HOMEWORK 2

Q.1. How many bits are required for addressing a memory of size 16 Bytes?

Q.2. Consider the problem of computing fourth power of a number x (Refer slide no. 39-41 of chapter 2). Now you have to write a machine language program to compute x^{29} for a given x. But you are allowed to use only seven multiplication.
(you do not have to worry about data type of x and suppose x's address is 100 or you may take it according to your convenience).

Q.3 Convert the following numbers from decimal number system to binary number system (as it would be stored in the computer memory)
a. 3456
b. 24
c. 1890
d. -456

Q.4 Represent the following numbers in significand-exponent notation: in binary system (refer to slide 29 and 30 of chp.2)

a. 675
b. 2439

Q.5 What is the value of a floating point number, x, in decimal notation, if x = 1.1 x 2^{11} in binary notation?

(A) 1.1 X 10^8 (B) 1.2 X 10^1 (C) 8.8 X 10^0 (D) 1.5 X 10^{11}

Q.6 If each character takes 1 byte of storage space, how much storage space is required to store i) "the quick brown fox jumps over the lazy dog"
        ii)"The Quick Brown Fox Jumps Over The Lazy Dog"

Q.7. Identify error(s) in the following code
        const int i = 2;
        const int j = i+10;
        i++;

Q.8 Check the following code for errors.

```
#include <simplecpp>
main_program
{
      float base;
      int val;
      cout<<"Enter base: << endl;
      cin >>base;
      cout<<"Enter exponent: "<<endl;
      cin>> float exp;
      repeat(exp)
      {
            val=val x base;
      }
      cout<<"Value is: "<<val;
}
```

Q.9 Which is a valid variable name in C++?

(A) 1myString   (B) cout   (C) abc&d   (D) _onevar   (E) None of the above

Q.10 Identify the incorrect statements from the statements given below and correct them.

  a. int height, float weight ;   // variable definitions
  b. const int i=5;
       int j=10;
       i=i+j;
  c. int i = 'a';
  d. char c='97'
  e. float a,b;
       int c=a%b;

Q.11 Which of the following are not valid variable names and why?

    a. unsigned

    b. int_a

    c. _inta

    d. gov1nd

    e. 1govind

    f. govind1

    g. gov ind

    h. $govind

    i. govi-ind

Q.12 Identify whether the following identifier names are valid or invalid

      Name, int, no^3, name_1, _ADD, Identifier, add 1

Q.13 Predict the output of the following program.

```
#include<simplecpp>
main_program{
        char c1='A',c2=93;
        int i=10,j=2;
        c1+=j;
        c2-= i;
        cout<<c1<<c2<<i++<<--j;
}
```


Q.14

    You know that characters are stored in computer in the form of numbers(ASCII code). So, Given a small case alphabet in input. How will you convert it into uppercase? Write a program for it, which takes small case alphabet as input and prints its corresponding uppercase.

Q.15 The ASCII codes for the digits *0* through *9* are *48* through *57*. Suppose user provide two values for *p* and *q*(only from 0 to 9). Fill the blank such that *i* get the value of digit in *p*(not the ASCII value), same for *j* get from *q*. Finally the *n* should get the number in which *p* is in tenth place and *q* is in unit's place.(i.e if user inputs 2 and 3, then output should be like: 2, 3, 23)

```
#include<simplecpp>
main_program
{
        char p,q;
        int i,j,n;
        cout<<"enter the values of p and q"<<endl;
        cin>>p>>q;
        i= ...a.....;
        j=.......b.....;
        n=......c......;
        cout<<" "<<i<<", "<<j<<", "<<n<<endl;
}
```

Q.16 Consider the following program:-

```
#include <simplecpp>
main_program{
        float n = 0.1;
        cout << n - 0.1 << endl;
}
```

Now,
1. Predict the output of following program
2. Now run the above program on your computer and check the output. (Surprised?)
3. Why is the output in step 2 different from your prediction? What's the reason behind the anomaly? Think of a possible explanation.
   (Hint: Try to represent 0.1 in binary)

Q.17
Predict the output of following program

```cpp
#include <simplecpp>
main_program{
        int a = 100/6;
        int b = 100/6.0;
        float c = 100/6;
        float d = 100.0/6;
        cout << a <<endl;
        cout << b <<endl;
        cout << c <<endl;
        cout << d <<endl;
}
```

Q.18.

```cpp
#include<simplecpp>
main_program
{
        int a=020;
        float b=10.5;
        cout << a - b;
}
```

What will be the output of the program?

(A) 9.5   (B) 4.5   (C) 5.5   (D) 9   (E) None of these

Q.19 What is the output of following program:

```cpp
#include<simplecpp>
main_program
{
```

```
        int i=15;
        int c=0;
        repeat(10)
        {
                i=i+3;
                int i=0,j=2;
                c=c+i+j;
        }
        cout<<" "<<i<<", "<<c;
}
```

a. 18, 47
b. 18, 20
c. 45, 20
d. 15, 50

Q.20. Write a program which inputs the height of the user in cm and gives output in feet and inches.

Q.21 Write a program which takes two natural numbers(say, a & b) as input, and prints a^b.

Q.22 Complete the program to reverse a given integer (no. of digits in the integer are also given). Use variables defined in the program and arithmetic operations taught in the class

```
#include<simplecpp>
main_program
{
  int num,digits,reverse=0;
  cout<<"Enter the number";
  cin>>num;
  cout<<"Enter the number of digits";
  cin>>digits;
  repeat( A )
  {
        reverse = reverse * 10;
        reverse = reverse + B;
        num = C;
```

```
   }
}
```

Q.23 How to swap the values in two variables without using a third variable?

Q.24 What is the output of the following code?
```
int a, b=3;
a = b;
a+=2;
cout << a;
```

Q.25 If an integer is stored in a variable 'x', how do you find the units digit of the integer using modulus function?

Q.26.
```
#include <simplecpp>
main_program{
        int a, b;
        cin >> a >> b;
        __INSERT YOUR CODE HERE__
        cout << a << b;
}
```
Without using third variable, interchange the values of a and b.
So if the input is 10 20, the output should be 20 10. Remember you are not allowed to declare any new variable.

Q.27 Write a program to find the value of e^x using Taylor series expansion.
Take the value of x from the user and also the number of terms in the expansion, n.

$$f(x) = f(0) + f'(0) \, x + $$
$$\frac{f''(0)}{2} x^2 + \sum_{n=3}^{\infty} \frac{f^{(n)}(0)}{n!} \, x^n$$

Q.28 Write a program which prints outs the squares of numbers from 1 to 100.
    (Hint: using repeat wisely)
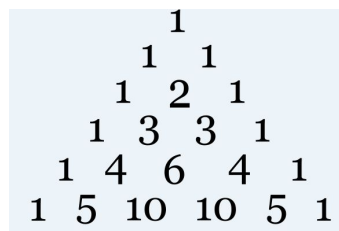
Q.29 Question For Thought

A terminating decimal number (a number which terminates at some point, like 0.2, 0.456 but not 0.333333.....) in binary can become repeating decimal like:-

$(0.2)_{10}$ = (0. 0011 0011 0011.... $)_2$

But can the opposite also happen? i.e. a number terminating in Base 2 (binary) be repeating in decimal (Base 10)? Why/Why not?

Hint:- For a number to be terminating in base N, it can be written in the form of:-
a/N^b for some natural numbers a and b

Q.30 Pascal's Triangle is a special triangle with applications in many areas of mathematics. It's basically a triangular array of binomial coefficients.

$$
\begin{array}{c}
1 \\
1 \quad 1 \\
1 \quad 2 \quad 1 \\
1 \quad 3 \quad 3 \quad 1 \\
1 \quad 4 \quad 6 \quad 4 \quad 1 \\
1 \quad 5 \quad 10 \quad 10 \quad 5 \quad 1
\end{array}
$$

Assuming that initially the   cursor is at the first row directly above the first "1" on the 6th row, can you come up with a way to complete the given code to generate the Pascal's triangle ?

Some facts to note about the Pascal's Triangle:-
 a. The rows of Pascal's triangle are conventionally enumerated starting with row n = 0 at the top (the 0th row).
 b. The entries in each row are numbered from the left beginning with k = 0.
 c. nCk appears in the nth row and kth column. nCk represents the number of ways of choosing k objects from n objects. (0C0=1)

```
#include <simplecpp>
main_program  {

        int rows;                  //stores the number of rows to be printed
        cin>>rows;    //inputs the number of rows to be printed
        repeat(A)      {
           int i=0;   //denoting "i"th row
           int val=1; //variable denoting the value to be printed
           repeat(B)  {
                 cout<<" ";
           }
           repeat(C)  {
                 int k=0;      //denoting kth entry in the ith row
                 cout<<val;
                 cout<<" ";
                 val = val * (D);
                 k=k+1;      //incrementing the value of k each time to move to the right
value to be printed in a row
           }
           cout<<"\n";
        }
}
```

Replace A, B, C, D with proper terms <u>consisting of variables already defined in the program</u> to print the given Pascal's Triangle with given input of rows.
   a. One important thing to notice is that the entries in the Pascal's Triangle can also
       be very easily obtained by another way.(Figure it out yourself) But to do that, we
       had to store all values of the previous row every-time to compute new values.
       This will also be achieved later in the course with structures called "arrays".