1. What is the output of this program?

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

int main()
{
    int a = 1, b = 2, c = 3, d = 4;
    cout << (a + b * c) << endl;       // (0)
    cout << (c / d) << endl;           // (1)
    cout << (a++) << endl;             // (2)
    cout << (! (c > d) && a > b) << endl; // (3)
    cout << (c == 4 ? b : c + 1) << endl; // (4)

    for ( int i = 100; i > 50; i -= 10 ) cout << i << "", ";
    cout << endl;                     // (5)

    char letter = 'a';
    do {
        cout << letter++ << "", ";
    } while ( letter < 'f' );
    cout << endl;                     // (6)

    int s = 3;
    switch (s)
    {
        case 1: cout << "Two";
        case 2: cout << "Four";
        case 3: cout << "Eight";
        case 4: cout << "Sixteen";
        default: cout << "Zero";
    }
    cout << endl;                     // (7)

    return 0;
}
```
2. The *Summer Olympic Games*, first held in 1896, is a major international multi-sport event held once every four years. The scheduled 1916 Summer Olympics were cancelled following the onset of World War I. Due to World War II, the Games of 1940 were cancelled. The Games of 1944 were due to be held in London but were also cancelled.

In this program, user is asked to enter a year and this program checks whether the year entered by user is Summer Olympic year or not.

```
Solution:

int main()
{
    int year;
    cout << "Please enter which year: ";
    cin >> year;

    if ( year == 1916 || year == 1940 || year == 1944 )
    {
        cout << "No" << endl;
        return 0;
    }

    for ( int i = 1896; i < 2020; i += 4 )
    {
        if ( year == i )
        {
            cout << "Yes" << endl;
            return 0;
        }
    }

    //if ( (year - 1896) % 4 == 0 ) cout << "Yes" << endl;
    //else cout << "No" << endl;

    return 0;
}
```
3. The following program asks the user to enter a number \( n \). It then prints a picture showing a figure that has \( 2n \) rows and columns. For example, if \( n = 3 \) the program would print:

*  
**  
***  
***  
**  
*  

Solution:

```cpp
int main()
{
    int n = 3;
    for ( int i = 1; i <= n; i++ )
    {
        for ( int j = 0; j < (n-i+1); j++ ) cout << " ";
        for ( int j = 0; j < i; j++ ) cout << "*";
        cout << endl;
    }
    for ( int i = 1; i <= n; i++ )
    {
        for ( int j = 0; j < (n+1); j++ ) cout << " ";
        for ( int j = 0; j < (n-i+1); j++ ) cout << "*";
        cout << endl;
    }
    return 0;
}
```
4. Write a program which lets users enter 3 numbers and prints the values from the lowest to the highest.

Solution:

```cpp
int main()
{
    int a = 2, b = 1, c = 3;

    //if ( a < b && b < c ) cout << a << " " << b << " " << c << endl;
    //if ( a < c && c < b ) cout << a << " " << c << " " << b << endl;
    //if ( b < a && a < c ) cout << b << " " << a << " " << c << endl;
    //if ( b < c && c < a ) cout << b << " " << c << " " << a << endl;
    //if ( c < a && a < b ) cout << c << " " << a << " " << b << endl;
    //if ( c < b && b < a ) cout << c << " " << b << " " << a << endl;

    if ( a < b )
    {
        if ( b < c ) cout << "abc" << endl;
        else if ( a < c ) cout << "acb" << endl;
        else cout << "cab" << endl;
    }
    else
    {
        if ( b < c )
        {
            if ( a < c ) cout << "bac" << endl;
            else cout << "bca" << endl;
        }
        else cout << "cba" << endl;
    }
}
```
5. Print a table of factorials of number $n$:

$1! = 1$
$2! = 1 \times 2$
$3! = 1 \times 2 \times 3$
$4! = 1 \times 2 \times 3 \times 4$

Solution:

```c++
int main()
{
    int n = 6;
    for ( int i = 1; i <= n; i++ )
    {
        cout << i << "! = ";
        for ( int j = 1; j <= i-1; j++ ) cout << j << " x ";
        cout << i;
        cout << endl;
    }
}
```
6. Write a program that lets the user play the game of “Heads or Tails” against the computer. The program should work as follows:

1. When it begins, a random head or tail is generated. (Don’t display the computer’s choice yet.)
2. The user enters his or her guessing at the keyboard.
3. The computer’s choice is displayed.
4. The computer displays whether the user’s guessing is correct or not.

**Solution:**

```cpp
int main()
{
    srand(time(0));

    int coin_computer = rand() % 2;
    int coin_user;
    cout << "Please enter your guessing (0) Tail (1) Head ? " ;
    cin >> coin_user;

    if ( coin_computer == 1 )
    {
        if ( coin_user == 1 ) cout << "Yes. It is head! You got it." << endl;
        else cout << "No. It is head! You lose it." << endl;
    }
    else
    {
        if ( coin_user == 0 ) cout << "Yes. It is tail! You got it." << endl;
        else cout << "No. It is tail! You lose it." << endl;
    }
    return 0;
}
```
7. Write a program which lets users enter 4 numbers and prints the the highest number.

Solution:

```c++
int main()
{
    int a = 2, b = 1, c = 5, d = 4;

    //if ( a >= b && a >= c && a >= d ) cout << a << endl;
    //if ( b >= a && b >= c && b >= d ) cout << b << endl;
    //if ( c >= a && c >= b && c >= d ) cout << c << endl;
    //if ( d >= a && d >= b && d >= c ) cout << d << endl;

    //int k = 0;
    //if ( a > k ) k = a;
    //if ( b > k ) k = b;
    //if ( c > k ) k = c;
    //if ( d > k ) k = d;

    //cout << k << endl;

    int e = a < b ? b : a;
    int f = c < d ? d : c;
    cout << ( e < f ? f : e ) << endl;
}
```

8. This program takes a positive integer from a user and displays all the factors of that number. For example, if the input number is 60, the program would print:

Enter a positive integer: 60
Factors of 60 are: 1 2 3 4 5 6 12 15 20 30 60

Solution:

```c++
int main()
{
    cout << "Please input a positive integer: ";
    int n;
    cin >> n;
    cout << "Factors of " << n << " are: ";

    for ( int i = 1; i <= n; i++ )
    {
        if ( n % i == 0 ) cout << i << " ";
    }

    return 0;
}
```
9. Write a full program that computes the final cost for a cell phone bill.

AT&T has two choices for unlimited plans: Unlimited Choice and Unlimited Plus. Both unlimited plans allow up to 10 lines. For two lines, the Unlimited Choice plan starts at $125 per month, and Unlimited Plus starts at $155. Each additional line beyond the first two is an extra $20 per month. Federal Universal Service Fund fees are 18.8% (of the total) additional charge.

Write code that prompts the user for the plan (choice or plus), and prompts the user for the number of lines. The code prints out the total amount due each month.

```
Solution:

int main()
{
    int choice = 0, nlines = 3;
    double total;
    cout << "...";
    cin >> choice;
    cin >> nlines;
    if (choice) total = (125 + 20 * (nlines - 2)) * 1.188;
    else total = (155 + 20 * (nlines - 2)) * 1.188;
    cout << total << endl;
    return 0;
}
```

10. Write a C++ program that asks the user to input the number of total hours it took for the computer to process the result of a complicated program. The program then prints the duration of the job in a nicer form; i.e. it prints out the number of total weeks, then (for the part left over) days and (for the part left) hours that the job took. For example, if the user types in 362 for the hours, the output will be: “2 weeks(s) and 1 day(s) and 2 hours(s)”.

Remember that there are 24 hours in a day and 7 days in a week. You may assume that there are no leap years.

```
Solution:

int main()
{
    int hours;
    cout << "Input hours: ";
    cin >> hours;
    int days = hours / 24;
    int rhours = hours % 24;
    int weeks = days / 7;
    int rdays = days % 7;
    cout << weeks << " week(s) ";
    if (rdays == 1) cout << rdays << " day ";
    else cout << rdays << " days ";
    cout << rhours << " hour(s)";
    return 0;
}
```