

Solutions

09.10am – 10.00am, Wednesday, March 17, 2021

**Problem 1** Write a complete C++ program that asks the user to enter their age and the number of pets that they have at home. A legal age must be between 1 and 100 (inclusive).

If the user enters an illegal age the program should print `I don't believe you!`

Otherwise if the number of pets is divisible by the age (without a remainder) the program should print `That is a lot of pets.`

Here is a sample to show how the program runs.

```
Enter the your age and number of pets: 20 200
That is a lot of pets.
```

**Answer:**

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

int main() {
    int age, pets;
    cout << "Enter the your age and number of pets: ";
    cin >> age >> pets;
    if (age < 1 || age > 100)
        cout << "I don't believe you!\n";
    else if (pets % age == 0)
        cout << "That is a lot of pets.\n";
    return 0;
}
```

**Problem 2** Consider the following C++ program. The program makes use of a function `first3digits` that returns the number formed by the first 3 digits of its input argument as its result. So for example, `first3digits(12345678)` would be 123.

Make sure to use your own 8-digit CUNY ID number as the number entered as input to the program. It would be a very bad idea to give answers based on another student's ID number!

```
int main() {
    int id, n, x = 100, y = 17, z = 19;

    cout << "Enter your 8-digit CUNY id number: ";
    cin >> id;    // assume that the user types YOUR OWN CUNY ID number

    cout << id << endl;           // line (a)
    n = first3digits(id);

    cout << n % x << endl;        // line (b)
    cout << n / x << endl;        // line (c)

    if ( (y < z) && ((x % y) < y) ) cout << "Yes\n"; // line (d)
    else cout << "No\n";
    y += 3; z /= 3;
    cout << y << z << y << endl; // line (e)

    return 0;
}
```

(a) What is the output from the instruction beginning on line (a)?

**Answer:**

12345678

This answer is based on the ID number 12345678. Actual answers will be different.

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

**Answer:**

23

The answer will be made from the 2nd and 3rd digits of the answer to (a).

(c) What is the output from the instruction beginning on line (c)?

**Answer:**

1

The answer will be the 1st digit of the answer to (a).

(d) What is the output from the instruction beginning on line (d)?

**Answer:**

Yes

(e) What is the output from the instruction beginning on line (e)?

**Answer:**

20620

**Problem 3** Write a complete C++ program that repeatedly asks the user to enter a number of **rows**. If **rows** is greater than or equal to 0, the program prints a triangular pattern of **\*s** with that number of rows. When a user enters a negative number of rows, the program tells the user the total number of **\*s** that have been printed and terminates.

Here is a sample to show how the program runs.

```
Enter the number of rows or a negative number to stop: 4
*
**
***
****
Enter the number of rows or a negative number to stop: 2
*
**
Enter the number of rows or a negative number to stop: 3
*
**
***
Enter the number of rows or a negative number to stop: -1
A total of 19 *s were printed.
```

**Answer:**

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

int main() {

    int rows = 0, total = 0;
    while (rows >= 0) {
        for (int r = 1; r <= rows; r++) {
            for (int c = 1; c <= r; c++) {
                cout << "*";
                total++;
            }
            cout << endl;
        }
        cout << "Enter the number of rows or a negative number to stop: ";
        cin >> rows;
    }
    cout << "A total of " << total << " *s were printed.\n";
    return 0;
}
```

**Problem 4** 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. The odd numbered rows are made of **\*s** and the even ones are made of **os**. For example, if  $n = 4$  the program would print:

```
*
oo
***
oooo
***
oo
*
```

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

```
int main() {
    int n;
    cout << "What is n? ";
    PART (a)
    for (int r = 1; PART (b); r++) {
        for (int c = 1; PART (c); c++) {
            if (PART (d)) cout << "*";
            else cout << "o";
        }
        PART (e)
    }
    for (int r = n - 1; PART (f); r--) {
        for (int c = 1; PART (g); c++) {
            if (PART (h)) cout << "*";
            else cout << "o";
        }
        PART (i)
    }

    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 the upper rows of the picture:

**Answer:** PART (b) is `r <= n`

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

**Answer:** PART (c) is `c <= r`

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

**Answer:** PART (d) is `r % 2 == 1`

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

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

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

**Answer:** PART (f) is `r >= 1`

(g) Give a replacement for PART (g) to loop over columns of the row:

**Answer:** PART (g) is `c <= r`

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

**Answer:** PART (h) is `r % 2 == 1`

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

**Answer:** PART (i) is `cout << endl;`

Solutions

10.10am – 11.00am, Wednesday, March 17, 2021

**Problem 1** Write a complete C++ program that asks the user to enter their name and age.

If the user is called Freddy and has an age that is either 7 or 17 the program should print `You won the special prize!`

Otherwise the program should print `Sorry, please try again.`

Here is a sample to show how the program runs.

```
Enter the your name and age: Freddy 17
You won the special prize!
```

**Answer:**

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

int main() {
    string name;
    int age;
    cout << "Enter the your name and age: ";
    cin >> name >> age;
    if (name == "Freddy" && (age == 7 || age == 17))
        cout << "You won the special prize!\n";
    else
        cout << "Sorry, please try again.\n";
    return 0;
}
```

**Problem 2** Consider the following C++ program. The program makes use of a function `first3digits` that returns the number formed by the first 3 digits of its input argument as its result. So for example, `first3digits(12345678)` would be 123.

Make sure to use your own 8-digit CUNY ID number as the number entered as input to the program. It would be a very bad idea to give answers based on another student's ID number!

```
int main() {
    int id, n, x = 10, y = 27, z = 16;

    cout << "Enter your 8-digit CUNY id number: ";
    cin >> id;    // assume that the user types YOUR OWN CUNY ID number

    cout << id << endl;           // line (a)
    n = first3digits(id);

    cout << n % x << endl;        // line (b)
    cout << n / x << endl;        // line (c)

    if ( (y < z) && ((x % y) < y) ) cout << "Yes\n";    // line (d)
    else cout << "No\n";
    y += 3; z /= 3;
    cout << y << z << y << endl;    // line (e)

    return 0;
}
```

(a) What is the output from the instruction beginning on line (a)?

**Answer:**

12345678

This answer is based on the ID number 12345678. Actual answers will be different.

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

**Answer:**

3

The answer will be the 3rd digit of the answer to (a).

(c) What is the output from the instruction beginning on line (c)?

**Answer:**

12

The answer will be the first two digits of the answer to (a).

(d) What is the output from the instruction beginning on line (d)?

**Answer:**

No

(e) What is the output from the instruction beginning on line (e)?

**Answer:**

30530



**Problem 3** Write a complete C++ program that repeatedly asks the user to enter a **size**. If the **size** is greater than or equal to 0, the program prints a square pattern of **\*s** with that size. When a user enters a negative size, the program tells the user the total number of **\*s** that have been printed and terminates.

Here is a sample to show how the program runs.

```
Enter a size or a negative number to stop: 2
**
**
Enter a size or a negative number to stop: 1
*
Enter a size or a negative number to stop: 2
**
**
Enter a size or a negative number to stop: -1
A total of 9 *s were printed.
```

**Answer:**

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

int main() {

    int size = 0, total = 0;
    while (size >= 0) {
        for (int r = 1; r <= size; r++) {
            for (int c = 1; c <= size; c++) {
                cout << "*";
                total++;
            }
            cout << endl;
        }
        cout << "Enter a size or a negative number to stop: ";
        cin >> size;
    }
    cout << "A total of " << total << " *s were printed.\n";
    return 0;
}
```

**Problem 4** 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  $n + 1$  columns. The odd numbered columns are made of `os` and the even ones are made of `*s`. For example, if  $n = 3$  the program would print:

```

o
o*
o*o
o*o*
o*o
o*
o

```

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

```

int main() {
    int n;
    cout << "What is n? ";
    PART (a)
    for (int r = 1; PART (b); r++) {
        for (int c = 1; PART (c); c++) {
            if (PART (d)) cout << "*";
            else cout << "o";
        }
        PART (e)
    }
    for (int r = n ; PART (f); r--) {
        for (int c = 1; PART (g); c++) {
            if (PART (h)) cout << "*";
            else cout << "o";
        }
        PART (i)
    }

    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 the upper rows of the picture:

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

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

**Answer:** PART (c) is `c <= r`

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

**Answer:** PART (d) is `c % 2 == 0`

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

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

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

**Answer:** PART (f) is `r >= 1`

(g) Give a replacement for PART (g) to loop over columns of the row:

**Answer:** PART (g) is `c <= r`

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

**Answer:** PART (h) is `c % 2 == 0`

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

**Answer:** PART (i) is `cout << endl;`