Programs

Prepare a C++ program to find the third side and the area of a triangle when two adjacent sides and included angle (in degrees) are given.

```
#include<iostream.h>

#include<math.h>

# define PI 3.14159

void main()

{

   double a, b, theta, area, side;

   cout <<"\n Enter the two adjacent sides of the triangle.\n";

   cin >>a >>b;

   cout <<"\n Enter the included angle in degrees.\n";

   cin >> theta;

   theta *= PI / 180;

   side  = sqrt (a * a + b * b – 2 * a * b * cos (theta) );

   area = 0.5 * a * b * sin (theta);

   cout <<"\n The third side of the triangle is = " <<side;

   cout <<"\n Area of the triangle is = " <<area;

}
```

//Prepare a C program to evaluate the equation y = x^n without using any library functions.

```
#include <iostream.h>
void main()
{
        float x, y = 1;
        int n, i = 1;
        cout <<"Enter the values of x & n. ";
        cin >>x >>n;
        while (i <= n)
        {          y *= x;   i++;     }
        cout <<"\n The value of the expression is " <<y;
}
```

Prepare a C program to find the sum of the digits and reverse any given number and print its output.

```
#include<iostream.h>
#include<math.h>
main()
{
        int num, digit;
        double rnum = 0, sum = 0;
        cout <<"\nEnter the number.\n";
        cin >>num;
```

```
while(num)
        {
                digit = num % 10;
                sum += digit;
                rnum = rnum * 10 + digit;
                num /= 10;
        }
        cout <<"\nThe reverse number is
" <<rnum;
        cout <<"\nThe sum of the digits
is " <<sum;
}
```

//Prepare a C program to find the number of terms in the divergent series 1 + 1/2 + 1/3 + ... when sum exceeds x.

```
#include<iostream.h>
void main()
{
        float sum = 1, x, i = 1;
        cout<< "\nEnter  value of x.\n";
        cin >>x;
        do
        {
                i++;
                sum += 1 / i;
        }while(sum <= x);
        cout <<"\nThe no. of terms in the divergent series when the sum exceeds "
<<x <<"  is  " <<i;
}
```

Program to Check whether a number is Prime or not

```
#include <iostream.h>
void main()
{
   int n, i, flag = 0;
   cout<<”Enter a positive integer: ");
   cin>>n;
   for(i = 2; i <= n/2; ++i)
   {
      // condition for nonprime number
      if(n%i == 0)
      {
         flag = 1;
         break;
      }
   }
```

```
 if (n == 1)
   {
     printf("1 is neither a prime nor a
composite number.");
   }
   else
   {
      if (flag == 0)
        printf("%d is a prime number.", n);
      else
        printf("%d is not a prime number.", n);
   }

}
```

Prepare a C program to sum up to the first N terms of the series
$1 + (1 + r^2) + (1 + r^3)^2 + (1 + r^4)^3 + \ldots\ldots\ldots\ldots$

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

main()
{
        float r, sum = 1, term;
        int n, t ;

        cout <<"\n Enter the value for r and N \n";
        cin >>r >>n;

        for (t = 2; t <= n; t ++)
        {
                term =  1 + pow(r, t);
                sum += pow (term, (t - 1)) ;
        }
        cout <<"Sum = " <<sum;
}
```

Prepare a C program to print the number series triangle - Lloyd's triangle

```
                                                                /*      1
                                                                        2       2
#include <iostream.h>                                                   3       3       3
void main()                                                             4       4       4       4       */
{
        int i, k, n;
        cout <<"\nEnter the number of lines required in the triangle \n";
        cin >>n;
        for(i = 1; i <= n; i++)
        {
                for(k = 1; k <= i; k++)
                        cout <<i <<"\t";
                cout <<"\n";
        }
}
```

Prepare a C program to print the number series triangle.

```
/*      1
        2       3
        4       5       6
        7       8       9       10      */
```

```
#include <iostream.h>
void main()
{
        int i, j = 0, k, n;
        cout <<"\nEnter the number of lines required in the triangle \n";
        cin >>n;
        for(i = 1; i <= n; i++)
        {
                for(k = 1; k <= i; k++)
                {
                        j++;
                        cout <<j <<"\t";
                }
                cout <<"\n";
        }
}
```

Prepare a C program to print the number series triangle.

```
/*                  1
              2     2     2
        3     3     3     3     3
  4     4     4     4     4     4     4 */
```

```
#include <iostream.h>
void main()
{
        int i, j, k, l = 1, n;
        cout <<"\nEnter the number of lines required in the triangle \n";
        cin >>n;
        for(i = 1, j = n-i; i <= n; i++, j--)
        {
                for(k = 1; k <= j; k++)
                        cout <<"\t";
                for(k = 1; k <= l; k++)
                        cout <<i <<"\t";
                cout <<"\n";
                l += 2;
        }
}
```

Computational Techniques

- Roots of Transcendental equations
  - Regula - Falsi, Newton Raphson Methods
- Lagrange interpolation method
- Fitting straight line & parabola
- Numerical Integration
  - Trapezoidal, Simpson’s rule & Gauss quadrature Method
- Gauss elimination method
- Partial differential Equation - Finite Difference Method

```
#include <stdio.h>

void main()
{
   int year;

   cout<<"Enter a year: ";
   cin>>year;

   if(year%4 == 0)
   {
      if( year%100 == 0)
      {
         if ( year%400 == 0)
            cout<<year<<“ is a leap year.";
         else
            cout<<year<<“ is NOT a leap year.";
      }
      else
         cout<<year<<“ is a leap year.";
   }
   else
      cout<<year<<“ is NOT a leap year.";

   }
```

Program to find if a given Year is a Leap Year

```
void main()
{
int year;
cout<<"Enter a year \n";
cin>>year;
if ((year % 400) == 0)
      cout<<year<<”is a leap year \n";
else if ((year % 100) == 0)
         cout<<year<<”is NOT a leap year \n";
       else if ((year % 4) == 0)
              cout<<year<<”is a leap year \n";
            else
                cout<<year<<”is NOT a leap year \n";
}
```

1. Take a year as input.
2. Check whether a given year is divisible by 400.
3. Check whether a given year is divisible by 100.
4. Check whether a given year is divisible by 4.
5. If the condition at step 2 and 4 becomes true, then the year is a leap year.
6. If the condition at step 3 becomes true, then the year is not a leap year.

If a year is evenly divisible by 4, but it is not evenly divisible 100, then it is a leap year. If a year is divisible by both 4 and 100, then it might not be a leap year, and you will have to perform 1 more calculation to check.

If a year is divisible by 100, but not 400, then it is **not** a leap year. If a year is divisible by both 100 and 400, then it is a leap year.

//Prepare a C++ program to input an array and print it in the ascending order - SELECTION SORTING METHOD.

```
#include<iostream.h>


void main()
{
        int i, j, a[10], big, m;


        cout <<"\nEnter the length of the array. \n";
        cin >>m;


        cout <<"\n Enter the elements of the  array. \n";
        for(i = 0; i < m; i++)
                cin >>a[i];
for(i = 0; i < m - 1; i++)
        for(j = i + 1; j < m; j++)
        {
                if (a[i] > a[j])
                {
                        big=a[i];
                        a[i]=a[j];
                        a[j]=big;
                }
        }

        cout <<"\n The resulting array  in ascending order is: \n";
        for(i = 0; i < m; i++)
                cout <<a[i] <<"\n";
}
```

Prepare a C++ program to print the transpose of a given matrix.

```
#include<iostream.h>
 void main()
{
      int i, j, ra, ca;
      float a[10][10], trana[10][10];

      cout <<"\nEnter the size of the
matrix.\n";
      cin >>ra >>ca;

      cout <<"\nEnter the elements of the
matrix.\n";
      for(i = 0; i < ra; i++)
            for(j = 0; j < ca; j++)
                  cin >>a[i][j];
```

```
for(i = 0; i < ra; i++)
            for(j = 0; j < ca; j++)
            trana[j][i] = a[i][j];

      cout <<"\n The transpose of the
matrix is:\n";
      for(i = 0; i < ca; i++)
      {
      for(j = 0; j < ra; j++)
            cout <<"\t" <trana[i][j];
      cout <<"\n";
      }
}
```

Prepare a C++ program to check whether the given square matrix of order m is an identity matrix.

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

void main()
{
        int i,j,ra,ca;
        float a[10][10];

        cout <<"\nEnter the order of the
square matrix.\n";
        cin >>ra >>ca;

        cout <<"\nEnter the elements of the
matrix.\n";
        for(i = 0; i < ra; i++)
                for(j = 0; j < ca; j++)
                        cin >>a[i][j];
```

CONTD….

Prepare a C++ program to check whether the given square matrix of order m is an identity matrix.

CONTD….

```
   for(i = 0; i < ra; i++)
   for(j = 0; j < ca; j++)
   if(i == j)
   {    if(a[i][j] != 1)
           {
           cout <<"\n The given matrix is not an identity matrix.\n";
           exit(0);
           }
   }
   else
   {       if(a[i][j] != 0)
           {
           cout <<"\n The given matrix is not an identity matrix.\n";
           exit(0);
           }
   }
   cout <<"\n The given matrix is an identity matrix.\n";
}
```

Prepare a C++ program that reads in a line of text and prints it in the forward and reverse order.

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

void main()
{
        char line[80];

        cout  <<"\nEnter  any  line.  Press 'Return'at the end. \n\n";
        cin.get(line,80);

        cout <<"\nThe input line is: ";
        cout <<line <<"\n";

        cout <<"\nThe line in reverse order is: \n";
        strrev(line);
        cout <<line <<"\n";
}
```

Prepare a C++ program to count the number of characters, words and sentences in a text.

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

void main()
{
        char line[100];
        int j, lines = 0, word = 0, letter = 0, end = 0;

        cout <<"\nEnter the text.  Give one space after each word.
When completed, press 'RETURN'. \n";
        cin.get(line,100);
// Counting the letters in a text.
        letter = strlen(line);
```

CONTD….

Prepare a C++ program to count the number of characters, words and sentences in a text.

CONTD….

```
//Counting words & sentences in  text
        if(line[0] == '\0') goto label;
        else
        {
        word++;
        for(j=0; line[j] != '\0'; j++)
                {
                if(line[j] == ' ' || line[j] == '\t') word++;
                if(line[j] == '.' || line[j] == '\n' || line[j] == '?' ||
line[j] == '!') lines++;
                }
        }

        label:cout <<"\n";
                cout <<"Number of lines = " <<lines <<".\n";
                cout <<"Number of words = " <<word <<".\n";
                cout <<"Number of characters = " <<letter <<".\n";
}
```

Prepare a C++ program to input an array of strings and print it in the alphabetic order.

```
#include<iostream.h>

#include<string.h>

 void main()

{

      int i = 0,j = 0, m;

      char word[10][30], dummy[30];

      cout <<"\nEnter the length of the array.\n";

      cin >>m;

      cout <<"\nEnter the elements of the  array.\n";

      for(i = 0; i < m; i++)

            cin >>word[i];
```

CONTD….

Prepare a C++ program to input an array of strings and print it in the alphabetic order.

CONTD….

```
        for(i = 0; i < m - 1; i++)
                for(j = i + 1; j < m; j++)
                        if(strcmp(word[i], word[j]) > 0)
                        {
                                strcpy(dummy, word[i]);
                                strcpy(word[i], word[j]);
                                strcpy(word[j], dummy);
                        }
            cout <<"\n Sorted list: \n";
            for(i = 0; i < m; i++)
                    cout <<word[i] <<"\n";
        }
```