Problem 1  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
Enter an integer: 4
Now enter 4 more numbers: 5 6 7 8
Their average is 6.5
venus>
venus> ./a.out
Enter an integer: 1
Now enter 1 more numbers: 8
Their average is 8
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 2
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:
   
   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 x < y < z, replace z by y - x
Answer:
   
   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 3  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 4  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

\[
\begin{align*}
X \\
XX \\
XXX \\
XXXX \\
XXXXX \\
XXXXX \\
XXXXX \\
XX \\
---
\begin{align*}
X \\
XX \\
XXX \\
XXXX \\
-----
\end{align*} \\
XXXXX \\
XXXXX \\
----
\end{align*}
\]

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 1  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
Enter an integer: 4
Now enter 4 more numbers: 6 7 8 9
2 were odd
venus>
```

```
venus> ./a.out
Enter an integer: 5
Now enter 5 more numbers: 1 3 5 7 9
5 were odd
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, count = 0;
    for (int c = 1; c <= n; c++) {
        cin >> x;
        if (x % 2 == 1) count++;
    }
    cout << count << " were odd\n";
    return 0;
}
```
Problem 2
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 3  
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 4  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

```
O
 O
 O
 O
 O
 O
O
 O
 O
 O
 O
O
 O
 O
 O
 O
O
 O
 O
 O
 O
O
 O
 O
 O
 O
O
 O
 O
 O
 O
O
 O
 O
O
 O
 O
 O
 O
```

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 1  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
Enter 2 positive integers: 4 2
XX
venus>
venus> ./a.out
Enter 2 positive integers: 4 5
XXXX
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 << "X";
    cout << endl;
    return 0;
}
Problem 2
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 3  Consider the following C++ program.

```cpp
#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)
}
```

(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 4  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

\[
\begin{array}{ccccccc}
XX & XX & XX & XX & XX & XX & XX \\
X & X & X & X & X & X & X \\
X & XX & XX & XX & XX & XX & X \\
\end{array}
\]

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 == 0 && c == r) cout << "X";
            else if (l % 2 == 1 && c + r == n + 1) cout << "X";
            else cout << " ";
        cout << endl;
    }
    return 0;
}
```
Problem 1  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
Enter 2 positive integers: 4 2
$$$$
venus>

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

Answer:

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

int main() {
    int a, b;
    cin >> a >> b;
    for (int c = 1; c <= a || c <= b; c++) cout << "$";
    cout << endl;
    return 0;
}
```
Problem 2
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:
   ```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 $0 < y^2 - 4xz < y^2$, print NEGATIVE
Answer:
   ```cpp
   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:
   ```cpp
   x = y * y * y;
   ```

(e) Print 80 copies of the number 5 (all on the same line of output)
Answer:
   ```cpp
   for (int n = 1; n <= 80; n++) cout << 5;
   ```
Problem 3  Consider the following C++ program.

```cpp
#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 4  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


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;
}
```