

Problem 1 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

- (1) The program asks the user to enter a positive integer n .
- (2) If the user enters a non-positive integer for n , the program terminates.
- (3) The program prints a triangle with n rows using the number r to make the characters on row number r .

For example, if the user enters 4 for n the output is as follows:

```
1
22
333
4444
```

Answer:

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

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

Problem 2 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 3 Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (y <= 0)
        cout << "Are you positive?\n";
    while (y < 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 4 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:

```
#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 5 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

- (1) The program asks the user to enter a positive integer n .
- (2) Until the user enters a positive integer for n , the program makes the user enter another choice for n .
- (3) The program prints a triangle with n rows, where the rows are formed by using the characters X and O in sequence.

For example, if the user enters 4 for n the output is as follows:

```
X
OO
XXX
OOOO
```

Answer:

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

int main() {
    int n;
    cout << "Enter a positive integer n: ";
    cin >> n;
    while (n <= 0) {
        cout << "Not positive. Try again: ";
        cin >> n;
    }
    for (int r = 1; r <= n; r++) {
        for (int c = 1; c <= r; c++)
            if (r % 2 == 1) cout << "X";
            else cout << "O";
        cout << endl;
    }
    return 0;
}
```

Problem 6 Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print to the screen the message:

```
1 x 2 x 3 x 4 = 24
```

Answer:

```
cout << "1 x 2 x 3 x 4 = 24";
```

(ii) Print a random number r with $11 \leq r \leq 29$. (An appropriate C++ function must be used to make the random number.)

Answer:

```
cout << rand() % 19 + 11;
```

(iii) Print the sum of the square roots of 11 and 12.

Answer:

```
cout << sqrt(11.0) + sqrt(12.0);
```

(iv) Ask the user to enter their age. If their answer does not satisfy $0 \leq age \leq 1000$ exit the program immediately.

Answer:

```
cout << "Enter your age: ";
int age;
cin >> age;
if (age < 0 || age > 1000) return 0;
```

(v) Print to the screen every four digit number n that is divisible by both 6 and 10. Print one number per line. (For example 6000 would be printed but 5999 would not be printed since $6000 = 6 \times 1000 = 10 \times 600$.)

Answer:

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

Problem 7 Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (y <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (x <= 0)
        cout << "Are you positive?\n";
    while (x < 10) {
        cout << x;
        x = y + x;
    }
    cout << y << endl;
    return 0;
}
```

(a) The user enters: -5 5

Are you positive?

-5055

(b) The user enters: 5 -5

Illegal

(c) The user enters: 10 1

1

(d) The user enters: 1 10

110

(e) The user enters: 1 1

1234567891

Problem 8 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 9 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

- (1) The program asks the user to enter a positive integer n .
- (2) If the user enters a non-positive integer for n , the program terminates.
- (3) The program prints a triangle with n rows using the number c to make the characters in column number c .

For example, if the user enters 4 for n the output is as follows:

```
1
12
123
1234
```

Answer:

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

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

Problem 10 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 11 Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (y <= 0)
        cout << "Are you positive?\n";
    while (y < 20) {
        cout << y;
        y = y + 2 * x;
    }
    cout << y << endl;
    return 0;
}
```

(a) The user enters: -5 5

Illegal

(b) The user enters: 5 -5

Are you positive?
-551525

(c) The user enters: 10 1

121

(d) The user enters: 1 10

101214161820

(e) The user enters: 1 1

13579111315171921

Problem 12 Write a complete C++ program that does the following.

1. It asks the user to enter an integer between 1000 and 9999.
2. If the entered number is out of range, the message "Wrong!" is printed and the program terminates.
3. Otherwise the program prints the two two digit number made from the first pair and last pair of digits (one number per line).

Here is an example of how the program should work:

```
Enter an integer between 1000 and 9999: 4567
45
67
```

Answer:

```

#include <iostream>
using namespace std;

int main() {
    int n;
    cout << "Enter a positive integer between 1000 and 9999: ";
    cin >> n;
    if (n < 1000 || n > 9999) {
        cout << "Wrong!" << endl;
        return 0;
    }
    cout << n / 100 << endl << n % 100 << endl;
    return 0;
}

```

Problem 13 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 14 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:

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

(ii) Print twice the square root of 17.

Answer:

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

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

Answer:

```
cout << "Enter your age: ";
int age;
cin >> age;
if (age < 1 || age > 90) {
    cout << "Illegal, try again: ";
    cin >> age;
}
```

(v) Print to the screen every four digit number n that is a perfect square (of an integer). Print one number per line. (For example 1600 would be printed but 1599 would not be printed since $1600 = 40 \times 40$.)

Answer:

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

Problem 15 Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (y <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (x <= 0)
        cout << "Are you positive?\n";
    while (x < 20) {
        cout << y;
        x = x + 2 * y;
    }
    cout << x << endl;
    return 0;
}
```

(a) The user enters: -5 5

Are you positive?

55525

(b) The user enters: 5 -5

Illegal

(c) The user enters: 10 1

1111120

(d) The user enters: 1 10

1021

(e) The user enters: 1 1

111111111121

Problem 16 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 17 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
00XX
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 << "0";
            else cout << "X";
        cout << endl;
    }

    return 0;
}
```

Problem 18 Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, 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:

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

Problem 19 Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (y <= 0) 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 20 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 21 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 22 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 23 Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (x <= 0) x = y;
    if (y <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (x <= 10) cout << y << x << endl;
    while (y > 0) {
        cout << y;
        y = y / 10;
    }
    cout << x << endl;
    return 0;
}
```

(a) The user enters: -5 5

```
55
55
```

(b) The user enters: 5 -5

```
Illegal
```

(c) The user enters: -5 -5

```
Illegal
```

(d) The user enters: 567 123

```
123121567
```

(e) The user enters: 567 0

```
Illegal
```

Problem 24 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 25 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

- (1) The program asks the user to enter a positive integer n .
- (2) If the user enters a non-positive integer for n , the program terminates.
- (3) The program prints a square with n rows and n columns using the letter X on odd numbered rows and O on even numbered rows.

For example, if the user enters 4 for n the output is as follows:

```
XXXX
0000
XXXX
0000
```

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 (r % 2 == 0) cout << "0";
            else cout << "X";
        cout << endl;
    }

    return 0;
}
```

Problem 26 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:

```
cout << "007 = Bond" << endl;
```

(ii) Print the numbers from -100 to 100 to the screen, one number per line.

Answer:

```
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:

```
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:

```
string name;
cout << "Enter your name: ";
cin >> name;
if (name == "007") return 0;
```

(v) Print to the screen every four digit number n that is not an exact multiple of 7. Print one number per line. (For example 1000 would be printed but 1001 would not be printed since $1001 = 7 \times 143$.)

Answer:

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

Problem 27 Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (y <= 0) 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 28 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 29 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 30 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 31 Consider the following C++ program. What is the output from the program in response to the following user input?

```
#include <iostream>
using namespace std;
int main() {
    int x, y;
    cout << "Please enter two positive integers: ";
    cin >> x >> y;
    if (x <= 0) x = y + 1;
    if (y <= 0) {
        cout << "Illegal" << endl;
        exit (1);
    }
    if (x <= 10) cout << y << x << endl;
    while (y > 100) {
```

```

        cout << y;
        y = y / 100;
    }
    cout << x << endl;
    return 0;
}

```

(a) The user enters: -5 5

```

56
6

```

(b) The user enters: 5 -5

Illegal

(c) The user enters: -5 -5

Illegal

(d) The user enters: 567 123

```

123567

```

(e) The user enters: 567 0

Illegal

Problem 32 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 << "Too easy!" << endl;
        return 0;
    }

    cout << "Larger: ";
    if (n > m) cout << n << endl;
    else cout << m << endl;
    return 0;
}

```

Problem 33 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:

```
#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 34 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:

```
while (number >= 10) {
    cout << number << " ";
    number--;
}
```

- (ii) Print the value of the sum of squares of x and y .

Answer:

```
cout << x * x + y * y << endl;
```

- (iii) Calculate x as the decimal that represents the fraction $5/7$.

Answer:

```
x = 5.0 / 7.0;
```

(iv) Print the sum of the square roots of all the numbers from 1048576 to 5764801.

Answer:

```
double sum = 0;
for (int n = 1048576; n <= 5764801; n++)
    sum += sqrt((double) n);
cout << sum << endl;
```

(v) Print every three digit number n for which the next to last digit of n^2 is 2. For example, 111 is printed because $111^2 = 12321$. (This number ends in the digits 21 and its next to last digit is 2.)

Answer:

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

Problem 35 Consider the following C++ program. What is the output from the program in response to the following user inputs?

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

int main () {
    int n;
    cout << "Please give me an integer: ";
    cin >> n;
    if (n < 10) {
        cout << "Integer is too small." << endl;
        if (n < 0) return 0;
    }
    if (n % 2 == 0) cout << 3 * n / 2 << endl;
    else if (n % 4 == 1) cout << 3 * ((n - 1) / 4) + 1;
    else cout << 3 * ((n + 1) / 4) - 1;
    cout << endl;
    return 0;
}
```

(a) The user enters: -9

Integer is too small.

(b) The user enters: 9

Integer is too small.

7

(c) The user enters: 10

15

(d) The user enters: 11

8

(e) The user enters: 21

16

Problem 36 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 37 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;
```

```

    if (n % 2 == 0) n = n / 2;
    else n = n * 3 + 1;
    cout << "The answer is: " << n << endl;
    return 0;
}

```

Problem 38 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 39 Consider the following C++ program. What is the output from the program in response to the following user inputs?

```

#include <iostream>
using namespace std;

int main () {
    int n;
    cout << "Please give me an integer: ";
    cin >> n;
}

```

```

if (n < 10) {
    cout << "Integer is too small." << endl;
    if (n < 0) return 0;
}
if (n % 3 == 0) cout << "n = " << n << endl;
else cout << "CSCI 111" << endl;
while (n > 20) {
    cout << n << ", ";
    n = n - 10;
}
cout << endl;
return 0;
}

```

(a) The user enters: -1 **Answer:**

Integer is too small.

(b) The user enters: 0 **Answer:**

Integer is too small.

n = 0

(c) The user enters: 1 **Answer:**

Integer is too small.

CSCI 111

(d) The user enters: 19 **Answer:**

CSCI 111

(e) The user enters: 111 **Answer:**

n = 111

111, 101, 91, 81, 71, 61, 51, 41, 31, 21,

Problem 40 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 41 Write a complete C++ program that does the following.

1. It asks the user to enter a decimal number that is greater than 0 and less than 10.
2. If the entered number is not within the desired range the program exits.
3. Otherwise the program prints the square of the number.

Here is an example of how the program should work:

```

Enter a number greater than 0 and less than 10: 2.5
The square is: 6.25

```

Answer:

```

#include <iostream>
using namespace std;

int main() {
    double number;
    cout << "Enter a number greater than 0 and less than 10: ";
    cin >> number;
    if (number <= 0 || number >= 10) exit(1);
    cout << "The square is: " << number * number << endl;
    return 0;
}

```

Problem 42 Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print to the screen the message:

```
2 + 2 = 5
```

```
cout << "2 + 2 = 5" << endl;
```

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

```
for (int i = 1; i <= 1000; i++)
    if (i % 2 == 1) cout << i << endl;
```

(c) Ask the user enter a number that is not a multiple of 10. If the user gives an incorrect response force the user to keep entering a number until legal answer is received.

```

cout << "Enter a number that is not a multiple of 10: ";
int number;
cin >> number;
while (number % 10 == 0) {
    cout << "That's a multiple of 10. Try again: ";
    cin >> number;
}

```

(d) Ask the user to enter a number and print its square root if it is positive. (Otherwise do not print anything.)

```
cout << "Enter a positive number: ";
double x;
cin >> x;
if (x > 0) cout << sqrt(x) << endl;
```

(e) Read an integer greater than 2 from the user, then print it in reverse. (If the user enters the number 125, the program should print 521.)

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

Problem 43 Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

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

int main(){
    int age;
    string name;
    cout << "Please enter your name and age: ";
    cin >> name >> age;

    if (name == "Kamil") exit(0);
    if (age < 0) {
        name = "Kamil";
        age = 5;
    }
    if (name == "Peter") {
        cout << "You rat!" << endl;
        return 0;
    }
    if (age >= 100) {
        cout << "Goodbye Kamil!" << endl;
    }
    cout << " Hello " << name << " you are about " << age << endl;
    return 0;
}
```

(i) The user enters: Freddy 17

Hello Freddy you are about 17

(ii) The user enters: Peter 19

You rat!

(iii) The user enters: Kamil 19

(iv) The user enters: Andrew -20

Hello Kamil you are about 5

(v) The user enters: Carl 200

Goodbye Kamil!

Hello Carl you are about 200

Problem 44 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:

```
#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 45 Write a complete C++ program that asks a user to enter their day and month of birth. If the user's birthday is March 14th, the program wishes the user a Happy Birthday, otherwise it just says Hello. For example, the program could run as follows:

```
What is your day and month of birth: 14 March
Happy Birthday.
```

```
#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 46 Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print to the screen the message (the word Hello repeats 10 times):

Hello Hello Hello Hello Hello Hello Hello Hello Hello Hello

```
for (int c = 1; c <= 10; c++) cout << "Hello ";
```

(b) Read an integer from the user and print the integer without its last digit. (For example if the user enters 19683, the program would print 1968.)

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

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

```
cout << sqrt(19683);
```

(d) Ask the user enter a name. If the user says Freddy, force the user to keep entering a name until something else is received.

```
string name;  
cout << "Who are you: ";  
cin >> name;  
while (name == "Freddy") {  
    cout << "No! Who are you: ";  
    cin >> name;  
}
```

(e) Print a random number between 1000 and 9999 to the screen.

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

Problem 47 Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```
#include <iostream>  
using namespace std;  
  
int main(){  
    int n, m;  
    cout << "Please two integers: ";  
    cin >> m >> n;  
  
    if (n == 0 && m == 0) cout << n << endl;;  
    if (n == 0 || m == 0) exit(1);  
    if (n < 0 && m < 0) cout << " Negative" << endl;  
    else {  
        if (n < m) cout << n << endl;  
    }  
    if (m > 7) cout << " 7" << n << endl;  
    return 0;  
}
```

(i) The user enters: 0 0

0

(ii) The user enters: 0 10

(iii) The user enters: -10 -10

Negative

(iv) The user enters: 10 -10

-10
7-10

(v) The user enters: 10 10

710

Problem 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 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:

```
#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 49 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:

```
#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 50 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 $1 \leq f < x$ 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 51 Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```

#include <iostream>
using namespace std;

int main(){
    int n; string name;
    cout << "Please enter your name and an integer: ";
    cin >> name >> n;

    if (n == 0 && name == "Freddy") cout << name << endl;;
    if (n == 0 || name == "Freddy") exit(1);
    if (n < 0) cout << " Negative" << endl;
    else {
        cout << " name " << name << " name " << endl;
    }
    if (n > 7) cout << " 7 " << endl;
    return 0;
}

```

(i) The user enters: Freddy 0

Freddy

(ii) The user enters: Freddy 10

(iii) The user enters: Fred -10

Negative

(iv) The user enters: Fred 5

name Fred name

(v) The user enters: Fred 10

name Fred name

7

Problem 52 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

The program prints a table with 100 lines of output. On output line number x the program should list the numbers from x to x^2 together with their sum.

For example, the first 4 lines of output read as follows:

```
1 the sum is 1
2 3 4 the sum is 9
3 4 5 6 7 8 9 the sum is 42
4 5 6 7 8 9 10 11 12 13 14 15 16 the sum is 130
```

Answer:

```
#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 53 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:

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

int main () {
    int q, d, n, p;

    cout << "How many quarters do you have? ";
    cin >> q;

    cout << "How many dimes do you have? ";
    cin >> d;

    cout << "How many nickels do you have? ";
    cin >> n;

    cout << "How many pennies do you have? ";
    cin >> p;

    cout << "That makes "
        << ((q * 25) + (d * 10) + (n * 5) + p) << " in change.";
    cout << endl;
}
```

```
        return 0;
} //main
```

Problem 54 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 55 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 56 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 57 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 58 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 positive 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 59 Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

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

int main(){
    int n, m;
    cout << "Please enter two integers: ";
    cin >> n >> m;

    if (n > m) cout << n % m << endl;
    else {
        for (int r = 1; r < n; r++) {
            for (int c = 1; c < m - n - 1; c++) {
                cout << "*";
            }
            cout << endl;
            if (n == 10) exit(1);
        }
    }
    return 0;
}
```

(i) The user enters: 10 9

Answer:

1

(ii) The user enters: 3 7

Answer:

***+

***+

(iii) The user enters: 3 15

Answer:

*****+

*****+

(iv) The user enters: 10 15

Answer:

*****+

(v) The user enters: -1 5

Answer:

Problem 60 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer.
2. If the input is illegal, the program should terminate.
3. The program prints the digits of the number in reverse order (separated by spaces) and then gives their sum. For example, if the user enters 19683 the program should print the following output.

```
3 8 6 9 1 sum to 27
```

Answer:

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

int main() {
    int n;
    cout << "Enter a positive integer: ";
    cin >> n;
    if (n <= 0) exit(1);

    int digit, sum = 0;
    while (n > 0) {
        digit = n % 10;
        n = n / 10;
        sum += digit;
        cout << digit << " ";
    }
    cout << "sum to " << sum << endl;

    return 0;
}
```

Problem 61 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:

```
#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 62 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:

```
for (int i = 1; i <= 5; i++) cout << rand()%9 + 1 << endl;
```

- (b) Print (to the output screen) the square root of 19683:

Answer:

```
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:

```
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:

```
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:

```

string name;
cout << "What is your name: ";
cin >> name;
if (name == "Freddy") exit(1);

```

Problem 63 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 64 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer.
2. The program reads a value n entered by the user. If the value is not legal, the program terminates.
3. The program prints a table with n lines of output. On output line number x the program should list the numbers from 1 to x together with their sum.

For example, if the user enters 7 for n the program should print the following table.

```
1 the sum is 1
1 2 the sum is 3
1 2 3 the sum is 6
1 2 3 4 the sum is 10
1 2 3 4 5 the sum is 15
1 2 3 4 5 6 the sum is 21
1 2 3 4 5 6 7 the sum is 28
```

Answer:

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

int main() {
    int r, c, n;
    cout << "How many rows of output do you want: ";
    cin >> n;
    if (n <= 0) exit(1);

    for (r = 1; r <= n; r++) {
        int sum = 0;
        for (c = 1; c <= r; c++) {
            cout << c << " ";
            sum = sum + c;
        }
        cout << "the sum is " << sum << endl;
    }

    return 0;
}
```

Problem 65 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 66 Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```

#include <iostream>
using namespace std;

int print1(int x){
    cout << "Odd" << endl;
    return 1;
}

int print2(int x){
    cout << x*x << endl;
    return x;
}

int main(){
    int n;
    cout << "Please enter a positive integer: ";
    cin >> n;

    if(n <= 0){
        cout << "No good!" << endl; exit(1);
    }

    if (n < 10) {
        cout << n % 2 << endl; exit(0);
    }
    if (n > 11) cout << print1(n) << endl;
    if (n % 2 == 1) print2(n);
    else print1(n);
    return 0;
}

```

(i) The user enters: 0

No good!

(ii) The user enters: 9

1

(iii) The user enters: 10

Odd

(iv) The user enters: 11

121

(v) The user enters: 12

Odd

1

Odd

Problem 67 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 68 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an even positive integer.
 2. The program reads a value n entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of n has been entered.
 3. The program prints an $n \times n$ pattern of * symbols in the shape of a large letter *U*.
- For example, if the user enters 6 for n the program should print the following picture.

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

Answer:

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

int main() {
    int c, r, n;
    cout << "Enter a positive even integer: ";
    cin >> n;
    while ((n <= 0) || (n % 2 != 0)) {
        cout << "Illegal. Try again: ";
        cin >> n;
    }
    for (r = 1; r < n; r++) {
        cout << "*";
        for (c = 2; c < n; c++) cout << " ";
    }
}
```

```

        cout << "*" << endl;
    }
    for (c = 1; c <= n; c++) cout << "*";
    cout << endl;
    return 0;
}

```

Problem 69 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 70 Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```

#include <iostream>
using namespace std;

void print1(int x){
    cout << "Odd" << endl;
}

void print2(int x){
    cout << "Even" << endl;
}

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

    if(n == 0) cout << "Hello" << endl;
    if(n <= 10) cout << "Goodbye" << endl;
    if(n > 10 && n%2 == 1) print1(n);
    if(n > 10 && n%2 == 0) print2(n);
    if (n < 0) print2(n);
    return 0;
}

```

(i) The user enters: 12

Even

(ii) The user enters: 11

Odd

(iii) The user enters: 10

Goodbye

(iv) The user enters: 0

Hello

Goodbye

(v) The user enters: -1

Goodbye

Even

Problem 71 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 72 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:

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

int main() {
    int c, r, n;
    cout << "Enter a positive odd integer: ";
    cin >> n;
    while ((n <= 0) || (n % 2 == 0)) {
        cout << "Illegal. Try again: ";
        cin >> n;
    }
    for (c = 1; c <= n; c++) cout << "*";
    cout << endl;
    for (r = 2; r <= n; r++) {
        for (c = 1; c <= n / 2; c++) cout << " ";
        cout << "*" << endl;
    }
    return 0;
}
```

Problem 73 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:

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

int main() {
    double x;
    cout << "Enter a positive number: ";
```

```

    cin >> x;
    if (x <= 0) exit(0);
    cout << "The square root is: " << sqrt(x) << endl;
    return 0;
}

```

Problem 74 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 75 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 76 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an odd positive integer.
 2. The program reads a value *n* entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of *n* has been entered.
 3. The program prints an $n \times n$ pattern in the shape of a star. The pattern should appear as a large X printed from copies of the letter *X* that lies over a large + printed from copies of the character +.
- For example, if the user enters 7 for *n* the program should print the following picture.

```
X + X
 X + X
  X+X
+++X+++
   X+X
    X + X
     X + X
```

Answer:

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

int main() {
    int n;
    cout << "Enter an odd positive integer: ";
    cin >> n;
    while ((n <= 0) || (n % 2 == 0)) {
        cout << "Illegal. Try again: ";
        cin >> n;
    }

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

```

    for (int c = 1; c <= n; c++)
        if (c == r || ((c + r) == (n + 1))) cout << "X";
        else if ((c == (n + 1) / 2) || (r == (n + 1) / 2)) cout << "+";
        else cout << " ";
    cout << endl;
}
return 0;
}

```

Problem 77 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 78 Write a complete C++ program that does the following.

1. It asks the user to enter a positive integer x .
2. The program reads the number entered by the user. If x is not positive, the program should terminate.
3. The program prints x randomly generated dice rolls.

Here is an example of how the program should work:

```
Enter a positive number: 3
The dice rolled: 4 1 6
```

Answer:

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

```

#include <time.h>
using namespace std;

int main() {
    srand(time(0));
    int x;
    cout << "Enter a positive number:";
    cin >> x;
    if (x <= 0) exit(0);
    cout << "The dice rolled: ";
    for (int c = 1; c <= x; c++)
        cout << rand()%6 + 1 << " ";
    cout << endl;
    return 0;
}

```

Problem 79 The following C++ program applies 5 different functions. Supply title lines (prototypes) for the 5 functions. Do not supply any blocks of code for the functions.

```

int main() {
    int x, c, r;
    x = readData();
    for (c = 0; c < 5; c++) printValues(x, c);
    x = adjust(x + 2);
    r = max3(x, c, 10);
    return fun(x + c, r - c);
}

```

(a)

Answer:

```
int readData()
```

(b)

Answer:

```
void printValues(int a, int b)
```

(c)

Answer:

```
int adjust(int a)
```

(d)

Answer:

```
int max3(int a, int b, int c)
```

(e)

Answer:

```
int fun(int a, int b)
```

Problem 80 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.

- 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.
- 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:

```
#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 81 Write a complete C++ program that does the following.

- It asks the user to enter a positive even integer.
- The program reads the number entered by the user. If the value is illegal, the program should terminate.
- 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:

```
#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 82 Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print (to the output screen) the message:

Today is March 19, 2008.

Answer:

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

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

Answer:

```
int age;
cout << "How old are you? ";
cin >> age;
```

(iii) Print the average 2 variables x and y each of which has type int. (For example, if x is 0 and y is 3, the average is 1.5 and a decimal number must be printed.)

Answer:

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

(iv) Make the user repeatedly enter a value for an integer variable x until the value entered is larger than 10.

Answer:

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

Problem 83 Consider the following C++ program. Explain what output is produced in response to the given user inputs.

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

int fun1(int x) {
    int ans = x / 10;
    return ans;
}

void fun2(int x) {
    cout << x << "* ";
}

void fun3(int x) {
    cout << "fun3 ";
}

int main() {
    int x;
    cout << "Enter an integer: ";
    cin >> x;
    if (x < 10) {
        cout << "Too small!" << endl; exit(1);
    }
    if (x == 10) fun3(x);
    if (x >= 20) fun2(x);
    if (x <= 20) cout << fun1(x);
    cout << endl;
    return 0;
}
```

(i) The user enters: 5

Answer:

Too small!

(ii) The user enters: 15

Answer:

1

(iii) The user enters: 25

Answer:

25*

(iv) The user enters: 10

Answer:

fun3 1

(v) The user enters: 20

Answer:

20* 2

Problem 84

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:

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

int main() {
    int x;
    cout << "Enter a value greater than 1 for x: ";
    cin >> x;

    while (x <= 1) {
        cout << "Try again: ";
        cin >> x;
    }
}
```

```

    for (int r = x; r >= 1; r--) {
        for (int c = 1; c <= r; c++) cout << c;
        cout << endl;
    }
    return 0;
}

```

Problem 85 Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```

#include <iostream>
using namespace std;
int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit(1);
    }
    if (x <= 100) {
        cout << x;
    }
    else {
        cout << x/100 << x%10 << endl;
    }
    return 0;
}

```

(i) The user enters: -50

Answer: Illegal

(ii) The user enters: 0

Answer: Illegal

(iii) The user enters: 99

Answer: 99

(iv) The user enters: 456

Answer: 46

(v) The user enters: 4560

Answer: 450

Problem 86 Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print (to the output screen) the message:

Easy!

Answer:

```
cout << "Easy!" << endl;
```

(ii) Read and store a name entered by the user.

Answer:

```
string name;
cout << "Who are you:";
cin >> name;
```

(iii) Print the value of the larger of 2 variables x and y each of which has type double.

Answer:

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

(iv) Print the difference between 2 variables a and b each of which has type int. (The printed difference should not be negative. For example the difference between 4 and 7 is 3, so too is the difference between 7 and 4.)

Answer:

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

Problem 87 Write a complete C++ program that does the following.

1. It asks the user to enter a positive number.
2. The program reads the number entered by the user. If the value is not positive, the program should terminate.
3. The program calculates and prints the last digit of the entered number.

Here is an example of how the program should work:

```
Enter a positive number: 56
last digit is 6.
```

Answer:

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

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

    if (x <= 0) exit(1);

    cout << "last digit is " << x % 10 << endl;
    return 0;
}
```

Problem 88

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:

```

#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 89 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.

```

#include <iostream>;
#include <string>;
Using namespace std;
main() {
    cout << "Enter your name and the month, day, and year of your birth: "
    int name, month, day, year; cin >> name >> day >> month >> year;
    cout << "Hello name" << endl; if (month = 3 || day = 14) {
    cout << "Happy birthday" << endl;
    }
}

```

Answer:

```

#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 90

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 $x \times x \times x \times \dots \times x$, a product of x copies of the number x .)

Answer:

```
#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 91 Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;
int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit(1);
    }
    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 92 The following C++ program is supposed to ask a user to enter three different integers. It then prints the middle value of the three input numbers. The program has several errors. Rewrite the program to fix the errors and arrange the program so that it is easier for a human to read.

```

# <iostream>;
using namespace std;
int main
{
int x, y, z;
    cout << "Enter three different integers: " endl;
cin >> "x" >> "y" >> "z" endl;
    if ((x > y > z) && (z > y > x)); cout << y;
    if ((y > x > z) && (z > x > y)); cout << x;
    if ((z > y > x) && (x > y > z)); cout << y; return; };

```

Answer:

```

#include <iostream>
using namespace std;

int main() {
    int x, y, z;
    cout << "Enter three different integers: " << endl;
    cin >> x >> y >> z;
    if ( (x > y && y > z) || (z > y && y > x)) cout << y;
    if ( (y > z && z > x) || (x > z && z > y)) cout << z;
    if ( (z > x && x > y) || (y > x && x > z)) cout << x;
    cout << endl;
    return 0;
}

```

Problem 93 Write a complete C++ program that does the following.

1. It asks the user to enter a positive integer value, x .
2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the user type in another value until a positive value of x has been entered. (Note positive means greater than 0.)
3. The program prints out a triangle with x rows that points downwards. For example, if the user enters 3 for x the program should print:

```

***
**
*

```

Answer:

```

#include <iostream>
using namespace std;

int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;

    while (x <= 0) {
        cout << "Enter a positive integer:";
        cin >> x;
    }

    for (int row = x; row >= 1; row--) { // print row stars
        for (int star = 1; star <= row; star++)
            cout << "*";
    }
}

```

```

        cout << endl;
    }
    return 0;
}

```

Problem 94 Consider the following C++ program. Write the exact output that is produced in response to the given user inputs.

```

#include <iostream>
using namespace std;

int fun(int a) {
    int b; b = a / 10; return b;
}

int main() {
    int x, y;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl; exit(1);
    }
    y = fun(x);
    cout << x << y << endl;
    return 0;
}

```

- (i) The user enters: -50 **Answer:** Illegal
- (ii) The user enters: 7 **Answer:** 70
- (iii) The user enters: 467 **Answer:** 46746

Problem 95 Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

- (i) Print (to the output screen) the greeting:

Hello. This is an easy question.

Answer:

```
cout << " Hello. This is an easy question." << endl;
```

- (ii) Get the user to enter their first name, which is to be stored as the variable *name*.

Answer:

```
string name;
cout << " Enter your first name:";
cin >> name;
```

- (iii) Print the sum of the numbers from 1 to 1000 onto the screen. (The output should be the value of $1 + 2 + \dots + 999 + 1000$).

Answer:

```
int sum = 0;
for (int c = 1; c <= 1000; c++)
    sum = sum + c;
cout << sum << endl;
```

(iv) Get the user to enter an integer value. Print the message *POSITIVE* if it is greater than zero, or *NEGATIVE* if it is less than zero. Do not take any action if the user enters zero.

Answer:

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

Problem 96 Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;
void multiPrint(int y) {
    for (int i = 1; i <= y; i++)
        cout << y << "!";
    return;
}
int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit(1);
    }
    if (x > 2) multiPrint(x);
    cout << x << endl;
    return 0;
}
```

(i) The user enters: -50

Answer:

Illegal

(ii) The user enters: 1

Answer:

1

(iii) The user enters: 4

Answer:

4!4!4!4!4

Problem 97 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter their 4 digit id number.
2. The program reads the number entered by the user and stores it as the variable x . If the value of x is not in the range from 1000 to 9999, the program repeatedly makes the user type in another number until a proper id number has been entered.
3. The program calculates and prints out the last digit of the id number.

For example: A typical interaction with a user might be as follows. (The user responses are shown as bold.)

Enter your 4 digit id: **56789**

Illegal, try again: **25**

Illegal, try again: **9995**

The last digit of your id is 5.

Answer:

```
#include <iostream>
using namespace std;
int main() {
    int x;
    cout << "Enter your 4 digit id: ";
    cin >> x;
    while ( x < 1000 || x > 9999) {
        cout << "Illegal, try again: ";
        cin >> x;
    }
    cout << "The last digit of your id is " << x % 10 << endl;
    return 0;
}
```

Problem 98 Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print (to the output screen) the greeting:

Hello. Today is 10/25/2006.

Answer:

```
cout << "Hello. Today is 10/25/2006." << endl;
```

(ii) Get the user to enter their age, which is to be stored as the variable *age*.

Answer:

```
int age;
cout << "How old are you: ";
cin >> age;
```

(iii) Get the user to enter a positive integer value. Exit if the user enters a non-positive value, otherwise: Print the message *EVEN* if the value is even, or *ODD* if it is odd.

Answer:

```
int x;
cout << "Enter a positive value: ";
cin >> x;
if (x <= 0) exit(0);
if ((x % 2) == 0) cout << "EVEN" << endl;
else cout << "ODD" << endl;
```

(iv) Get the user to enter a name. If the user enters the name *Freddy*, tell the user to enter a different name and force the user to re-enter a name until it is different from *Freddy*.

Answer:

```
string name;
cout << "What is your name? ";
cin >> name;
while (name == "Freddy") {
    cout << "That name is illegal. Give another: ";
    cin >> name;
}
```

Problem 99 Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```
int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit(1);
    }
    if (x < 10) cout << x--;
    else {
        if ((x % 10) == 0) cout << x / 10;
        cout << x * 10;
    }
    cout << endl;
}
```

(i) The user enters: -50

Answer: Illegal

(ii) The user enters: 0

Answer: Illegal

(iii) The user enters: 9

Answer: 9

(iv) The user enters: 456

Answer: 4560

(v) The user enters: 4560

Answer: 45645600

Problem 100 Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer value, x .
2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the user type in another value until a positive value of x has been entered. (Note positive means greater than 0.)
3. The program prints a triangular pattern that is x rows high. The characters 0 and 1 are used to print the pattern. Odd numbered rows are printed using a 1 and even numbered rows are printed using a 0.

For example, if the user enters 4 for x the program should print the following pattern with 4 rows.

```
1
00
111
0000
```

Answer:

```
#include <iostream>
using namespace std;
int main() {
    int x;
    cout << "Give a positive integer value of x: ";
    cin >> x;

    while (x <= 0) {
```

```

        cout << "Give a POSITIVE value: ";
        cin >> x;
    }

    for (int r = 1; r <= x; r++) {
        for (int c = 1; c <= r; c++)
            cout << r % 2;
        cout << endl;
    }
}

```

Problem 101 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 102 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.

- The program reads the number entered by the user. If the value is not in the right range, the program should terminate.
- 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:

```
#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 103

Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

- It asks the user to enter a positive integer value, x .
- 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.)
- 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;
        }
    }
}
```