Problem 1  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:

```cpp
#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 2

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 = 18;
```

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

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

(b) Print the square of x.
Answer:

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

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

```cpp
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:

```cpp
for (int n = 1; n < 1000; n++)
    if ((n % 7 == 0) || ((n % 2 == 0) && (n > 400))) cout << n << endl;
```
(c) Print the square root of 3/8.
Answer:

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

Problem 3
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 4
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:

```
*   **   *
*   **   *
*     *   *
*     *   *
*   **   *
*   **   *
```
Problem 5  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 << " ";
    cout << endl;
    return 0;
}

Problem 6
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 7 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:
(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 8  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 9  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
Problem 10
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: \textit{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:
Problem 11  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 12  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:

#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 13
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:

#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 14
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: Quote Hello but do not quote cout.
Answer:
```
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 15  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:
(b) What is the output at line (b)?

Answer:

16

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

Answer:

azabza

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

Answer:

81

Problem 16 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 << "+
        }
    }
    return 0;
}
```
Problem 17  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 18
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:

\[
\text{cout} \ll a / 10 \ll \text{endl};
\]

(d) If \( \text{word} \) and \( \text{second} \) are equal print the value of \( a \), otherwise print the value of \( b \).

Answer:

\[
\text{if (word == second) cout} \ll a \ll \text{endl;}
\]

\[
\text{else cout} \ll b \ll \text{endl;}
\]

(e) Print \( a \) copies of the value of \( \text{word} \) on one line separated by single spaces.

Answer:

\[
\text{for (int x = 1; x <= a; x++) cout} \ll \text{word} \ll " \ ";
\]

\[
\text{cout} \ll \text{endl;}
\]

**Problem 19**

Consider the following C++ program.

```cpp
#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:
(e) What is the output at line (e)?

**Answer:**

30

**Problem 20**

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 21**

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:

```cpp
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:

```cpp
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:

```cpp
for (int a = 1; a <= x; a++) cout << x;
for (int a = 1; a <= y; a++) cout << message;
```

**Problem 22**  Consider the following C++ program.

```cpp
#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 23  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:

```
#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 24  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:

\[
Area = \frac{1}{2} \text{Base} \times \text{Height}
\]

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 25
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:

```cpp
    for (int a = 1; a <= x; a++) cout << name;
    for (int a = 1; a <= y; a++) cout << message;
```

Problem 26  
Consider the following C++ program.

```cpp
#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 27  
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 28 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 /= 10;
    }
    return 0;
}
```
Problem 29  

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;
```

(a) Prompt for, and read values for x and y from the user.

**Answer:**

```cpp
cout << "Enter 2 integers: ";
cin >> x >> y;
```

(b) Print x copies of the number y, without spaces on one line of output.

**Answer:**

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

(c) Print the remainder when x is divided by y

**Answer:**

```cpp
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:**

```cpp
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:**

```cpp
cout << (x + y) / 2.0 << endl;
```

Problem 30  

Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;
```
```cpp
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 fred 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 31** 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:

```
#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 32
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:

#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 33
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; string name;

(a) Prompt for, and read values for x, y and name from the user.
Answer:
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:
    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 34  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:
fredf Fred
(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 35**   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 36  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
XXO0X
XXX00
XXXXO
```

Answer:

```cpp
#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 37  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; c++)
            if ((c == r) || (c == (r - 1))) cout << "O";
            else cout << " ";
        cout << endl;
    }
    return 0;
}

Problem 38 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

```
  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:

#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 << "O";
            else cout << " ";
        cout << endl;
    }
    return 0;
}
Problem 39  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 40  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;

    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;
}
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 << c;
    cout << endl;
}
return 0;

Problem 41  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:
#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 42  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 43

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:

```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 = n; r >= 1; r--) {
        for (int c = 1; c <= r; c++) cout << n + 1 - r;
        cout << endl;
    }
    return 0;
}
```
Problem 44  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 45  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;
}
```
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 46  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:

#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 47  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:
#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 48 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:

#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 49 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
Problem 50
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

Problem 51
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
Problem 52  Consider the following C++ program.

```
#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 53  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 54  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 55  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 56  Consider the following C++ program.

```cpp
#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 57  Consider the following C++ program.
Problem 58 Consider the following C++ program.

```c++
#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
```
(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:
26

(e) What is the output at line (e)?
Answer:
13*13

Problem 59  Consider the following C++ program.

#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:
Problem 60
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:
```cpp
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:
```cpp
cout << 100.0 * x / y << "%" << endl;
```

(c) Read new values for x and y from the user.
Answer:
```cpp
    cin >> x >> y;
```

(d) Replace y by its absolute value.
Answer:
```cpp
if (y < 0) y = -y;
```

(e) Print the first digit of y
Answer:
```cpp
while (y >= 10) {
    y = y / 10;
}
cout << y << endl;
```

Problem 61
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 62
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:

```cpp
cout << 100.0 * x / y << "%" << endl;
```

(c) Print x copies of the word `cin` on a single line of output.

Answer:

```cpp
for (int c = 1; c <= x; c++) cout << "cin";
cout << endl;
```

(d) Replace y by the absolute value of x.

Answer:

```cpp
if (x < 0) y = -x;
else y = x;
```

(e) Print the first digit of y

Answer:

```cpp
while (y >= 10) {
    y = y / 10;
}
cout << y << endl;
```

Problem 63

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) Read a new value for y and then for x from the user.

Answer:

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

(b) Print y copies of the number x on a single line of output.

Answer:

```cpp
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:

\[
y = - x - y; \\
\text{if} \ (y < 0) \ y = -y;
\]

(e) If y is greater than 10, print the second digit of y

Answer:

\[
\text{while} \ (y > 100) \{
\ y = y / 10;
\}
\text{if} \ (y > 10) \ cout \ << \ y \ % \ 10 << \ endl;
\]

Problem 64
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

\[
\text{int} \ x, \ y;
\]

(a) Print x copies of the last digit of x on a single line of output.

Answer:

\[
\text{for} \ (\text{int} \ c = 1; \ c <= x; \ c++) \ cout \ << \ x \ % \ 10;
\text{cout} \ << \ \text{endl};
\]

(b) Print the exact value the quotient of x by y, as a decimal

Answer:

\[
\text{cout} \ << \ (1.0 \ * \ x) / y << \ \text{endl};
\]

(c) Exit the program if y is negative

Answer:

\[
\text{if} \ (y < 0) \ \text{return} \ 0;
\]

(d) Replace y by its absolute value.

Answer:

\[
\text{if} \ (y < 0) \ y = -y;
\]
(e) Print the first digit of x

Answer:

```cpp
while (x >= 10) {
    x = x / 10;
}
cout << x << endl;
```

Problem 65

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

```cpp
int x, y;
```

(a) Exit the program if y is positive

Answer:

```cpp
if (y > 0) return 0;
```

(b) Print -y copies of the the string "y >= 0; 

Answer:

```cpp
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:

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

(d) Replace y by the absolute value of x + y.

Answer:

```cpp
y = x + y;
if (y < 0) y = -y;
```

(e) Print the first digit of y

Answer:

```cpp
while (y >= 10) {
    y = y / 10;
}
cout << y << endl;
```
Problem 66
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

\[ \text{int } x, y; \]

(a) Exit the program if y is negative
Answer:
\[ \text{if } (y < 0) \text{ return 0; } \]

(b) Print x copies of the last digit of y on a single line of output.
Answer:
\[ \text{for (int } c = 1; c <= x; c++) \text{ cout } \text{<< } y \text{ % 10;} \]
\[ \text{cout } \text{<< endl;} \]

(c) Print the exact value the quotient of x by y, as a decimal
Answer:
\[ \text{cout } \text{<< (1.0 * x) / y } \text{<< endl;} \]

(d) Replace y by its absolute value.
Answer:
\[ \text{if } (y < 0) \text{ y = } -y; \]

(e) Print the first digit of x followed by the last digit of y
Answer:
\[ \text{while (x } >= 10 \text{) } \{ \]
\[ \text{ x = x } / \text{ 10;} \]
\[ \}\]
\[ \text{cout } \text{<< x } \text{<< y } \text{ % 10 } \text{<< endl;} \]

Problem 67
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

\[ \text{int } x, y; \]

(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 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 68** 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:

```cpp
#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 << "0";
            if (c % 3 == 0) cout << "X";
            if (c % 3 != 0) cout << "X";
        }
    }
    return 0;
}
```
Problem 69  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:

```cpp
#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 70  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:

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

int main() {
  for (int r = 1; r <= 101; r++) {
    for (int c = 1; c <= 51; c++) {
      if ((c % 5) == 0) cout << "O";
      else cout << "X";
    }
    cout << endl;
  }
  return 0;
}
```
for (int c = 1; c <= 51; c++) {
    if ((r == 51) || (c == 26)) cout << "O";
    else cout << "X";
}
cout << endl;
}
return 0;
}

Problem 71 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:

#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 72 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:

#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 73   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:

#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 74   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:
#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 75
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 76
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 77
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 78
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 79
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;
Problem 80
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.

\[ \text{int } x, y, z; \]

(a) Print \( x \) copies of the number \( y \) on a single line of output.
\[ \text{Answer:} \]
\[ \text{for (int } c = 1; c <= x; c++) \text{ cout } \ll \text{ y } \ll " \ " ; \]
\[ \text{cout } \ll \text{ endl; } \]

(b) Print the exact average of \( x \), \( y \) and \( z \).
\[ \text{Answer:} \]
\[ \text{cout } \ll \text{ (x } + y + z) / 3.0 \ll \text{ endl; } \]

(c) Print the square root of 5. Use a C++ function for the calculation.
\[ \text{Answer:} \]
\[ \text{cout } \ll \text{ sqrt(5.0) } \ll \text{ endl; } \]

(d) Print a random number in the range 1 to 6, inclusive. Use a C++ function.
\[ \text{Answer:} \]
\[ \text{cout } \ll \text{ rand() } \% 6 + 1 \ll \text{ endl; } \]

(e) Print the first digit of the variable \( x \).
\[ \text{Answer:} \]
\[ \text{while (x } >= 10) \{ \]
\[ \quad x = x / 10; \]
\[ \} \]
\[ \text{cout } \ll x \ll \text{ endl; } \]
Problem 81
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 82
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 83
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:
   ```cpp
cout << rand() % 6 + 13 << endl;
```

(d) Print the square root of 80. Use a C++ function for the calculation.
Answer:
   ```cpp
cout << sqrt(80.0) << endl;
```

(e) Print the first digit of the sum \( y + z \).
Answer:
   ```cpp
x = y + z;
while (x >= 10) {
    x = x / 10;
}
cout << x << endl;
```

Problem 84 Consider the following C++ program.

```cpp
#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:

```
```
Problem 85  
Consider the following C++ program.

```
#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 86  
Consider the following C++ program.

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

int main() {
    int x = 4, y = 11, z = 9;
```
string freddy = "Fred";
string fred = "Freddy";

int main() {
    int x = 12, y = 11, z = 19;
    string freddy = "Freddy";
    string fred = "Fred";
    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 87   Consider the following C++ program.

#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:
FredFreddy

(e) What is the output at line (e)?
Answer:
1211+19=151

Problem 88 Consider the following C++ program.

#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:
**Problem 89**  Consider the following C++ program.

```cpp
#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 90**  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 = "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:**
FredFred

(c) What is the output at line (c)?
**Answer:**
1411=151
Problem 91   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
Problem 92  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.

Problem 93  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 94    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: ";
```

```cpp
```
Problem 95  
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:

```cpp
#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 96  
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

XXXXYYYY
XXXXYYYY
XXXXYYYY
XXXX
XXXX

Answer:

#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 97  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

XXXX
XXXX
XXXX
XXXX
XXXX
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 98  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
XXXXXY
XXXXXY
XXXXXY

Answer:

```cpp
#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 99 
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
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";
        }
        cout << endl;
    }
    return 0;
}
Problem 100  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 101  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

```cpp
```
Problem 102  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 \( a \times b \) 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 103  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 \( a \times b \) 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
XXXX|XXXX|XXXX|XXXX|
XXXX|XXXX|XXXX|XXXX|
XXXX|XXXX|XXXX|XXXX|
XXXX|XXXX|XXXX|XXXX|
XXXX|XXXX|XXXX|XXXX|
XXXX|XXXX|XXXX|XXXX|
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 104  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 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;
}
```
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 105 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 106 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 107  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:

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

Problem 108  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 109   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 110  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 111  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.

```plaintext
***
** *
***
** *
```

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 112  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

```plaintext
1
2
3
4
5
```

Answer:

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

int main() {
    int n;
    cout << "Enter an integer 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 113 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 114 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 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 115  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:

```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;
    }
    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) 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:

```cpp
#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 117  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:

\[ x + y + z \text{ is positive} \]

Answer:

```cpp
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 118  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 119** 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:**

```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 c = 1; c <= n; c++) {
                if (c >= r) cout << "*";
                else cout << " ";
            }
            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) 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:**
Problem 121 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
#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;
}
```

(i) Print to the screen the message:

**PI is 22/7**

**Answer:**

```cpp
    cout << "PI is 22/7" << endl;
```

(ii) Print to the screen the value of \(x/y + z\) (use integer division).

**Answer:**

```cpp
    cout << x / y + z << endl;
```

(iii) Read in the values of \(x\) and \(y\) (in this order).

**Answer:**

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

(iv) If the value of `firstName` is Freddy, exit the program. Otherwise print Hello.

**Answer:**

```cpp
    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:**

```cpp
    cout << "Enter last name and first name:"
    cin >> lastName >> firstName;
```

Problem 122 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() {
```
```cpp
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 123**  
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 retype \( n \) 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:**

```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 = 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;
}
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 126 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
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. 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.

```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 128
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
```
#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 129  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 name is x

Answer:
    cout << "Your name is x" << endl;

(ii) Print to the screen the quotient when x is divided by yz (use integer division).

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 x is 5 or firstName is not Freddy, print the message Hello. Otherwise end the program.

Answer:
    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:
    cout << "Enter x,y and z: ";
    cin >> x;

Problem 130  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
Goodbye!

(c) The user enters: 12 12
144 12

(d) The user enters: 1 12
12

(e) The user enters: 1 13

Problem 131  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:

#include <iostream>
using namespace std;

int main() {


Problem 132  
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:

```cpp
#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 133  
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:

\( x \% y + z \) is positive

```cpp
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 134 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 135 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 136 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:

*  
**  
*** 
* 
** 
***
Problem 137 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:

cout << "2 + 2 = 3";

(ii) Print the square root of 10.

Answer:

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:

cout << rand() % 21 + 7;

(iv) Ask the user to enter their age. If their answer does not satisfy \( 5 \leq \text{age} \leq 99 \) exit the program immediately.

Answer:

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:

for (int n = 10; n <= 99; n++)
    if (n % 3 == 0) cout << n << endl;
Problem 138  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 139  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 140 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
00
XXX
0000

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 141 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:
$1 \times 2 \times 3 \times 4 = 24$

**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:**

```cpp
for (int i = 1000; i <= 9999; i++)
    if (i % 6 == 0 && i % 10 == 0) cout << i << endl;
```

**Problem 142**

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) {
        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 143 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:

#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 144 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
Problem 145   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:

cout << "Hello\nHello Hello\n";

(ii) Print the square root of 2.

Answer:

cout << sqrt(2.0);

(iii) Print a random number \( r \) with \(-7 \leq r \leq 0\). (An appropriate C++ function must be used to make the random number.)

Answer:

cout << rand() % 8 - 7;

(iv) Ask the user to enter their age. If their answer does not satisfy \( 5 \leq age \leq 99 \) print the word “Illegal”.

Answer:

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:

for (int i = 10; i <= 99; i++)
    if (i % 10 == 4) cout << i << endl;

Problem 146   Consider the following C++ program. What is the output from the program in response to the following user input?
Problem 147 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 x, y;
    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;
}
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 148 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 149 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 \( 0 \leq r \leq 10. \) (An appropriate C++ function must be used to make the random number.)

Answer:

```cpp
cout << rand() % 11;
```

(ii) Print twice the square root of 17.

Answer:

```cpp
cout << 2 * sqrt(17);
```

(iv) Ask the user to enter their age. If their answer does not satisfy \( 1 \leq age \leq 90 \) make them try exactly one more time.

Answer:

```cpp
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:

```cpp
for (int i = 1; i < 100; i++)
    if (i * i >= 1000 && i * i <= 9999)
        cout << i * i << endl;
```

Problem 150  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) {
        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
Problem 151  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. (Print 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:

#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 152  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
000X

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 = 1; r <= n; r++) {
        for (int c = 1; c <= n; c++)
            if (c < r) cout << "O";
            else cout << "X";
        cout << endl;
    }
    return 0;
}

Problem 153 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:

    cout << "007 = 7" << endl;

(ii) Print the numbers from 1 to 1000 to the screen, one number per line.

Answer:

    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:

    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:

    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:**

```cpp
for (int n = 10; n <= 99; n++)
    if (n % 3 != 0)
        cout << n << endl;
```

**Problem 154**  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 155**  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:

#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 156  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:

#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 157 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 158 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;
}
Problem 159  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:

#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 160  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:
```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 161** 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 × 143.)

Answer:

```cpp
for (int n = 1000; n <= 9999; n++)
    if (n % 7 != 0)
        cout << n << endl;
```

Problem 162  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 163  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:

#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 164  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:

#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 165  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 166  Consider the following C++ program. What is the output from the program in response to the following user input?

```c++
#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) {
```

```c++
```
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 167    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:

#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 168  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 169  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 `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:**

```c++
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:**

```c++
for (int n = 100; n <= 999; n++)
    if ((20 <= (n * n) % 100) && ((n * n) % 100 <= 29))
        cout << n << endl;
```

**Problem 170** Consider the following C++ program. What is the output from the program in response to the following user inputs?

```c++
#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
Problem 171  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:

#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 172  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:

#include <iostream>
using namespace std;

int main () {
    int n;
    cout << "Enter an integer: ";
    cin >> n;
Problem 173  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 174  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 % 2 == 0) n = n / 2;
    else n = n * 3 + 1;
    cout << "The answer is: " << n << endl;
    return 0;
}
```
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 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 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 176** 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:**

```cpp
#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 177** 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.)

```cpp
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.)

```cpp
int n;
cout << "Enter a number greater than 2: ";
cin >> n;
while (n > 0) {
    cout << n % 10;
    n = n / 10;
}
cout << endl;
```

**Problem 178** 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 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
The user enters: Andrew -20
Hello Kamil you are about 5

The user enters: Carl 200
Goodbye Kamil!
Hello Carl you are about 200

Problem 179  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 180  Write a complete C++ program that asks a user to enter their day and month of birth. If the user's birthday is March 14$^{th}$, 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 181  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):
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.)

```cpp
int n;
cin >> n;
cout << n / 10;
```

c) Print the square root of 19683 to the output screen:

```cpp
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.

```cpp
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.

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

Problem 182 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, 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
Problem 183  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:

```c++
#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 184  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 185  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

cout << "2 + 2 = 4";

(b) Print all the numbers from 1 to 1000 to the screen (one number per line).

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.

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:

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 ≤ 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 186 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
name Fred name
7

(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

Problem 187 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 x² 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 188
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;
```
Problem 189  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 190  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 191 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:
#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 192   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:

#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 193   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 \( 1 \leq f \leq x - 1 \) 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 194  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, 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;
}
Problem 195  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

```
#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 << " \n";
    return 0;
}
```
**Problem 196**  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 197**  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 \(2 \leq f \leq x\) 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:**
Problem 198  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) 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 199  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 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 200 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 201 Consider the following C++ program. Explain what output is produced in response to the given user inputs.
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.

(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 203** 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:**

```cpp
#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;
    for (c = 2; c < n; c++) cout << "* ";
    cout << endl;
    for (r = 1; r < n; r++) {
        cout << "* ";
        for (c = 2; c < n; c++) cout << " ";
        cout << endl;
    }
    cout << endl;
}```
Problem 204 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 205 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;
}
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.

(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 207  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 << "*
    for (r = 2; r <= n; r++) {
        for (c = 1; c <= n / 2; c++) cout << " 
        cout << "*" << endl;
    }
    return 0;
}
```

Problem 208  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: ";
```
Problem 209     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 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.

(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 211 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* × *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 212**

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 213**

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:**

```cpp
#include <iostream>
#include <stdlib.h>
```
```cpp
#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 214  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.

```cpp
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:
```cpp
int readData()
```
(b) Answer:
```cpp
void printValues(int a, int b)
```
(c) Answer:
```cpp
int adjust(int a)
```
(d) Answer:
```cpp
int max3(int a, int b, int c)
```
(e) Answer:
```cpp
int fun(int a, int b)
```

Problem 215  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 216** 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 217** 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:

```cpp
    cout << "Today is March 19, 2008." << endl;
```

(ii) Read and store an age entered by the user.

Answer:

```cpp
    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:

```cpp
    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:

```cpp
    int x = 0;
    while (x <= 10) {
        cout << "Enter a value of x that is larger than 10: ";
        cin >> x;
    }
```

Problem 218 Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```cpp
#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;
}
```
Problem 219
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;
    }

    // Print the picture
    for (int i = 0; i < x; i++) {
        for (int j = x; j > i; j--)
            cout << j << " ";
        cout << endl;
    }
}
```
Problem 220  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);
    }
    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 221  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:

```cpp
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:

```cpp
if (a > b) cout << a - b;
else cout << b - a;
```

Problem 222  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:

```cpp
#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 223  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 224  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;

int 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 225
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 226** 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 227** 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.
```cpp
#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 228

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:

```
Problem 229  Consider the following C++ program. Write the exact output that is produced in response to the given user inputs.

```cpp
#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 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 output screen) the greeting:
Hello. This is an easy question.
Answer:
```cpp
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:
```cpp
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:
```cpp
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:

```c++
int x;
cout << "Enter an integer: ";
cin >> x;
if (x > 0) cout << "POSITIVE" << endl;
if (x < 0) cout << "NEGATIVE" << endl;
```

Problem 231 Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```c++
#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 232 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:**

```cpp
#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 233** 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:**

```cpp
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:**

```cpp
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:**

```cpp
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:**

```cpp
string name;
cout << "What is your name? ";
cin >> name;
while (name == "Freddy") {
  cout << "That name is illegal. Give another: ";
cin >> name;
}
```
Problem 234  Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```cpp
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 235  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:**

```cpp
#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 236  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-enter 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 237  Write a complete C++ program that does the following.
1. It asks the user to enter a number of cents that is between 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 238

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:
#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;
        }
    }
    cout << endl;
}