Problem 1  (10 points) 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 = 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 2  (10 points)
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 3  (10 points) 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 4  (10 points) 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:

\[
\begin{align*}
\$ & === \\
\$ & $$$ \\
\$ & $$$$ \\
\$ & $$$$$ \\
\$ & $$$$$$
\end{align*}
\]

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 << "$\$ = \\
        cout << endl;
    return 0;
}
```
Problem 1  (10 points) 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 && 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 2  (10 points)
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:
    ```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 or y is not positive, exit the program
Answer:
    ```cpp
    if ((x <= 0) || (y <= 0)) return 0;
    ```

(d) Print the square root of x + y.
Answer:
    ```cpp
    cout << sqrt(x + y) << endl;
    ```

(e) On one output line, print x random numbers in the range 1 to y (inclusive)
Answer:
    ```cpp
    for (int n = 1; n <= x; n++) cout << 1 + rand() % y << " ";
    ```
Problem 3  (10 points) Consider the following C++ program.

```cpp
#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 4  (10 points) 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;
}
```