < r) cout << "O";
            else cout << "X";
        cout << endl;
    }

    return 0;
}
```

Problem 230   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print to the screen the message:

```
007 = 7
```

Answer:

```cpp
    cout << "007 = 7" << endl;
```

(ii) Print the numbers from 1 to 1000 to the screen, one number per line.
Answer:

```cpp
    for (int i = 1; i <= 1000; i++) cout << i << endl;
```

(iii) Print the numbers from 1 to 1000 to the screen, ten numbers per line.
Answer:

```cpp
    for (int i = 1; i <= 1000; i += 10) {
        for (int j = i; j < i + 10; j++) cout << j << " ";
        cout << endl;
    }
```

(iv) Ask the user to enter their name, if they enter the name "Freddy" exit the program immediately.
Answer:

```cpp
    string name;
    cout << "Enter your name: ";
    cin >> name;
    if (name == "Freddy") return 0;
```

(v) Print to the screen every two digit number n that is not an exact multiple of 3. Print one number per line. (For example 14 would be printed but 15 would not be printed since $15 = 5 \times 3$.)

Answer:

```
for (int n = 10; n <= 99; n++)
    if (n % 3 != 0)
        cout << n << endl;
```

Problem 231   Consider the following C++ program. What is the output from the program in response to the following user input?

```cpp
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (y <= 0) y = x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (x <= 10) cout << y << x << endl;
    while (y > 0) {
        cout << y;
        y = y / 10;
    }
    cout << x << endl;
    return 0;
}
```

(a) The user enters: -5 5

Illegal

(b) The user enters: 5 -5

55
55

(c) The user enters: -5 -5

Illegal

(d) The user enters: 567 123

123121567

(e) The user enters: 567 0

567565567

Problem 232   Write a complete C++ program that does the following.

1. It asks the user to enter a positive integer with 2 digits.

2. If the entered number is out of range, the message "Too difficult!" is printed and the program terminates.

3. Otherwise the program prints the sum of the two digits in the number that was entered.

Here is an example of how the program should work:

```
Enter a 2-digit integer:    89
Sum of digits: 17
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a 2 digit integer: ";
   cin >> n;

   if ( n < 10 || n > 99) {
      cout << "Too difficult!" << endl;
      return 0;
   }

   cout << "Sum of digits: " << n % 10 + n / 10 << endl;
   return 0;
}
```

Problem 233   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n.

(2) If the user enters a non-positive integer for n, the program terminates.

(3) The program prints a square with n rows and n columns using the letter A on or below the main diagonal and the letter B above it.

For example, if the user enters 4 for n the output is as follows:

```
ABBB
AABB
AAAB
AAAA
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a positive integer n:";
   cin >> n;
   if (n <= 0) return 0;

   for (int r = 1; r <= n; r++) {
      for (int c = 1; c <= n; c++)
         if (c <= r) cout << "A";
         else cout << "B";
      cout << endl;
   }

   return 0;
}
```

Problem 234 Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print to the screen the message:

```
007 * 007 = 49
```

Answer:

```
cout << "007 * 007 = 49" << endl;
```

(ii) Print the even numbers from 2 to 400 to the screen, one number per line.

Answer:

```
for (int i = 2; i <= 400; i += 2) cout << i << endl;
```

(iii) Print the even numbers from 2 to 400 to the screen, ten numbers per line.

Answer:

```
for (int i = 2; i <= 400; i += 20) {
    for (int j = i; j < i + 20; j += 2) cout << j << " ";
    cout << endl;
}
```

(iv) Ask the user to enter their name, if they enter the name "Freddy" print "Hello" to the screen, otherwise print nothing.

Answer:

```
string name;
cout << "Enter your name: ";
cin >> name;
if (name == "Freddy") cout << "Hello" << endl;
```

(v) Print to the screen every number n that is less than 100 and is either an exact multiple of 3 or an exact multiple of 5. Print one number per line. (For example 14 would not be printed but 15 would be printed.)

Answer:

```
for (int n = 1; n <= 99; n++)
    if (n % 3 == 0 || n % 5 == 0)
        cout << n << endl;
```

Problem 235 Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (x <= 0) x = y;
    if (y <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (x <= 10) cout << y << x << endl;
    while (y > 0) {
        cout << y;
        y = y / 10;
    }
    cout << x << endl;
    return 0;
}
```

(a) The user enters: -5 5

```
55
55
```

(b) The user enters: 5 -5

```
Illegal
```

(c) The user enters: -5 -5

```
Illegal
```

(d) The user enters: 567 123

```
123121567
```

(e) The user enters: 567 0

```
Illegal
```

Problem 236   Write a complete C++ program that does the following.
1. It asks the user to enter two different positive integers each of which has 2 digits.
2. If the input is illegal, the message "Too easy!" is printed and the program terminates.
3. Otherwise the program prints the absolute value of the difference of the numbers that were entered.
Here is an example of how the program should work:

```
Enter two different 2-digit integers:   89 91
Absolute difference: 2
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n, m;
   cout << "Enter two different 2 digit integers: ";
   cin >> n >> m;

   if ( n < 10 || n > 99 || m < 10 || m > 99 || n == m) {
      cout << "Too easy!" << endl;
      return 0;
   }

   cout << "Absolute difference: ";
   if (n > m) cout << n - m << endl;
   else cout << m - n << endl;
   return 0;
}
```

Problem 237   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n.

(2) If the user enters a non-positive integer for n, the program terminates.

(3) The program prints a square with n rows and n columns using the letter X on odd numbered rows and O on even numbered rows.

For example, if the user enters 4 for n the output is as follows:

```
XXXX
OOOO
XXXX
OOOO
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer n:";
    cin >> n;
    if (n <= 0) return 0;

    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= n; c++)
            if (r % 2 == 0) cout << "O";
            else cout << "X";
        cout << endl;
    }

    return 0;
}
```

Problem 238   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print to the screen the message:

```
007 = Bond
```

Answer:

```cpp
 cout << "007 = Bond" << endl;
```

(ii) Print the numbers from -100 to 100 to the screen, one number per line.
Answer:

```cpp
    for (int i = -100; i <= 100; i++) cout << i << endl;
```

(iii) Print the numbers from -100 to 100 to the screen, three numbers per line.
Answer:

```cpp
    for (int i = -100; i <= 100; i += 3) {
        for (int j = i; j < i + 3; j++) cout << j << " ";
        cout << endl;
    }
```

(iv) Ask the user to enter their name, if they enter the name "007" exit the program immediately.
Answer:

```cpp
    string name;
    cout << "Enter your name: ";
    cin >> name;
    if (name == "007") return 0;
```

(v) Print to the screen every four digit number n that is not an exact multiple of 7. Print one number per line. (For example 1000 would be printed but 1001 would not be printed since $1001 = 7 \times 143$.)

Answer:

```
    for (int n = 1000; n <= 9999; n++)
        if (n % 7 != 0)
            cout << n << endl;
```

Problem 239   Consider the following C++ program. What is the output from the program in response to the following user input?

```cpp
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (y <= 0) y = x + 1;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (x <= 10) cout << y << x << endl;
    while (y > 100) {
        cout << y;
        y = y / 100;
    }
    cout << x << endl;
    return 0;
}
```

(a) The user enters: -5 5

Illegal

(b) The user enters: 5 -5

65
5

(c) The user enters: -5 -5

Illegal

(d) The user enters: 567 123

123567

(e) The user enters: 567 0

568567

Problem 240   Write a complete C++ program that does the following.

1. It asks the user to enter a positive integer with 2 digits.

2. If the entered number is out of range, the message "Too difficult!" is printed and the program terminates.

3. Otherwise the program prints the absolute value of the difference of the two digits in the number that was entered.

Here is an example of how the program should work:

```
Enter a 2-digit integer:    79
Absolute difference: 2
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a 2 digit integer: ";
    cin >> n;

    if ( n < 10 || n > 99) {
        cout << "Too difficult!" << endl;
        return 0;
    }

    int ans = n % 10 - n / 10;
    if (ans < 0) ans = -ans;
    cout << "Absolute difference: " << ans << endl;
    return 0;
}
```

Problem 241   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n.

(2) If the user enters a non-positive integer for n, the program terminates.

(3) The program prints a square with n rows and n columns using the letter A on odd numbered columns and B on even numbered columns.

For example, if the user enters 4 for n the output is as follows:

```
ABAB
ABAB
ABAB
ABAB
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer n:";
    cin >> n;
    if (n <= 0) return 0;

    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= n; c++)
            if (c % 2 == 0) cout << "B";
            else cout << "A";
        cout << endl;
    }

    return 0;
}
```

Problem 242   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print to the screen the message:

```
000 + 7 = 007
```

Answer:

```
 cout << "000 + 7 = 007" << endl;
```

(ii) Print the even numbers from -200 to 200 to the screen, one number per line.

Answer:

```
    for (int i = -200; i <= 200; i += 2) cout << i << endl;
```

(iii) Print the even numbers from -200 to 200 to the screen, three numbers per line.

Answer:

```
    for (int i = -200; i <= 200; i += 6) {
       for (int j = i; j < i + 6; j += 2) cout << j << " ";
       cout << endl;
    }
```

(iv) Ask the user to enter their name, if they enter the name "007" print the message "James Bond" otherwise print their name.

Answer:

```
    string name;
    cout << "Enter your name: ";
    cin >> name;
    if (name == "007") cout << "James Bond" << endl;
    else cout << name;
```

(v) Print to the screen every four digit number n that is an exact multiple of 7 and an exact multiple of 11. Print one number per line. (For example 1000 would not be printed but 1001 would be printed since $1001 = 7 \times 143$ and $1001 = 11 \times 91$.)

Answer:

```
    for (int n = 1000; n <= 9999; n++)
       if (n % 7 == 0 && n % 11 == 0)
          cout << n << endl;
```

Problem 243   Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
   int x, y;
   cout << "Please enter two positive integers: ";
   cin >> x >> y;
   if (x <= 0) x = y + 1;
   if (y <= 0) {
       cout << "Illegal" << endl;
       exit (1);
   }
   if (x <= 10) cout << y << x << endl;
   while (y > 100) {
```

```
        cout << y;
        y = y / 100;
    }
    cout << x << endl;
    return 0;
}
```

(a) The user enters: -5 5

```
56
6
```

(b) The user enters: 5 -5

```
Illegal
```

(c) The user enters: -5 -5

```
Illegal
```

(d) The user enters: 567 123

```
123567
```

(e) The user enters: 567 0

```
Illegal
```

Problem 244   Write a complete C++ program that does the following.

1. It asks the user to enter two different positive integers each of which has 2 digits.

2. If the input is illegal, the message "Illegal!" is printed and the program terminates.

3. Otherwise the program prints the larger of the numbers that were entered.

Here is an example of how the program should work:

```
Enter two different 2-digit integers:   89 91
Larger: 91
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n, m;
    cout << "Enter two different 2 digit integers: ";
    cin >> n >> m;

    if ( n < 10 || n > 99 || m < 10 || m > 99 || n == m) {
        cout << "Illegal!" << endl;
        return 0;
    }

    cout << "Larger: ";
    if (n > m) cout << n << endl;
    else cout << m << endl;
    return 0;
}
```

Problem 245   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n.

(2) If the user enters a non-positive integer for n, the program terminates.

(3) The program prints a rectangle of $*$ symbols with n rows and twice as many columns as rows.

For example, if the user enters 4 for n the output is as follows:

```
********
********
********
********
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter a positive integer n: ";
   cin >> n;
   if (n <= 0) return 0;

   for (int r = 1; r <= n; r++) {
      for (int c = 1; c <= 2 * n; c++) cout << "*";
      cout << endl;
   }
   return 0;
}
```

Problem 246   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following variables have been declared, and if necessary have values, for each part:

```cpp
int number;
double x, y;
```

Declare any other variables that you use.

(i) Print all integers from number down to 10. For example if *number* is 13, the output should be 13 12 11 10. (If *number* < 10, nothing is printed.)

Answer:

```cpp
while (number >= 10) {
   cout << number << " ";
   number--;
}
```

(ii) Print the value of the sum of squares of x and y.

Answer:

```cpp
cout << x * x + y * y << endl;
```

(iii) Calculate x as the decimal that represents the fraction 5/7.

Answer:

```cpp
x = 5.0 / 7.0;
```

(iv) Print the sum of the square roots of all the numbers from 1048576 to 5764801.

Answer:

```
double sum = 0;
for (int n = 1048576; n<= 5764801; n++)
    sum += sqrt((double) n);
cout << sum << endl;
```

(v) Print every three digit number n for which the next to last digit of n^2 is 2. For example, 111 is printed because $111^2 = 12321$. (This number ends in the digits 21 and its next to last digit is 2.)

Answer:

```
for (int n = 100; n <= 999; n++)
    if ( (20 <= (n * n) % 100) && ((n * n) % 100 <= 29))
        cout << n << endl;
```

Problem 247   Consider the following C++ program. What is the output from the program in response to the following user inputs?

```
#include <iostream>
using namespace std;

int main () {
    int n;
    cout << "Please give me an integer: ";
    cin >> n;
    if (n < 10) {
        cout << "Integer is too small." << endl;
        if (n < 0) return 0;
    }
    if (n % 2 == 0) cout <<  3 * n / 2 << endl;
    else if (n % 4 == 1) cout << 3 * ((n - 1) / 4) + 1;
    else cout << 3 * ((n + 1) / 4) - 1;
    cout << endl;
    return 0;
}
```

(a) The user enters: -9

```
Integer is too small.
```

(b) The user enters: 9

```
Integer is too small.
7
```

(c) The user enters: 10

```
15
```

(d) The user enters: 11

```
8
```

(e) The user enters: 21

```
16
```

Problem 248 Write a complete C++ program that does the following.

1. It repeatedly, asks the user to enter an integer.

2. If the entered number is negative, the word "Negative" is printed and the program terminates.

3. Otherwise the square root of the number is calculated and the nearest integer to this square root is printed.

Here is an example of how the program should work:

```
Enter an integer:    100
10
Enter an integer:   97
10
Enter an integer: 101
10
Enter an integer: -100
Negative
```

Answer:

```cpp
#include <iostream>
#include <cmath>
using namespace std;

int main() {
   int n = 0;

   while (n >= 0) {
      cout << "Enter an integer n: ";
      cin >> n;
      if (n < 0) {
         cout << "Negative" << endl;
         return 0;
      }
      cout << (int) (sqrt((double) n) + 0.5) << endl;
   }
   return 0;
}
```

Problem 249 Write a complete C++ program that does the following.

1. It asks the user to enter an integer.

2. If the entered number is even it divides the number by 2.

3. Otherwise the program multiplies the number by 3 and adds 1.

4. It prints the result.

Here is an example of how the program should work:

```
Enter an integer:    5
The answer is:    16
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main () {
   int n;
   cout << "Enter an integer: ";
   cin >> n;
```

```
    if (n % 2 == 0) n = n / 2;
    else n = n * 3 + 1;
    cout << "The answer is:  " << n << endl;
    return 0;
}
```

Problem 250   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following variables have been declared, and if necessary have values, for each part:

```
int number;
double x, y;
```

Declare any other variables that you use.

(i) Print all integers from 1 through number.

Answer:

```
for (int i = 1; i <= number; i++)
    cout << i << " ";
```

(ii) Print the value of the larger of x and y.

Answer:

```
if (x < y) cout << y;
else cout << x;
```

(iii) Calculate x as the decimal that represents the fraction 1/7.

Answer:

```
x = 1.0 / 7;
```

(iv) Print the sum of the square roots of the numbers 19683, 19684, and 19685.

Answer:

```
double sum = 0;
for (int x = 19683; x <= 19685; x++)
    sum += sqrt ((double) x);
cout << sum << endl;
```

(v) Print every three digit number n for which the square of n ends with the digits 21. For example, 111 is printed because $111^2 = 12321$.

Answer:

```
for (int n = 100; n <= 999; n++)
    if (n * n % 100 == 21) cout << n << endl;
```

Problem 251   Consider the following C++ program. What is the output from the program in response to the following user inputs?

```
#include <iostream>
using namespace std;

int main () {
    int n;
    cout << "Please give me an integer: ";
    cin >> n;
```

```
    if (n < 10) {
        cout << "Integer is too small." << endl;
        if (n < 0) return 0;
    }
    if (n % 3 == 0) cout << "n = " << n << endl;
    else cout << "CSCI 111" << endl;
    while (n > 20) {
        cout << n << ", ";
        n = n - 10;
    }
    cout << endl;
    return 0;
}
```

(a) The user enters: -1 **Answer:**

```
Integer is too small.
```

(b) The user enters: 0 **Answer:**

```
Integer is too small.
n = 0
```

(c) The user enters: 1 **Answer:**

```
Integer is too small.
CSCI 111
```

(d) The user enters: 19 **Answer:**

```
CSCI 111
```

(e) The user enters: 111 **Answer:**

```
n = 111
111, 101, 91, 81, 71, 61, 51, 41, 31, 21,
```

Problem 252   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

(1) The program asks the user to enter a positive integer n.

(2) If the user enters a non-positive integer for n, the program terminates.

(3) The program prints a triangle with n rows whose straight vertical edge is at the right of the picture.

For example, if the user enters 4 for n the output is as follows:

```
   *
  **
 ***
****
```

Answer:

```
#include <iostream>
using namespace std;
int main() {
    int n;
    cout << "Enter a positive integer n: ";
    cin >> n;
    if (n <= 0) return 0;
```

```
    for (int r = n; r >= 1; r--){
        for (int c = 1; c <= n; c++)
            if (c >= r) cout << "*";
            else cout << " ";
        cout << endl;
    }

    return 0;
}
```

Problem 253   Write a complete C++ program that does the following.

1. It asks the user to enter a decimal number that is greater than 0 and less than 10.

2. If the entered number is not within the desired range the program exits.

3. Otherwise the program prints the square of the number.

Here is an example of how the program should work:

```
Enter a number greater than 0 and less than 10:    2.5
The square is:    6.25
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    double number;
    cout << "Enter a number greater than 0 and less than 10:    ";
    cin >> number;
    if (number <= 0 || number >= 10) exit(1);
    cout << "The square is:    " << number * number << endl;
    return 0;
}
```

Problem 254   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print to the screen the message:

```
2 + 2 = 5
```

```
cout << "2 + 2 = 5" << endl;
```

(b) Print all the odd numbers from 1 to 1000 to the screen (one number per line).

```
for (int i = 1; i<= 1000; i++)
    if (i % 2 == 1) cout << i << endl;
```

(c) Ask the user enter a number that is not a multiple of 10. If the user gives an incorrect response force the user to keep entering a number until legal answer is received.

```
cout << "Enter a number that is not a multiple of 10: ";
int number;
cin >> number;
while (number %10 == 0) {
    cout << "That's a multiple of 10. Try again: ";
    cin >> number;
}
```

(d) Ask the user to enter a number and print its square root if it is positive. (Otherwise do not print anything.)

```
cout << "Enter a positive number: ";
double x;
cin >> x;
if (x > 0) cout << sqrt(x) << endl;
```

(e) Read an integer greater than 2 from the user, then print it in reverse. (If the user enters the number 125, the program should print 521.)

```
int n;
cout << "Enter a number greater than 2: ";
cin >> n;
while (n > 0) {
    cout << n % 10;
    n = n / 10;
}
cout << endl;
```

Problem 255 Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;

int main(){
    int age;
    string name;
    cout << "Please enter your name and age: ";
    cin >> name >> age;

    if (name == "Kamil") exit(0);
    if (age < 0) {
        name = "Kamil";
        age = 5;
    }
    if (name == "Peter") {
        cout << "You rat!" << endl;
        return 0;
    }
    if (age >= 100) {
        cout << "Goodbye Kamil!" << endl;
    }
    cout << " Hello " << name << " you are about "  << age << endl;
    return 0;
}
```

(i) The user enters: Freddy 17

```
 Hello Freddy you are about 17
```

(ii) The user enters: Peter 19

```
You rat!
```

(iii) The user enters: Kamil 19

(iv) The user enters: Andrew -20

```
 Hello Kamil you are about 5
```

(v) The user enters: Carl 200

```
Goodbye Kamil!
 Hello Carl you are about 200
```

Problem 256   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

The program prints a table with 100 lines of output. On output line number x the program should list the first x odd numbers.

For example, the first 4 lines of output read as follows:

```
1
1 3
1 3 5
1 3 5 7
```

Answer:

```cpp
#include <iostream>
using namespace std;
int main() {
   for (int r = 1; r <= 100; r++) {
      for (int c = 1; c < 2*r; c += 2)
            cout << c << " ";
      cout << endl;
   }
   return 0;
}
```

Problem 257   Write a complete C++ program that asks a user to enter their day and month of birth. If the user's birthday is March 14th, the program wishes the user a Happy Birthday, otherwise it just says Hello. For example, the program could run as follows:

```
What is your day and month of birth:   14 March
Happy Birthday.
```

```cpp
#include <iostream>
using namespace std;
int main() {
   int d;
   string month;
   cout << "Enter your day and month of birth: ";
   cin >> d >> month;
   if (d == 14 && month == "March")
      cout << "Happy Birthday." << endl;
   else cout << "Hello" << endl;
   return 0;
}
```

Problem 258   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print to the screen the message (the word Hello repeats 10 times):

```
Hello Hello Hello Hello Hello Hello Hello Hello Hello Hello
```

```
for (int c = 1; c <= 10; c++) cout << "Hello ";
```

(b) Read an integer from the user and print the integer without its last digit. (For example if the user enters 19683, the program would print 1968.)

```
int n;
cin >> n;
cout << n / 10;
```

(c) Print the square root of 19683 to the output screen:

```
cout << sqrt(19683);
```

(d) Ask the user enter a name. If the user says Freddy, force the user to keep entering a name until something else is received.

```
string name;
cout << "Who are you: ";
cin >> name;
while (name == "Freddy") {
   cout << "No!  Who are you: ";
   cin >> name;
}
```

(e) Print a random number between 1000 and 9999 to the screen.

```
cout << rand() % 9000 + 1000;
```

Problem 259 Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;

int main(){
      int n, m;
      cout << "Please two integers: ";
      cin >> m >> n;

      if (n == 0 && m == 0) cout << n << endl;;
      if (n == 0 || m == 0) exit(1);
      if (n < 0 && m < 0) cout << " Negative" << endl;
      else {
         if (n < m) cout << n << endl;
      }
      if (m > 7) cout << " 7" << n << endl;
      return 0;
}
```

(i) The user enters: 0 0

0

(ii) The user enters: 0 10

(iii) The user enters: -10 -10

```
 Negative
```

(iv) The user enters: 10 -10

```
-10
 7-10
```

(v) The user enters: 10 10

```
 710
```

Problem 260   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer that is at least 3.

2. The program reads a value x entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of x has been entered.

3. The program prints a picture with x columns. The picture should display a left pointing arrow pattern.

For example, if the user enters 4 for x the program should print the following picture.

```
   *
  *
 *
*
 *
  *
   *
```

Answer:

```cpp
#include <iostream>
using namespace std;
int main() {
  int x;
  cout << "Enter an integer that is at least 3: ";
  cin >> x;
  while (x < 3) {
    cout << "Must be at least 3.  Try again: ";
    cin >> x;
  }
  int rows = 2 * x - 1;

  for (int r = 1; r <= rows; r++) {
    for (int c = 1; c <= x; c++) {
      if ((r + c == x + 1) || (r - c == x - 1))
        cout << "*";
      else cout << " ";
    }
    cout << endl;
  }
  return 0;
}
```

Problem 261   Write a complete C++ program that does the following.

1. It asks the user to enter their favorite positive integer.

2. The program prints the square root of that integer.

Here is an example of how the program should work:

```
Enter your favorite positive integer:   25
It has square root: 5.0
```

Answer:

```cpp
#include <iostream>
#include <cmath>
using namespace std;

int main() {
   int n;
   cout << "Enter your favorite positive integer:   ";
   cin >> n;
   cout << "It has square root: " << sqrt(n) << endl;
   return 0;
}
```

Problem 262   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print to the screen the message:

```
2 + 2 = 4
```

```cpp
cout << "2 + 2 = 4";
```

(b) Print all the numbers from 1 to 1000 to the screen (one number per line).

```cpp
for (int c = 1; c <= 1000; c++)
   cout << c << endl;
```

(c) Ask the user enter a multiple of 3. If the user gives an incorrect response force the user to keep entering a number until a multiple of 3 is received.

```cpp
int n;
cout << "Enter a multiple of 3: ";
cin >> n;
while ( n % 3 != 0 ) {
   cout << "Wrong.   Enter a multiple of 3: ";
   cin >> n;
}
```

(d) Print 10 random numbers each between 10 and 20 to the output screen:

```cpp
for (int c = 1; c <= 10; c++) {
   cout << rand() % 11 + 10 << endl;
}
```

(e) Read an integer greater than 2 from the user, then print its largest factor. (For this problem, a factor of x is a number f with $1 \le f < x$ that divides into x without remainder.)

```
int n;
cout << "Enter an integer greater than 2: ";
cin >> n;
factor = n - 1;
while ( n % factor > 0) factor--;
cout << factor;
```

Problem 263   Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;

int main(){
    int n;  string name;
    cout << "Please enter your name and an integer: ";
    cin >> name >> n;

    if (n == 0 && name == "Freddy") cout << name << endl;;
    if (n == 0 || name == "Freddy") exit(1);
    if (n < 0) cout << " Negative" << endl;
    else {
        cout << " name " << name << " name " << endl;
    }
    if (n > 7) cout << " 7 " << endl;
    return 0;
}
```

(i) The user enters: Freddy 0

```
Freddy
```

(ii) The user enters: Freddy 10

(iii) The user enters: Fred -10

```
 Negative
```

(iv) The user enters: Fred 5

```
 name Fred name
```

(v) The user enters: Fred 10

```
 name Fred name
 7
```

Problem 264   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

The program prints a table with 100 lines of output. On output line number x the program should list the numbers from x to x^2 together with their sum.

For example, the first 4 lines of output read as follows:

```
1 the sum is 1
2 3 4 the sum is 9
3 4 5 6 7 8 9 the sum is 42
4 5 6 7 8 9 10 11 12 13 14 15 16 the sum is 130
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
  for (int x = 1; x <= 100; x++) {
    int sum = 0;
    for (int c = x; c <= x * x; c++) {
      cout << c << " ";
      sum = sum + c;
    }
    cout << "the sum is " << sum << endl;
  }
  return 0;
}
```

Problem 265   Write a complete C++ program that does the following.

1. It asks the user to enter the number of quarters, dimes, nickels and cents that they are carrying.

2. The program then reports the total amount of change that the user has.

Here is an example of how the program should work:

```
How many quarters do you have?  7
How many dimes do you have?     2
How many nickels do you have?   3
How many cents do you have ?    6
That makes 216 cents in change.
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main () {
        int q, d, n, p;

        cout << "How many quarters do you have? ";
        cin >> q;

        cout << "How many dimes do you have? ";
        cin >> d;

        cout << "How many nickels do you have? ";
        cin >> n;

        cout << "How many pennies do you have? ";
        cin >> p;

        cout << "That makes "
            << ((q * 25) + (d * 10) + (n * 5) + p) << " in change.";
        cout << endl;
```

```
        return 0;
} //main
```

Problem 266   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print a random number between -1 and -9 to the output screen:

Answer:

```
int r = rand() % 9 + 1;
cout << -r;
```

(b) Print (to the output screen) the sum of the square roots of the numbers $1, 2, 3, 4, 5$ and 6.

Answer:

```
double sum = 0;
for (int s = 1; s <= 6; s++)
      sum += sqrt(s);
cout << sum;
```

(c) Ask the user to enter the word "Hello". Force the user to keep entering a new word until an input equal to "Hello" is received.

Answer:

```
string input = "";
while (input != "Hello") {
   cout << "Please enter the word 'Hello': ";
   cin >> input;
}
```

(d) Print twelve random negative numbers.

Answer:

```
for (int n = 1; n <= 12; n++) {
      int r = rand();
      if (r > 0) r = -r;
      cout << r;
}
```

(e) Print the largest integer whose square root is less than 1729.

Answer:

```
int n = 1;
while (sqrt(n) < 1729) n++;
cout << n - 1;
```

Problem 267   Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;

int main(){
      int n, m;  string name;
      cout << "Please enter two integers followed by your name: ";
```

```
        cin >> m >> n >> name;

        if(n == 0) exit(1);
        if(m >= n) cout << name;
        if(m % n == 1) cout << name << name;
        else while (n > 7) {
          cout << n;
          n = n - m;
        }
        cout << endl;
        return 0;
}
```

(i) The user enters: 2 2 Freddy

Answer:

```
Freddy
```

(ii) The user enters: 0 7 007

Answer:

(iii) The user enters: 1 10 X

Answer:

```
XX
```

(iv) The user enters: 1 2 3

Answer:

```
33
```

(v) The user enters: 11 111 Freddy

Answer:

```
1111008978675645342312
```

Problem 268   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an odd positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program terminates.

3. The program prints an $n \times n$ grid displaying a large letter X. The left half of the X should be made with the character $+$, the right half should be made with the character x and the very center should be a $*$.

For example, if the user enters 7 for n the program should print the following picture.

```
+       x
 +     x
  +   x
   *
  +   x
 +     x
+       x
```

Answer:

```cpp
#include <iostream>
using namespace std;
int main ()
{
        int n;
        cout << "Please enter an odd positive integer ";
        cin >> n;

        if (n < 0 || n % 2 != 1) exit (1);

        int middle = (n / 2) + 1;
        for (int r = 1; r <= n; r++) {
                for (int c = 1; c <= n; c++) {
                        if (r == middle && c == middle)
                                cout << "*";
                        else if ((r == c || r + c == n + 1) && c < middle)
                                cout << "+";
                        else if ((r == c || r + c == n + 1) && c > middle)
                                cout << "x";
                        else
                                cout << " ";
                } //for
                cout << endl;
        } //for

        return 0;
} //main
```

Problem 269   Write a complete C++ program that does the following.

1. It asks the user to enter their age (which is assumed to be a positive integer).

2. The program should print the word *Hello* once for each year of the user's age.

Here is an example of how the program should work:

```
Enter your age:  5
Hello Hello Hello Hello Hello
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int age;
   cout << "Enter your age:   ";
   cin >> age;
   for (int x = 1; x <= age; x++)
      cout << "Hello" << " ";
   cout << endl;
   return 0;
}
```

Problem 270   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print a random number that has 3 digits to the output screen:

Answer:

```
    cout << rand()%900 + 100 << endl;
```

(b) Print (to the output screen) the smallest integer whose square root is larger than 3141.5926:

Answer:

```
    int k = (int) (3141.5926 * 3141.5926);
    cout << k + 1 << endl;
```

(c) Ask the user to type a password and then to type it again. Print *Error* if the two words are different.

Answer:

```
    string pw1, pw2;
    cout << "Enter a password twice ";
    cin >> pw1 >> pw2;
    if (pw1 != pw2) cout << "Error" << endl;
```

(d) Read a positive integer greater than 2 from the user, and print its largest factor. (For this problem a number f is a factor of the number x if $1 \le f \le x - 1$ and f divides into x without remainder.)

Answer:

```
    cout << "Enter a postive integer (greater than 2): ";
    cin >> n;
    m = n - 1;
    while (n % m != 0) m--;
    cout << m << endl;
```

(e) Read a name from the user. If necessary, repeatedly ask the user to reenter a name until the user has said *Freddy*.

Answer:

```
    string name;
    cout << "You are Freddy. What is your name: ";
    cin >> name;
    while (name != "Freddy") {
       cout << "Wrong! What is your name: ";
       cin >> name;
    }
```

Problem 271   Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;

int main(){
    int n, m;
    cout << "Please enter two integers: ";
    cin >> n >> m;

    if (n > m) cout << n % m << endl;
    else {
       for (int r = 1; r < n; r++) {
          for (int c = 1; c < m - n - 1; c++) {
             cout << "*+";
          }
          cout << endl;
          if (n == 10) exit(1);
       }
    }
    return 0;
}
```

(i) The user enters: 10 9

Answer:

```
1
```

(ii) The user enters: 3 7

Answer:

```
*+*+
*+*+
```

(iii) The user enters: 3 15

Answer:

```
*+*+*+*+*+*+*+*+
*+*+*+*+*+*+*+*+
```

(iv) The user enters: 10 15

Answer:

```
*+*+*+
```

(v) The user enters: -1 5

Answer:

Problem 272   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer.

2. If the input is illegal, the program should terminate.

3. The program prints the digits of the number in reverse order (separated by spaces) and then gives their sum.

For example, if the user enters 19683 the program should print the following output.

```
3 8 6 9 1 sum to 27
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer: ";
    cin >> n;
    if (n <= 0) exit(1);

    int digit, sum = 0;
    while (n > 0) {
        digit = n % 10;
        n = n / 10;
        sum += digit;
        cout << digit << " ";
    }
    cout << "sum to " << sum << endl;

    return 0;
}
```

Problem 273   Write a complete C++ program that does the following.

1. It asks the user to enter their age (which is assumed to be a positive integer).

2. If the user is a teenager, the program should print *Hello Teenager* otherwise it should just print *Hello*.

Here is an example of how the program should work:

```
Enter your age:   15
Hello Teenager
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int age;
    cout << "Enter your age:   ";
    cin >> age;
    if ((13 <= age) && (age <= 19)) cout << "Hello Teenager" << endl;
    else cout << "Hello" << endl;
    return 0;
}
```

Problem 274   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print 5 random numbers each between 1 and 9 to the output screen:

Answer:

```cpp
for (int i = 1; i <= 5; i++) cout << rand()%9 + 1 << endl;
```

(b) Print (to the output screen) the square root of 19683:

Answer:

```cpp
cout << sqrt(19683) << endl;
```

(c) Ask the user enter a positive integer and if the user gives a non-positive response force the user to keep entering a number until a positive input is received.

Answer:

```cpp
cout << "Enter a positive integer: ";
cin >> n;
while (n <= 0) {
    cout << "Wrong! try again: ";
    cin >> n;
}
```

(d) Read an integer greater than 2 from the user, then print its smallest factor. (For this problem, a factor of x is a number f with $2 \le f \le x$ that divides into x without remainder.)

Answer:

```cpp
cout << "Enter a postive integer (greater than 2): ";
cin >> n;
int f = 2;
while (n % f != 0) f++;
cout << f << endl;
```

(e) Read a name from the user and exit the program if the name is *Freddy*.

Answer:

```cpp
    string name;
    cout << "What is your name: ";
    cin >> name;
    if (name == "Freddy") exit(1);
```

Problem 275   Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```cpp
#include <iostream>
using namespace std;

int main(){
     int n;  string name;
     cout << "Please enter your name and an integer: ";
     cin >> name >> n;

     if(n == 0) cout << name;
     if(n >= 100) exit(1);
     if(n % 5 == 1) cout << name << name;
     else while (n > 7) {
       cout << n;
       n = n - 2;
     }
     cout << endl;
     return 0;
}
```

(i) The user enters: Freddy 0

Answer:

Freddy

(ii) The user enters: 007 6

Answer:

007007

(iii) The user enters: Fred 10

Answer:

108

(iv) The user enters: 9 11

Answer:

99

(v) The user enters: Freddy 111

Answer:

Problem 276   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program terminates.

3. The program prints a table with n lines of output. On output line number x the program should list the numbers from 1 to x together with their sum.

For example, if the user enters 7 for n the program should print the following table.

```
1 the sum is 1
1 2 the sum is 3
1 2 3 the sum is 6
1 2 3 4 the sum is 10
1 2 3 4 5 the sum is 15
1 2 3 4 5 6 the sum is 21
1 2 3 4 5 6 7 the sum is 28
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int r, c, n;
   cout << "How many rows of output do you want: ";
   cin >> n;
   if (n <= 0) exit(1);

   for (r = 1; r <= n; r++) {
      int sum = 0;
      for (c = 1; c <= r; c++) {
         cout << c << " ";
         sum = sum + c;
      }
      cout << "the sum is " << sum << endl;
   }

   return 0;
}
```

Problem 277   Write a complete C++ program that does the following.

1. It asks the user to enter a positive integer x.

2. The program reads the number entered by the user. If x is not a positive integer, the program should terminate.

3. The program prints a countdown from x to 1.

Here is an example of how the program should work:

```
Enter a positive integer:  5
5 4 3 2 1
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int x;
   cout << "Enter a positive integer: ";
   cin >> x;
   if (x <= 0) exit(1);
   for (int n = x; n >= 1; n--) cout << n << " ";
   cout << endl;
   return 0;
}
```

Problem 278   Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;

int print1(int x){
      cout << "Odd" << endl;
      return 1;
}

int print2(int x){
      cout << x*x << endl;
      return x;
}

int main(){
      int n;
      cout << "Please enter a positive integer: ";
      cin >> n;

      if(n <= 0){
            cout << "No good!" << endl; exit(1);
      }

      if (n < 10) {
            cout << n % 2 << endl; exit(0);
      }
      if (n > 11) cout << print1(n) << endl;
      if (n % 2 == 1) print2(n);
      else print1(n);
      return 0;
}
```

(i) The user enters: 0

```
No good!
```

(ii) The user enters: 9

```
1
```

(iii) The user enters: 10

```
Odd
```

(iv) The user enters: 11

```
121
```

(v) The user enters: 12

```
Odd
1
Odd
```

Problem 279   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print (to the output screen) the message:

Very Easy Question

```
    cout << "Very Easy Question" << endl;
```

(b) Print (to the output screen) the square root of 11:

```
    cout << sqrt(11.0) << endl;
```

(c) Make the user enter 6 decimal values and print their product.

```
    double x, product = 1.0;
    for (int c = 1; c <= 6; c++) {
        cin >> x;
        product *= x;
    }
    cout << product << endl;
```

(d) The header line for a function *add3* that calculates the sum of three input integer values. (A header line is a title line, or prototype.)

```
int add3(int x, int y, int z)
```

(e) Print the value of a randomly selected integer between 31 and 41. (The program should make a random selection using the function *rand*. Output values of 31 and 41 are allowed.).

```
    cout << rand() % 11 + 31 << endl;;
```

Problem 280   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an even positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of n has been entered.

3. The program prints an $n \times n$ pattern of $*$ symbols in the shape of a large letter U.

For example, if the user enters 6 for n the program should print the following picture.

```
*    *
*    *
*    *
*    *
*    *
******
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int c, r, n;
    cout << "Enter a positive even integer: ";
    cin >> n;
    while ((n <= 0) || (n % 2 != 0)) {
        cout << "Illegal.  Try again: ";
        cin >> n;
    }
    for (r = 1; r < n; r++) {
        cout << "*";
        for (c = 2; c < n; c++) cout << " ";
```

```
        cout << "*" << endl;
    }
    for (c = 1; c <= n; c++) cout << "*";
    cout << endl;
    return 0;
}
```

Problem 281   Write a complete C++ program that does the following.

1. It asks the user to enter a positive integer x.

2. The program reads the number entered by the user. If x is not a positive integer, the program should terminate.

3. The program repeatedly prints the word *Hello* a total of x times.

Here is an example of how the program should work:

```
Enter a positive integer:  3
Hello Hello Hello
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) exit(1);
    for (int n = 1; n <= x; n++) cout << "Hello ";
    cout << endl;
    return 0;
}
```

Problem 282   Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;

void print1(int x){
        cout << "Odd" << endl;
}

void print2(int x){
        cout << "Even" << endl;
}

int main(){
        int n;
        cout << "Please enter an integer: ";
        cin >> n;

        if(n == 0) cout << "Hello" << endl;
        if(n <= 10) cout << "Goodbye" << endl;
        if(n > 10 && n%2 == 1) print1(n);
        if(n > 10 && n%2 == 0) print2(n);
        if (n < 0) print2(n);
        return 0;
}
```

(i) The user enters: 12

```
Even
```

(ii) The user enters: 11

```
Odd
```

(iii) The user enters: 10

```
Goodbye
```

(iv) The user enters: 0

```
Hello
Goodbye
```

(v) The user enters: -1

```
Goodbye
Even
```

Problem 283   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print (to the output screen) the message:

Easy Question

```
cout << "Easy Question" << endl;
```

(b) Print (to the output screen) a message made from the first 20 integers:

1234567891011121314151617181920

```
for (int n = 1; n <= 20; n++) cout << n;
cout << endl;
```

(c) Make the user enter 6 decimal values and print their sum.

```
double x, sum = 0.0;
for (int c = 1; c <= 6; c++) {
    cin >> x;
    sum += x;
}
cout << sum << endl;
```

(d) The header line for a function *max3* that calculates the maximum of three input decimal values. (A header line is a title line, or prototype.)

```
double max3(double x, double y, double z)
```

(e) Print the value of a randomly selected teen age. (The program should make a random selection using the function *rand*. A teen age is a number between 13 and 19.).

```
cout << rand() % 7 + 13 << endl;;
```

Problem 284   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an odd positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of n has been entered.

3. The program prints an $n \times n$ pattern of $*$ symbols in the shape of a large letter T.

For example, if the user enters 7 for n the program should print the following picture.

```
*******
   *
   *
   *
   *
   *
   *
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int c, r, n;
   cout << "Enter a positive odd integer: ";
   cin >> n;
   while ((n <= 0) || (n % 2 == 0)) {
      cout << "Illegal.  Try again: ";
      cin >> n;
   }
   for (c = 1; c <= n; c++) cout << "*";
   cout << endl;
   for (r = 2; r <= n; r++) {
     for (c = 1; c <= n / 2; c++) cout << " ";
     cout << "*" << endl;
   }
   return 0;
}
```

Problem 285   Write a complete C++ program that does the following.

1. It asks the user to enter a positive number x.

2. The program reads the number entered by the user. If x is not positive, the program should terminate.

3. The program prints the square root of x.

Here is an example of how the program should work:

```
Enter a positive number:  6.25
The square root is:  2.5
```

Answer:

```cpp
#include <iostream>
#include <cmath>
using namespace std;

int main() {
   double x;
   cout << "Enter a positive number: ";
```

```
        cin >> x;
        if (x <= 0) exit(0);
        cout << "The square root is:  " << sqrt(x) << endl;
        return 0;
}
```

Problem 286   Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```
int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit(1);
    }
    for (int i = 1; i <= x % 10; i++)
        cout << x << i << ".";
    cout << x/10 << endl;
}
```

(i) The user enters: 0

Answer:

```
Illegal
```

(ii) The user enters: 1

Answer:

```
11.0
```

(iii) The user enters: 11

Answer:

```
111.1
```

(iv) The user enters: 44

Answer:

```
441.442.443.444.4
```

(v) The user enters: 40

Answer:

```
4
```

Problem 287   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print (to the output screen) the message:

$2 + 2 = 4$

Answer:

```
cout << "2 + 2 = 4" << endl;
```

(b) Read and store a first name, a middle initial, and a last name as entered by the user.

Answer:

```
string first, middle, last;
cin >> first >> middle >> last;
```

(c) Make the user enter 6 integer values and print the product.

Answer:

```
int x, product = 1;
for (int i = 1; i <= 6; i++) {
   cin >> x;
   product *= x;
}
cout << product;
```

(d) Print the message *odd* if the integer variable x stores an odd value, otherwise print the message *even*.

Answer:

```
if ((x % 2) == 1) cout << "odd" << endl;
else cout << "even" << endl;
```

(e) Print the value of a randomly selected two digit integer. (The program should make a random selection using the function *rand*).

Answer:

```
cout << rand() % 90 + 10 << endl;
```

Problem 288   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an odd positive integer.

2. The program reads a value n entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of n has been entered.

3. The program prints an $n \times n$ pattern in the shape of a star. The pattern should appear as a large X printed from copies of the letter X that lies over a large + printed from copies of the character +.

For example, if the user enters 7 for n the program should print the following picture.

```
X   +   X
 X  +  X
  X+X
+++X+++
  X+X
 X  +  X
X   +   X
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int n;
   cout << "Enter an odd positive integer: ";
   cin >> n;
   while ((n <= 0) || (n % 2 == 0)) {
     cout << "Illegal. Try again: ";
     cin >> n;
   }

   for (int r = 1; r <= n; r++) {
```

```
        for (int c = 1; c <= n; c++)
            if (c == r || ((c + r) == (n + 1))) cout << "X";
            else if ((c == (n + 1) / 2) || (r == (n + 1) / 2)) cout << "+";
            else cout << " ";
        cout << endl;
    }
    return 0;
}
```

Problem 289   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print (to the output screen) the message:

Problem 1(a).

Answer:

```
    cout << "Problem 1(a)." << endl;
```

(b) Read and store a name as entered by the user.

Answer:

```
    string name;
    cout << "Enter your name: ";
    cin >> name;
```

(c) Print the value of the larger of two variables x and y each of which has type int. (For example, if x is 0 and y is 3, the larger value 3 is printed.)

Answer:

```
    if (x > y) cout << x;
    else cout << y;
```

(d) Make the user enter 10 integer values and print the sum.

Answer:

```
    cout << "Enter 10 integers: ";
    int x, sum = 0;
    for (int c = 1; c <= 10; c++) {
        cin >> x;
        sum = sum + x;
    }
    cout << sum << endl;
```

Problem 290   Write a complete C++ program that does the following.

1. It asks the user to enter a positive integer x.

2. The program reads the number entered by the user. If x is not positive, the program should terminate.

3. The program prints x randomly generated dice rolls.

Here is an example of how the program should work:

```
Enter a positive number:  3
The dice rolled:  4 1 6
```

Answer:

```
#include <iostream>
#include <stdlib.h>
```

```
#include <time.h>
using namespace std;

int main() {
    srand(time(0));
    int x;
    cout << "Enter a positive number:";
    cin >> x;
    if (x <= 0) exit(0);
    cout << "The dice rolled:  ";
    for (int c = 1; c <= x; c++)
        cout << rand()%6 + 1 << " ";
    cout << endl;
    return 0;
}
```

Problem 291   The following C++ program applies 5 different functions. Supply title lines (prototypes) for the 5 functions. Do not supply any blocks of code for the functions.

```
int main() {
    int x, c, r;
    x = readData();
    for (c = 0; c < 5; c++) printValues(x, c);
    x = adjust(x + 2);
    r = max3(x, c, 10);
    return fun(x + c, r - c);
}
```

(a)
Answer:

```
    int readData()
```

(b)
Answer:

```
    void printValues(int a, int b)
```

(c)
Answer:

```
    int adjust(int a)
```

(d)
Answer:

```
    int max3(int a, int b, int c)
```

(e)
Answer:

```
    int fun(int a, int b)
```

Problem 292   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer.

2. The program reads a value x entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of x has been entered.

3. The program prints a triangular display which has the number x on its top row. Each later row is obtained by omitting the last digit from the number on the previous row.

For example, if the user enters 19683 for x the program should print the following picture.

```
19683
1968
196
19
1
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 0;
    while (x <= 0) {
        cout << "Enter a positive integer: ";
        cin >> x;
    }
    while (x > 0) {
        cout << x << endl;
        x = x / 10;
    }
    return 0;
}
```

Problem 293   Write a complete C++ program that does the following.

1. It asks the user to enter a positive even integer.

2. The program reads the number entered by the user. If the value is illegal, the program should terminate.

3. The program calculates and prints the square of the number.

Here is an example of how the program should work:

```
Enter a positive even number:  6
The square is 36.
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive even integer: ";
    cin >> n;
    if ((n <= 0) || (n % 2 == 1)) exit(1);
    int ans = n * n;
    cout << "The square is " << ans << "." << endl;
    return 0;
}
```

Problem 294   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print (to the output screen) the message:

Today is March 19, 2008.

Answer:

```
cout << "Today is March 19, 2008." << endl;
```

(ii) Read and store an age entered by the user.

Answer:

```
int age;
cout << "How old are you? ";
cin >> age;
```

(iii) Print the average 2 variables x and y each of which has type int. (For example, if x is 0 and y is 3, the average is 1.5 and a decimal number must be printed.)

Answer:

```
cout << (x + y) / 2.0 << endl;
```

(iv) Make the user repeatedly enter a value for an integer variable x until the value entered is larger than 10.

Answer:

```
int x = 0;
while (x <= 10) {
    cout << "Enter a value of x that is larger than 10: ";
    cin >> x;
}
```

Problem 295   Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;

int fun1(int x) {
    int ans = x / 10;
    return ans;
}
void fun2(int x) {
    cout << x << "* ";
}
void fun3(int x) {
    cout << "fun3 ";
}
int main() {
    int x;
    cout << "Enter an integer: ";
    cin >> x;
    if (x < 10) {
        cout << "Too small!" << endl; exit(1);
    }
    if (x == 10) fun3(x);
    if (x >= 20) fun2(x);
    if (x <= 20) cout << fun1(x);
    cout << endl;
    return 0;
}
```

(i) The user enters: 5

Answer:

```
Too small!
```

(ii) The user enters: 15

Answer:

```
1
```

(iii) The user enters: 25

Answer:

```
25*
```

(iv) The user enters: 10

Answer:

```
fun3 1
```

(v) The user enters: 20

Answer:

```
20* 2
```

Problem 296

Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer that is at least 2.

2. The program reads a value x entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of x has been entered. (Note legal means greater than 1.)

3. The program prints a picture with x rows. The first row should show the first x positive integers, the next row the first $x - 1$ positive integers, until eventually the last row shows only the number 1.

For example, if the user enters 5 for x the program should print the following picture.

```
12345
1234
123
12
1
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
    int x;
    cout << "Enter a value greater than 1 for x: ";
    cin >> x;

    while (x <= 1) {
        cout << "Try again: ";
        cin >> x;
    }
```

```
      for (int r = x; r >= 1; r--) {
         for (int c = 1; c <= r; c++) cout << c;
         cout << endl;
      }
      return 0;
}
```

Problem 297   Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;
int main() {
   int x;
   cout << "Enter a positive integer: ";
   cin >> x;
   if (x <= 0) {
      cout << "Illegal" << endl;
      exit(1);
   }
   if (x <= 100) {
      cout << x;
   }
   else {
     cout << x/100 << x%10 << endl;
   }
   return 0;
}
```

(i) The user enters: -50

Answer: Illegal

(ii) The user enters: 0

Answer: Illegal

(iii) The user enters: 99

Answer: 99

(iv) The user enters: 456

Answer: 46

(v) The user enters: 4560

Answer: 450

Problem 298   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print (to the output screen) the message:

Easy!

Answer:

```
cout << "Easy!" << endl;
```

(ii) Read and store a name entered by the user.

Answer:

```
string name;
cout << "Who are you:";
cin >> name;
```

(iii) Print the value of the larger of 2 variables x and y each of which has type double.

Answer:

```
if (x > y) cout << x;
else cout << y;
```

(iv) Print the difference between 2 variables a and b each of which has type int. (The printed difference should not be negative. For example the difference between 4 and 7 is 3, so too is the difference between 7 and 4.)

Answer:

```
if (a > b) cout << a - b;
else cout << b - a;
```

Problem 299   Write a complete C++ program that does the following.

1. It asks the user to enter a positive number.

2. The program reads the number entered by the user. If the value is not positive, the program should terminate.

3. The program calculates and prints the last digit of the entered number.

Here is an example of how the program should work:

```
Enter a positive number:   56
last digit is 6.
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int x;
   cout << "Enter a positive number: ";
   cin >> x;

   if (x <= 0) exit(1);

   cout << "last digit is " << x % 10 << endl;
   return 0;
}
```

Problem 300

Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer value, x.

2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the user type in another value until a positive value of x has been entered. (Note positive means greater than 0.)

3. The program prints an $x \times x$ rectangle outlined with $*$ symbols.

For example, if the user enters 5 for x the program should print the following pattern.

```
*****
*   *
*   *
*   *
*****
```

Answer:

```cpp
#include <iostream>
using namespace std;

int main() {
   int x;
   cout << "Enter a positive number: ";
   cin >> x;

   while (x <= 0) {
      cout << "Enter a positive number: ";
      cin >> x;
   }

   for (int row = 1; row <= x; row ++) {
     for (int col = 1; col <= x; col++)
        if (row == 1 || row == x || col == 1 || col == x) cout << "*";
        else cout << " ";
     cout << endl;
   }
}
```

Problem 301   The following C++ program is supposed to ask a user to enter their name and date of birth. It then greets the user and wishes a happy birthday if it is the user's birthday. The program has a number of errors. Rewrite the program to fix the errors.

```cpp
#Include <iostream>;
#Include <string>;
Using namespace std;
main() {
cout  "Enter your name and the month, day, and year of your birth: "
int name, month, day, year; cin >> name >> day >> month >> year;
cout  "Hello  name"  endl; if (month = 3 || day = 14) {
cout  "Happy birthday"  endl;
}
```

Answer:

```cpp
#include <iostream>
using namespace std;
int main() {
   cout << "Enter your name and the month, day, and year of your birth: ";
   string name;
   int month, day, year;
   cin >> name >> month >> day >> year;
   cout << "Hello " <<  name << endl;
   if (month == 3 && day == 14)
      cout << "Happy birthday" << endl;
   return 0;
}
```

Problem 302

Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer value, x.

2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the user type in another value until a positive value of x has been entered. (Note positive means greater than 0.)

3. The program calculates and prints out x^x. (The value of x^x is $x \times x \times x \times \ldots \times x$, a product of x copies of the number x.)

Answer:

```cpp
#include <iostream>
using namespace std;
int main() {
   int x;
   cout << "Enter a positive integer: ";
   cin >> x;

   while (x <= 0) {
     cout << "Please enter a positive value: ";
     cin >> x;
   }

   int power = 1;
   for (int i = 1; i <= x; i++)
      power = power * x;
   cout << power << endl;
   return 0;
}
```

Problem 303   Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```cpp
#include <iostream>
using namespace std;
int main() {
   int x;
   cout << "Enter a positive integer: ";
   cin >> x;
   if (x <= 0) {
      cout << "Illegal" << endl;
      exit(1);
   }
   while (x > 0) {
      cout << x % 10;
      x = x / 10;
   }
   cout << x << endl;
   return 0;
}
```

(i) The user enters: -50 **Answer:** Illegal

(ii) The user enters: 7 **Answer:** 70

(iii) The user enters: 467 **Answer:** 7640

(iv) The user enters a positive integer. (Explain how the output is related to the integer that the user enters.)

Answer: The digits of the input number are printed in reverse order, followed by a 0.

Problem 304   The following C++ program is supposed to ask a user to enter three different integers. It then prints the middle value of the three input numbers. The program has several errors. Rewrite the program to fix the errors and arrange the program so that it is easier for a human to read.

```
# <iostream>;
using namespace std;
int main
    {
int x, y, z;
          cout << "Enter three different integers: " endl;
cin >> "x" >> "y" >> "z" endl;
    if ((x > y > z) && (z > y > x)); cout << y;
    if ((y > x > z) && (z > x > y)); cout << x;
    if ((z > y > x) && (x > y > z)); cout << y; return; };
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int x, y, z;
   cout << "Enter three different integers: " << endl;
   cin >> x >> y >> z;
   if ( (x > y && y > z) || (z > y && y > x)) cout << y;
   if ( (y > z && z > x) || (x > z && z > y)) cout << z;
   if ( (z > x && x > y) || (y > x && x > z)) cout << x;
   cout << endl;
   return 0;
}
```

Problem 305   Write a complete C++ program that does the following.

1. It asks the user to enter a positive integer value, x.

2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the user type in another value until a positive value of x has been entered. (Note positive means greater than 0.)

3. The program prints out a triangle with x rows that points downwards. For example, if the user enters 3 for x the program should print:

```
***
**
*
```

Answer:

```
#include <iostream>
using namespace std;

int main() {
   int x;
   cout << "Enter a positive integer: ";
   cin >> x;

   while (x <= 0) {
      cout << "Enter a positive integer:";
      cin >> x;
   }

   for (int row = x; row >= 1; row--) {   // print  row stars
      for (int star = 1; star <= row; star++)
         cout << "*";
```

```
        cout << endl;
    }
    return 0;
}
```

Problem 306   Consider the following C++ program. Write the exact output that is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;

int fun(int a) {
    int b;  b = a / 10; return b;
}

int main() {
    int x, y;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl; exit(1);
    }
    y = fun(x);
    cout << x << y << endl;
    return 0;
}
```

(i) The user enters: -50 **Answer:** Illegal

(ii) The user enters: 7 **Answer:** 70

(iii) The user enters: 467 **Answer:** 46746

Problem 307   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print (to the output screen) the greeting:

Hello. This is an easy question.

Answer:

```
cout << " Hello.  This is an easy question." << endl;
```

(ii) Get the user to enter their first name, which is to be stored as the variable *name*.

Answer:

```
string name;
cout << " Enter your first name:";
cin >> name;
```

(iii) Print the sum of the numbers from 1 to 1000 onto the screen. (The output should be the value of $1 + 2 + \ldots + 999 + 1000$).

Answer:

```
int sum = 0;
for (int c = 1; c <= 1000; c++)
    sum = sum + c;
cout << sum << endl;
```

(iv) Get the user to enter an integer value. Print the message *POSITIVE* if it is greater than zero, or *NEGATIVE* if it is less than zero. Do not take any action if the user enters zero.

Answer:

```
int x;
cout << "Enter an integer: ";
cin >> x;
if (x > 0) cout << "POSITIVE" << endl;
if (x < 0) cout << "NEGATIVE" << endl;
```

Problem 308   Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;
void multiPrint(int y) {
   for (int i = 1; i <= y; i++)
      cout << y << "!";
   return;
}
int main() {
   int x;
   cout << "Enter a positive integer: ";
   cin >> x;
   if (x <= 0) {
      cout << "Illegal" << endl;
      exit(1);
   }
   if (x > 2) multiPrint(x);
   cout << x << endl;
   return 0;
}
```

(i) The user enters: -50

Answer:

```
Illegal
```

(ii) The user enters: 1

Answer:

```
1
```

(iii) The user enters: 4

Answer:

```
4!4!4!4!4
```

Problem 309   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter their 4 digit id number.

2. The program reads the number entered by the user and stores it as the variable x. If the value of x is not in the range from 1000 to 9999, the program repeatedly makes the user type in another number until a proper id number has been entered.

3. The program calculates and prints out the last digit of the id number.

For example: A typical interaction with a user might be as follows. (The user responses are shown as bold.)

Enter your 4 digit id: **56789**

Illegal, try again: **25**

Illegal, try again: **9995**

The last digit of your id is 5.

Answer:

```
#include <iostream>
using namespace std;
int main() {
    int x;
    cout << "Enter your 4 digit id: ";
    cin >> x;
    while ( x < 1000 || x > 9999) {
        cout << "Illegal, try again: ";
        cin >> x;
    }
    cout << "The last digit of your id is " << x % 10 << endl;
    return 0;
}
```

Problem 310   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print (to the output screen) the greeting:

Hello. Today is 10/25/2006.

Answer:

```
cout << "Hello.  Today is 10/25/2006." << endl;
```

(ii) Get the user to enter their age, which is to be stored as the variable *age*.

Answer:

```
int age;
cout << "How old are you: ";
cin >> age;
```

(iii) Get the user to enter a positive integer value. Exit if the user enters a non-positive value, otherwise:

Print the message *EVEN* if the value is even, or *ODD* if it is odd.

Answer:

```
int x;
cout << "Enter a positive value: ";
cin >> x;
if (x <= 0) exit(0);
if ((x % 2) == 0) cout << "EVEN" << endl;
else cout << "ODD" << endl;
```

(iv) Get the user to enter a name. If the user enters the name *Freddy*, tell the user to enter a different name and force the user to re-enter a name until it is different from *Freddy*.

Answer:

```
string name;
cout << "What is your name? ";
cin >> name;
while (name == "Freddy") {
    cout << "That name is illegal.  Give another: ";
    cin >> name;
}
```

Problem 311   Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```
int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit(1);
    }
    if (x < 10)  cout << x--;
    else {
        if ((x % 10) == 0) cout << x / 10;
        cout << x * 10;
    }
    cout << endl;
}
```

(i) The user enters: -50

Answer: Illegal

(ii) The user enters: 0

Answer: Illegal

(iii) The user enters: 9

Answer: 9

(iv) The user enters: 456

Answer: 4560

(v) The user enters: 4560

Answer: 45645600

Problem 312   Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer value, x.

2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the user type in another value until a positive value of x has been entered. (Note positive means greater than 0.)

3. The program prints a triangular pattern that is x rows high. The characters 0 and 1 are used to print the pattern. Odd numbered rows are printed using a 1 and even numbered rows are printed using a 0.

For example, if the user enters 4 for x the program should print the following pattern with 4 rows.

```
1
00
111
0000
```

Answer:

```
#include <iostream>
using namespace std;
int main() {
    int x;
    cout << "Give a positive integer value of x: ";
    cin >> x;

    while (x <= 0) {
```

```
        cout << "Give a POSITIVE value: ";
        cin >> x;
    }

    for (int r = 1; r <= x; r++) {
        for (int c = 1; c <= r; c++)
            cout << r % 2;
        cout << endl;
    }
}
```

Problem 313   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print (to the output screen) the greeting:

Hello.

Answer:

```
cout << "Hello." << endl;
```

(ii) Get the user to enter their age. Then print out whichever the following messages applies:

You are over 25

You are not over 25

Answer:

```
int age;
cout << "Enter your age: ";
cin >> age;
if (age > 25) cout << "You are over 25";
else cout "You are not over 25";
cout << endl;
```

(iii) Ask the user to enter an even number.

Make the user re-eneter the number as often as is needed until the number is even.

Answer:

```
int number;
cout << "Enter an even number: ";
cin >> number;
while (number % 2 != 0) {
    cout << "Try again: ";
    cin >> number;
}
```

(iv) Print the average value of 3 variables x, y, and z each of which has type double.

Answer:

```
cout << (x + y + z) / 3;
```

(v) Calculate and print the decimal that represents the fraction $\frac{1}{7}$.

Answer:

```
cout << 1.0 / 7;
```

Problem 314   Write a complete C++ program that does the following.

1. It asks the user to enter a number of cents that is betwee 0 and 99.

2. The program reads the number entered by the user. If the value is not in the right range, the program should terminate.

3. The program calculates and prints out the most efficient combination of quarters, nickels, dimes, and pennies that provide the sum entered by the user.

Here is an example of how the program should work:

```
How many cents? 57
quarters: 2
dimes: 0
nickels: 1
pennies: 2
```

Answer:

```cpp
#include <iostream>
using namespace std;
int main() {
   int cents, q, d, n;
   cout << " How many cents? ";
   cin >> cents;
   if (cents < 0 || cents > 99) exit(1);

   q = cents / 25;
   cents = cents % 25;
   d = cents / 10;
   cents = cents % 10;
   n = cents / 5;
   cents = cents % 5;

   cout << "quarters: " << q << endl
        << "dimes: " << d << endl
        << "nickels: " << n << endl
        << "pennies: " << cents << endl;
   return 0;
}
```

Problem 315

Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer value, x.

2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the user type in another value until a positive value of x has been entered. (Note positive means greater than 0.)

3. The program prints an $x \times x$ square pattern of $*$ symbols in such a way that rows and columns are separated by rows and columns of $-$ symbols.

For example, if the user enters 3 for x the program should print the following pattern (there are 3 rows and 3 columns that contain $*$'s, but there are other rows and columns with only $-$'s).

```
*-*-*
-----
*-*-*
-----
*-*-*
```

Answer:

```cpp
#include <iostream>
using namespace std;
int main() {
    int x, r, c;
    cout << "Enter a positive integer: ";
    cin >> x;
    while (x <= 0) {
        cout << "Try again: ";
        cin >> x;
    }

    for (r = 1; r <= x; r++) {
        for (c = 1; c <= x; c++) {
            cout << "*";
            if (c < x) cout << "-";
            else cout << endl;
        }
        if (r < x) {
            for (c = 1; c <= 2 * x - 1; c++) cout << "-";
            cout << endl;
        }
    }
}
```