Lab 7

Write a program using while loop to print 1 to 10

```
#include <stdio.h>
void main()
{
    int i = 1;
    printf("\n");
    while (i <= 10)
    {
        printf("%d\n", i);
        i++;
    }
}
```

Write a program using while loop to print 1 to n

```
#include <stdio.h>
void main()
{
    int i = 1, n;
    printf("Enter n value: ");
    scanf("%d", &n);

    while (i <= n)
    {
        printf("%d\n", i);
        i++;
    }
}
```

Write a program using while loop to print odd numbers between 1 to n

```
#include <stdio.h>
void main()
```

```
{
    int i = 1, n;
    printf("Enter n value: ");
    scanf("%d", &n);

    while (i <= n)
    {
        if (i % 2 != 0)
            printf("%d\n", i);
        i++;
    }
}
```

Write a program using while loop to print numbers between two given numbers which is divisible by 2 but not divisible by 3

```
#include <stdio.h>
void main()
{
    int a, b;
    printf("Enter a, and b value: ");
    scanf("%d%d", &a, &b);

    while (a <= b)
    {
        if (a % 2 == 0 && a % 3 != 0)
            printf("%d\n", a);
        a++;
    }
}
```

Lab 8

Write a program to print sum of 1 to n numbers

```
#include <stdio.h>
void main()
{
    int i = 1, n;
    int sum = 0;

    printf("Enter n value: ");
    scanf("%d", &n);

    while (i <= n)
    {
        sum += i;
        i++;
    }
    printf("\nSum = %d\n", sum);
}
```

Write a program to print sum of series 1 + 4 + 9 + 16 + 25 + ... + n

```
#include <stdio.h>
void main()
{
    int i = 1, n;
    int sum = 0;

    printf("Enter n value: ");
    scanf("%d", &n);

    while (i <= n)
    {
        sum += i * i;
        i++;
    }
```

```
    printf("\nSum = %d\n", sum);
}
```

Write a program to print sum of series 1 - 2 + 3 - 4 + 5 - ... + n

```
#include <stdio.h>
void main()
{
    int i = 1, n;
    int sum = 0;

    printf("Enter n value: ");
    scanf("%d", &n);

    while (i <= n)
    {
        if (i % 2 == 0)
            sum -= i;
        else
            sum += i;
        i++;
    }
    printf("\nSum = %d\n", sum);
}
```

Write a program to print sum of series 1 + 1/2 + 1/3 + 1/4 + 1/5 + ... + 1/n

```
#include <stdio.h>
void main()
{
    int i = 1, n;
    float sum = 0;

    printf("Enter n value: ");
    scanf("%d", &n);
```

```
    while (i <= n)
    {
        sum += (float)1 / i;
        i++;
    }
    printf("\nSum = %.2f\n", sum);
}
```

Lab 9

Write a program calculate x^y without using power function

```
#include <stdio.h>
void main()
{
    int x, y;
    int i = 1, result = 1;
    printf("Enter value of x and y: ");
    scanf("%d%d", &x, &y);
    while (i <= y)
    {
        result *= x;
        i++;
    }
    printf("\n%d^%d = %d\n", x, y, result);
}
```

Write a program to find the factorial of the given number. e.g. 5! = 120

```
#include <stdio.h>
void main()
{
    int n, i = 1;
    double result = 1;
    printf("Enter value of n: ");
    scanf("%d", &n);
    while (i <= n)
    {
        result *= i;
        i++;
    }
    printf("\n%d! = %.0f\n", n, result);
}
```

Write a program to find factors of the given number

```
#include <stdio.h>
void main()
{
    int n, i = 1;
    printf("Enter value of n: ");
    scanf("%d", &n);
    printf("Factors of %d are: ", n);
    while (i <= n)
    {
        if (n % i == 0)
            printf("%d ", i);
        i++;
    }
    printf("\n");
}
```

Write a program to find out sum of first and last digit of a given number

```
#include <stdio.h>
void main()
{
    int n;
    int first, last, sum = 0;
    printf("Enter value of n: ");
    scanf("%d", &n);
    last = n % 10;
    while (n >= 10)
    {
        n /= 10;
    }
    first = n;
    sum = first + last;
    printf("Sum = %d\n", sum);
}
```

Write a program to find the sum and average of different numbers which are accepted by user as many as user wants

```
#include <stdio.h>
void main()
{
    int n, i = 0;
    int sum = 0;
    float average = 0;
    while (n != -1)
    {
        printf("Enter value of n: ");
        scanf("%d", &n);
        if (n == -1)
            break;
        sum += n;
        i++;
    }
    average = (float)sum / i;
    printf("\nSum = %d\n", sum);
    printf("\nAverage = %.2f\n", average);
}
```

Write a program to check whether the given number is perfect or not. [Sum of factors including 1 excluding number itself - 6, 28, 496, 8128]

```
#include <stdio.h>
void main()
{
    int n, i = 1;
    int sum = 0;

    printf("Enter value of n: ");
    scanf("%d", &n);
    while (i < n)
```

```
    {
        if (n % i == 0)
        {
            sum += i;
            printf("i = %d\n", i);
        }
        i++;
    }
    if (sum == n)
        printf("%d is a perfect number\n", n);
    else
        printf("%d is not perfect number\n", n);
}
```

Write a program to find whether the given number is prime or not using break

```
#include <stdio.h>
void main()
{
    int n, i = 2, flag = 0;

    printf("Enter value of n: ");
    scanf("%d", &n);
    if (n == 1)
        exit(0);
    while (i < n)
    {
        if (n % i == 0)
        {
            flag = 1;
        }
        i++;
    }
    if (flag == 0)
        printf("%d is a prime number\n", n);
    else
        printf("%d is not a prime number\n", n);
}
```

Write a program to find whether the given number is prime or not, using flag

```
#include <stdio.h>
void main()
{
    int n, i = 2, flag = 0;
    printf("Enter value of n: ");
    scanf("%d", &n);
    if (n == 1)
        exit(0);
    while (i < n)
    {
        if (n % i == 0)
        {
            flag++;
            break;
        }
        i++;
    }
    if (flag == 0)
        printf("%d is a prime number\n", n);
    else
        printf("%d is not a prime number\n", n);
}
```

Lab 10

Write a program to print digits of given number

```
#include <stdio.h>
void main()
{
    int n, i;

    printf("Enter a number: ");
    scanf("%d", &n);

    while (n != 0)
    {
        i = n % 10;
        printf("%d", i);
        n /= 10;

        if (n == 0)
            break;
        else
            printf(", ");
    }
    printf("\n");
}
```

Write a program to print sum of digits of given number

```
#include <stdio.h>
void main()
{
    int n, i;
    int sum = 0;

    printf("Enter a number: ");
    scanf("%d", &n);

    while (n != 0)
    {
```

```
        i = n % 10;
        sum += i;
        n /= 10;
    }
    printf("\nSum = %d\n", sum);
}
```

Write a program to print given number in reverse order

```
#include <stdio.h>
void main()
{
    int n, i;
    int r, rev = 0;

    printf("Enter a number: ");
    scanf("%d", &n);

    while (n != 0)
    {
        r = n % 10;
        rev = rev * 10 + r;
        n /= 10;
    }
    printf("\nReverse = %d\n", rev);
}
```

Write a program to check whether the given number is palindrome or not

```
#include <stdio.h>
void main()
{
    int n, i, t;
    int r, rev = 0;

    printf("Enter a number: ");
    scanf("%d", &n);
```

```
    t = n;

    while (n != 0)
    {
        r = n % 10;
        rev = rev * 10 + r;
        n /= 10;
    }

    if (rev == t)
        printf("\n%d is a palindrome.\n", rev);
    else
        printf("\n%d is not a palindrome.\n", rev);
}
```

Write a program to check whether the given number is Armstrong or not [153, 370, 371, 407]

```
#include <stdio.h>
void main()
{
    int n, i, t;
    int r, sum = 0;

    printf("Enter a number: ");
    scanf("%d", &n);
    t = n;

    while (n != 0)
    {
        r = n % 10;
        sum += r * r * r;
        n /= 10;
    }
    if (sum == t)
        printf("\n%d is an armstrong.\n", t);
    else
        printf("\n%d is not an armstrong.\n", t);
}
```

Lab 11

Write a program using for loop to print 1 to 10

```
#include <stdio.h>
void main()
{
    int i;

    printf("\n");
    for (i = 1; i <= 10; i++)
    {
        printf("%d\n", i);
    }
}
```

Write a program using for loop to print 1 to n

```
#include <stdio.h>
void main()
{
    int i, n;

    printf("Enter n value: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        printf("%d\n", i);
    }
}
```

Write a program using for loop to print odd numbers between 1 to n

```
#include <stdio.h>
void main()
```

```
{
    int i, n;

    printf("Enter n value: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        if (i % 2 != 0)
            printf("%d\n", i);
    }
}
```

Write a program using for loop to print numbers between two given numbers which is divisible by 2 but not divisible by 3

```
#include <stdio.h>
void main()
{
    int a, b;

    printf("Enter a, and b value: ");
    scanf("%d%d", &a, &b);

    for (; a <= b; a++)
    {
        if (a % 2 == 0 && a % 3 != 0)
            printf("%d\n", a);
    }
}
```

Write a program to print sum of 1 to n numbers using for loop

```
#include <stdio.h>
void main()
{
```

```
    int i, n;
    int sum = 0;

    printf("Enter n value: ");
    scanf("%d", &n);
    for (i = 1; i <= n; i++)
    {
        sum += i;
    }
    printf("\nSum = %d\n", sum);
}
```

Write a program to print sum of series 1 + 4 + 9 + 16 + 25 + ... + n using for loop

```
#include <stdio.h>
void main()
{
    int i, n;
    int sum = 0;

    printf("Enter n value: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        sum += i * i;
    }
    printf("\nSum = %d\n", sum);
}
```

Write a program to print sum of series 1 - 2 + 3 - 4 + 5 - ... + n using for loop

```
#include <stdio.h>
void main()
{
    int i, n;
```

```
    int sum = 0;

    printf("Enter n value: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        if (i % 2 == 0)
            sum -= i;
        else
            sum += i;
    }
    printf("\nSum = %d\n", sum);
}
```

Write a program to print sum of series 1 + 1/2 + 1/3 + 1/4 + 1/5 + ... + 1/n using for loop

```
#include <stdio.h>
void main()
{
    int i, n;
    float sum = 0;

    printf("Enter n value: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        sum += (float)1 / i;
    }
    printf("\nSum = %.2f\n", sum);
}
```

Write a program calculate x^y without using power function using for loop

```
#include <stdio.h>
```

```
void main()
{
    int x, y;
    int i, result = 1;

    printf("Enter value of x and y: ");
    scanf("%d%d", &x, &y);
    for (i = 1; i <= y; i++)
    {
        result *= x;
    }
    printf("\n%d^%d = %d\n", x, y, result);
}
```

Write a program to find the factorial of the given number. e.g. 5! = 120 using for loop

```
#include <stdio.h>
void main()
{
    int n, i;
    double result = 1;

    printf("Enter value of n: ");
    scanf("%d", &n);
    for (i = 1; i <= n; i++)
    {
        result *= i;
    }
    printf("\n%d! = %.0f\n", n, result);
}
```

Write a program to find factors of the given number using for loop

```
#include <stdio.h>
void main()
{
```

```
    int n, i;

    printf("Enter value of n: ");
    scanf("%d", &n);
    printf("Factors of %d are: ", n);
    for (i = 1; i <= n; i++)
    {
        if (n % i == 0)
            printf("%d ", i);
    }
    printf("\n");
}
```

Write a program to find out sum of first and last digit of a given number using for loop

```
#include <stdio.h>
void main()
{
    int n;
    int first, last, sum = 0;

    printf("Enter value of n: ");
    scanf("%d", &n);
    last = n % 10;
    for (; n >= 10;)
    {
        n /= 10;
    }
    first = n;
    sum = first + last;
    printf("Sum = %d\n", sum);
}
```

Write a program to find the sum and average of different numbers which are accepted by user as many as user wants using for loop

```
#include <stdio.h>
void main()
{
    int n, i;
    int sum = 0;
    float average = 0;

    for (i = 1; n != -1; i++)
    {
        printf("Enter value of n: ");
        scanf("%d", &n);
        if (n == -1)
            break;
        sum += n;
        i++;
    }
    average = (float)sum / i;
    printf("\nSum = %d\n", sum);
    printf("\nAverage = %.2f\n", average);
}
```

Write a program to check whether the given number is perfect or not. [Sum of factors including 1 excluding number itself :: 6, 28, 496, 8128] using for loop

```
#include <stdio.h>
void main()
{
    int n, i;
    int sum = 0;

    printf("Enter value of n: ");
    scanf("%d", &n);
```

```
    for (i = 1; i < n; i++)
    {
        if (n % i == 0)
        {
            sum += i;
        }
    }
    if (sum == n)
        printf("%d is a perfect number\n", n);
    else
        printf("%d is not perfect number\n", n);
}
```

Write a program to find whether the given number is prime or not using break using for loop

```
#include <stdio.h>
void main()
{
    int n, i, flag = 0;

    printf("Enter value of n: ");
    scanf("%d", &n);
    if (n == 1)
        exit(0);
    for (i = 2; i < n; i++)
    {
        if (n % i == 0)
        {
            flag = 1;
        }
    }
    if (flag == 0)
        printf("%d is a prime number\n", n);
    else
        printf("%d is not a prime number\n", n);
}
```

Write a program to find whether the given number is prime or not, using flag using for loop

```
#include <stdio.h>
void main()
{
    int n, i, flag = 0;

    printf("Enter value of n: ");
    scanf("%d", &n);
    if (n == 1)
        exit(0);
    for (i = 2; i < n; i++)
    {
        if (n % i == 0)
        {
            flag++;
            break;
        }
    }
    if (flag == 0)
        printf("%d is a prime number\n", n);
    else
        printf("%d is not a prime number\n", n);
}
```

Write a program to print digits of given number using for loop

```
#include <stdio.h>
void main()
{
    int n, i;

    printf("Enter a number: ");
    scanf("%d", &n);
    for (; n != 0;)
    {
        i = n % 10;
```

```
        printf("%d", i);
        n /= 10;
        if (n == 0)
            break;
        else
            printf(", ");
    }
    printf("\n");
}
```

Write a program to print sum of digits of given number using for loop

```
#include <stdio.h>
void main()
{
    int n, i;
    int sum = 0;

    printf("Enter a number: ");
    scanf("%d", &n);

    for (; n != 0;)
    {
        i = n % 10;
        sum += i;
        n /= 10;
    }
    printf("\nSum = %d\n", sum);
}
```

Write a program to print given number in reverse order using for loop

```
#include <stdio.h>
void main()
{
    int n;
```

```
    int r, rev = 0;

    printf("Enter a number: ");
    scanf("%d", &n);

    for (; n != 0;)
    {
        r = n % 10;
        rev = rev * 10 + r;
        n /= 10;
    }
    printf("\nReverse = %d\n", rev);
}
```

Write a program to check whether the given number is palindrome or not using for loop

```
#include <stdio.h>
void main()
{
    int n, i, t;
    int r, rev = 0;

    printf("Enter a number: ");
    scanf("%d", &n);
    t = n;
    for (; n != 0;)
    {
        r = n % 10;
        rev = rev * 10 + r;
        n /= 10;
    }
    if (rev == t)
        printf("\n%d is a palindrome.\n", t);
    else
        printf("\n%d is not a palindrome.\n", t);
}
```

Write a program to check whether the given number is Armstrong or not using for loop [153, 370, 371, 407]

```
#include <stdio.h>
void main()
{
    int n, i, t;
    int r, sum = 0;
    printf("Enter a number: ");
    scanf("%d", &n);
    t = n;
    for (; n != 0;)
    {
        r = n % 10;
        sum += r * r * r;
        n /= 10;
    }
    if (sum == t)
        printf("\n%d is an armstrong.\n", t);
    else
        printf("\n%d is not an armstrong.\n", t);
}
```

Lab 12

Write a program to find the sum of 1 + (1 + 2) + (1 + 2 + 3) + ... + (1 + 2 + ... + n)

```
#include <stdio.h>
void main()
{
    int n, i, j;
    int sum = 0;

    printf("Enter n: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        for (j = 1; j <= i; j++)
        {
            sum += j;
        }
    }
    printf("\nSum = %d\n", sum);
}
```

Write a program to estimate the value of the mathematical constant e by using the formula e = 1 + 1/1! + 1/2! + 1/3! + ... + 1/n!

```
#include <stdio.h>
void main()
{
    int n, i, j;
    float m = 1;
    float e = 1;

    printf("Enter n: ");
```

```
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        m = 1;
        for (j = 1; j <= i; j++)
        {
            m *= j;
        }
        m = 1 / m;
        e += m;
    }
    printf("\ne = %.2f\n", e);
}
```

Write a program to compute the value of e^x by using the formula: e^x = 1 + x / 1! + x^2 / 2! + ...

```
#include <stdio.h>
#include <math.h>
void main()
{
    int n, i, j, x;
    float m = 1;
    float e = 1;

    printf("Enter n: ");
    scanf("%d", &n);
    printf("Enter x: ");
    scanf("%d", &x);

    for (i = 1; i <= n; i++)
    {
        m = 1;
        for (j = 1; j <= i; j++)
        {
            m *= j;
        }
        m = pow(x, i) / m;
        e += m;
```

```
    }
    printf("\ne^%d = %.2f\n", x, e);
}
```

Write a program to evaluate the series by using the formula sum = 1 - x + x^2/2! - x^3/3! + x^4/4! + ... - x^9/9!

```
#include <stdio.h>
#include <math.h>
void main()
{
    int x, i, j;
    float m = 1;
    float sum = 0;

    printf("Enter x: ");
    scanf("%d", &x);

    for (i = 1; i <= 9; i++)
    {
        m = 1;
        for (j = 1; j <= i; j++)
        {
            m *= j;
        }
        if (i % 2 == 0)
            sum += pow(x, i) / m;
        else
            sum -= pow(x, i) / m;
    }

    printf("\nsum = %.2f\n", 1 - sum);
}
```

Write a program to find out prime numbers between given two numbers

```
#include <stdio.h>
#include <stdlib.h>
void main()
{
    int a, b, n, i, j, flag = 0;

    printf("Enter value of a and b (a > b): ");
    scanf("%d%d", &a, &b);

    if (b < a || b < 2)
    {
           printf("\nSorry, there are no primes for the given
range.\n");
        exit(0);
    }

    for (i = a; i <= b; i++)
    {
        flag = 0;
        for (j = 2; j < i; j++)
        {
            if (i % j == 0)
            {
                flag++;
                break;
            }
        }
        if (flag == 0)
            printf("%d ", i);
    }
    printf("\n");
}
```

Write a program to print multiplication table up to n

```
#include <stdio.h>
void main()
{
    int n;
    int i, j, m = 1;

    printf("Enter n: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        for (j = 1; j <= n; j++)
        {
            m = i * j;
            printf("%5d", m);
        }
        printf("\n");
        if (i == 1)

     printf("-------------------------------------------------
     --\n");
    }
}
```

Lab 13

//Write a program to display following patterns

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

```
#include <stdio.h>
void main()
{
    int i, j, n;

    printf("Enter n: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        for (j = 1; j <= i; j++)
        {
            printf("* ");
        }
        printf("\n");
    }
}
```

Write a program to display following patterns

```
1
1 2
1 2 3
1 2 3 4
```

```
#include <stdio.h>
void main()
{
    int i, j, n;
```

```
    printf("Enter n: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        for (j = 1; j <= i; j++)
        {
            printf("%d ", j);
        }
        printf("\n");
    }
}
```

Write a program to display following patterns

1
2 3
4 5 6
7 8 9 10

```
#include <stdio.h>
void main()
{
    int i, j, k = 1, n;

    printf("Enter n: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        for (j = 1; j <= i; j++, k++)
        {
            printf("%d ", k);
        }
        printf("\n");
    }
}
```

Write a program to display following patterns

```
1
2 3
3 4 5
4 5 6 7
```

```
#include <stdio.h>
void main()
{
    int i, j, k, n;

    printf("Enter n: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        k = i;
        for (j = 1; j <= i; j++)
        {
            printf("%d ", k++);
        }
        printf("\n");
    }
}
```

Write a program to display following patterns - Floyd's Triangle

```
1
0 1
1 0 1
0 1 0 1
```

```
#include <stdio.h>
void main()
{
    int i, j, n, p, q;
```

```
    printf("Enter n: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        if (i % 2 == 0)
        {
            p = 1;
            q = 0;
        }
        else
        {
            p = 0;
            q = 1;
        }
        for (j = 1; j <= i; j++)
        {
            if (j % 2 == 0)
                printf("%d ", p);
            else
                printf("%d ", q);
        }
        printf("\n");
    }
}
```

Write a program to display following patterns

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

```
#include <stdio.h>
void main()
{
    int i, j, sp, n;

    printf("Enter n: ");
    scanf("%d", &n);
```

```
    for (i = 1; i <= n; i++)
    {
        for (sp = 1; sp <= n - i; sp++)
        {
            printf(" ");
        }
        for (j = 1; j <= i; j++)
        {
            printf("* ");
        }
        printf("\n");
    }
}
```

Write a program to display following patterns

```
   1
  2 2
 3 3 3
4 4 4 4
```

```
#include <stdio.h>
void main()
{
    int i, j, sp, n;

    printf("Enter n: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        for (sp = 1; sp <= n - i; sp++)
        {
            printf(" ");
        }
        for (j = 1; j <= i; j++)
        {
            printf("%d ", i);
        }
```

```
        printf("\n");
    }
}
```

Write a program to display following patterns

```
  1
 A B
 2 3 4
C D E F
```

```
#include <stdio.h>
void main()
{
    int i, j, k = 1, sp, n;
    char ch = 'A';

    printf("Enter n: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++)
    {
        for (sp = 1; sp <= n - i; sp++)
        {
            printf(" ");
        }
        for (j = 1; j <= i; j++)
        {
            if (i % 2 != 0)
                printf("%3d", k++);
            else
                printf("%3c", ch++);
        }
        printf("\n");
    }
}
```

Write a program to display following patterns

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

```
#include <stdio.h>
void main()
{
    int i, j, n, k;

    printf("Enter n: ");
    scanf("%d", &n);

    k = n;
    for (i = 1; i <= n; i++)
    {
        for (j = 1; j <= k; j++)
        {
            printf("* ");
        }
        k--;
        printf("\n");
    }
}
```

Write a program to display following patterns

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

```
#include <stdio.h>
void main()
{
    int i, j, n, k;
```

```
    printf("Enter n: ");
    scanf("%d", &n);

    k = n;
    for (i = 1; i <= n; i++)
    {
        for (j = 1; j <= k; j++)
        {
            printf("%d ", j);
        }
        k--;
        printf("\n");
    }
}
```

Write a program to display following patterns

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

```
#include <stdio.h>
void main()
{
    int i, j, n, k;

    printf("Enter n: ");
    scanf("%d", &n);

    k = n;
    for (i = 1; i <= n; i++)
    {
        for (j = 1; j <= k; j++)
        {
            printf("%d ", k);
        }
        k--;
        printf("\n");
```

```
    }
}
```

Write a program to display following patterns

```
A A A A A
B B B B
C C C
D D
E
```

```
#include <stdio.h>
void main()
{
    int i, j, n, k;
    char ch = 'A';

    printf("Enter n: ");
    scanf("%d", &n);

    k = n;
    for (i = 1; i <= n; i++, k--, ch++)
    {
        for (j = 1; j <= k; j++)
        {
            printf("%c ", ch);
        }

        printf("\n");
    }
}
```

Write a program to display following patterns

```
/*
A B C D E
A B C D
A B C
A B
A
```

```
#include <stdio.h>
void main()
{
    int i, j, n, k;
    char ch = 'A';

    printf("Enter n: ");
    scanf("%d", &n);

    k = n;
    for (i = 1; i <= n; i++, k--)
    {
        ch = 'A';
        for (j = 1; j <= k; j++)
        {
            printf("%c ", ch++);
        }

        printf("\n");
    }
}
```

Write a program to display following patterns - hollow square

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

```
#include <stdio.h>
void main()
{
    int i, j, n;

    printf("Enter n: ");
    scanf("%d", &n);
```

```
    for (i = 1; i <= n; i++)
    {
        for (j = 1; j <= n; j++)
        {
            if (i == 1 || i == n || j == 1 || j == n)
            {
                printf("* ");
            }
            else
                printf("  ");
        }
        printf("\n");
    }
}
```

Write a program to print pascal triangle

```
#include <stdio.h>
void main()
{
    int n, k = 1, sp, i, j;

    printf("Enter the number of rows: ");
    scanf("%d", &n);

    for (i = 0; i < n; i++)
    {
        for (sp = 1; sp <= n - i; sp++)
            printf("  ");
        for (j = 0; j <= i; j++)
        {
            if (j == 0 || i == 0)
                k = 1;
            else
                k = k * (i - j + 1) / j;
            printf("%4d", k);
        }
        printf("\n");
    }
}
```

Write a program to display following patterns

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

```
#include <stdio.h>
void main()
{
    int n, i, j, sp;

    printf("Enter n: ");
    scanf("%d", &n);

    for (i = n; i >= 1; --i)
    {
        for (sp = 0; sp < n - i; ++sp)
            printf("  ");
        for (j = i; j <= 2 * i - 1; ++j)
            printf("* ");
        for (j = 0; j < i - 1; ++j)
            printf("* ");
        printf("\n");
    }
}
```

Write a program to display following patterns - mirrored triangle

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

```
#include <stdio.h>
void main()
{
```

```
    int n, i, j, sp, k = 1;

    printf("Enter n: ");
    scanf("%d", &n);

    for (i = n; i >= 1; i--)
    {
        for (sp = 1; sp <= i - 1; sp++)
        {
            printf(" ");
        }
        for (j = 1; j <= k; j++)
        {
            printf("*");
        }
        printf("\n");
        k++;
    }
}
```

Lab 14

Write a program to count number of positive or negative number from an array of n numbers

```
#include <stdio.h>
#define N 100
void main()
{
    int n, i;
    int p = 0, ne = 0;
    int a[N];

    printf("Enter the size of an array: ");
    scanf("%d", &n);
    printf("\nEnter elements of an array:\n");
    for (i = 0; i < n; i++)
    {
        printf("a[%d]: ", i);
        scanf("%d", &a[i]);
        if (a[i] > 0)
            p++;
        else
            ne++;
    }
    printf("\nPositive Numbers = %d", p);
    printf("\nNegative Numbers = %d\n\n", ne);
}
```

Write a program to count number of even or odd number from an array of n numbers

```
#include <stdio.h>
#define N 100
void main()
{
    int n, i;
```

```
    int e = 0, o = 0;
    int a[N];

    printf("Enter the size of an array: ");
    scanf("%d", &n);
    printf("\nEnter elements of an array:\n");
    for (i = 0; i < n; i++)
    {
        printf("a[%d]: ", i);
        scanf("%d", &a[i]);
        if (a[i] % 2 == 0)
            e++;
        else
            o++;
    }
    printf("\nOdd Numbers = %d", o);
    printf("\nEven Numbers = %d\n\n", e);
}
```

Write a program to read n numbers in an array and print them in reverse order

```
#include <stdio.h>
#define N 100
void main()
{
    int n, i, j, temp;
    int a[N];

    printf("Enter the size of an array: ");
    scanf("%d", &n);
    printf("\nEnter elements of an array:\n");
    for (i = 0; i < n; i++)
    {
        printf("a[%d]: ", i);
        scanf("%d", &a[i]);
    }
    for (i = n - 1; i >= 0; i--)
    {
        printf("%d, ", a[i]);
```

```
    }
    printf("\n");
}
```

Write a program to find Max, Min, Sum, Average of given numbers from an array

```
#include <stdio.h>
#define N 100
void main()
{
    int n, i;
    int max, min, sum = 0;
    int a[N];
    float avg = 0;

    printf("Enter the size of an array: ");
    scanf("%d", &n);
    printf("\nEnter elements of an array:\n");

    for (i = 0; i < n; i++)
    {
        printf("a[%d]: ", i);
        scanf("%d", &a[i]);
        min = a[0];
        max = a[0];

        sum += a[i];
        if (a[i] > max)
            max = a[i];
        if (a[i] < min)
            min = a[i];
    }
    printf("\nMinimum Numbers = %d", min);
    printf("\nMaximum Numbers = %d", max);
    printf("\nSum of Numbers = %d", sum);
    printf("\nAverage of Numbers = %.2f\n\n", (float)sum / n);
}
```

Write a program to calculate average and total of 5 students for 3 subjects

```
#include <stdio.h>
#define N 100
void main()
{
    int n, i, j;
    int sum = 0;
    int a[N], total[3];
    float average[3];

    for (i = 1; i <= 3; i++)
    {
        printf("Enter marks for %d student:\n", i);
        sum = 0;
        for (j = 0; j < 5; j++)
        {
            printf("a[%d]: ", i);
            scanf("%d", &a[i]);
            sum += a[i];
        }
        total[i] = sum;
        average[i] = (float)(sum / 5);
    }
    for (i = 1; i <= 3; i++)
    {
           printf("\nStudent::%d --> Total = %d\t|\tAverage =
%.2f\n", i, total[i], average[i]);
    }
    printf("\n");
}
```

Write a program to read five person height and weight and count the number of person having height greater than 170 and weight less than 50

```
#include <stdio.h>
```

```
#define N 100
void main()
{
    int i, c = 0;
    int a[N];
    float h[5], w[5];

    printf("Enter height and weight of 5 persons:\n");

    for (i = 1; i <= 5; i++)
    {
        printf("h[%d]: ", i);
        scanf("%f", &h[i]);
        printf("w[%d]: ", i);
        scanf("%f", &w[i]);
        if (h[i] > 170 && w[i] < 50)
            c++;
    }
     printf("\nPerson with height > 170 and weight < 50 are:
%d\n\n", c);
}
```

Write a program to count numbers higher than the average of an array

```
#include <stdio.h>
#define N 100
void main()
{
    int n, i, j;
    int sum = 0, count = 0;
    float average;
    int a[N];

    printf("Enter the size of an array: ");
    scanf("%d", &n);
    printf("\nEnter elements of an array:\n");
    for (i = 0; i < n; i++)
    {
        printf("a[%d]: ", i);
```

```
        scanf("%d", &a[i]);
        sum += a[i];
    }
    average = (float)sum / n;
    printf("\nAverage = %f", average);
    for (i = 0; i < n; i++)
    {
        if (a[i] > average)
            count++;
    }
    printf("\nCount: %d\n", count);
}
```

Write a program to calculate the average, geometric and harmonic mean of n elements in an array

```
#include <stdio.h>
#include <math.h>
int main()
{
    int i, op, n;
    float sum = 0, am, hm, gm, arr[100];

    printf("\nHow array size: ");
    scanf(" %d", &n);

    for (i = 0; i < n; i++)
    {
        printf("\nEnter %d th number: ", i);
        scanf(" %f", &arr[i]);
    }
    do
    {
        printf("\n1. Arihmetic Mean");
        printf("\n2. Harmonic Mean");
        printf("\n3. Geometric Mean\n");

        printf("\nWhich operation do you want to perform? ");
        scanf(" %d", &op);
```

```
        switch (op)
        {
        case 1:
            for (i = 0; i < n; i++)
            {
                sum += arr[i];
            }
            am = sum / n;
            printf("\nArithmetic Mean: %f\n", am);
            break;

        case 2:
            for (i = 0; i < n; i++)
            {
                sum += (1 / arr[i]);
            }
            hm = n / sum;
            printf("\nHarmonic Mean: %f\n", hm);
            break;

        case 3:
            sum = 1;
            for (i = 0; i < n; i++)
            {
                sum *= arr[i];
            }
            gm = pow(sum, (float)1 / n);

            printf("\nGeometric Mean: %f\n", gm);
            break;
        }
    } while (op != 4);
}
```

Write a program to sort elements of an array in an ascending order (*Use Bubble Sort*)

```
#include <stdio.h>
#define N 100
void main()
```

```
{
    int n, i, j, temp;
    int a[N];

    printf("Enter array size: ");
    scanf("%d", &n);
    printf("\nEnter elements of an array:\n");
    for (i = 0; i < n; i++)
    {
        printf("a[%d]: ", i);
        scanf("%d", &a[i]);
    }
    for (i = 0; i < n; i++)
    {
        for (j = 0; j < n; j++)
        {
            if (a[i] < a[j])
            {
                temp = a[i];
                a[i] = a[j];
                a[j] = temp;
            }
        }
    }
    printf("\nAfter Bubble Sort\n");
    for (i = 0; i < n; i++)
    {
        printf("%d\n", a[i]);
    }
    printf("\n");
}
```

Write a program to sort elements of an array in an ascending order (*Use Insertion Sort*)

```
#include <stdio.h>
#define N 1000
void main()
{
    int n, arr[N], i, j, t, flag = 0;
```

```
    printf("Enter array size: ");
    scanf("%d", &n);

    for (i = 0; i < n; i++)
    {
        printf("Enter arr[%d]: ", i);
        scanf("%d", &arr[i]);
    }
    for (i = 1; i <= n - 1; i++)
    {
        t = arr[i];

        for (j = i - 1; j >= 0; j--)
        {
            if (arr[j] > t)
            {
                arr[j + 1] = arr[j];
                flag = 1;
            }
            else
                break;
        }
        if (flag)
            arr[j + 1] = t;
    }

    printf("\nAfter Insertion Sort\n");
    for (i = 0; i <= n - 1; i++)
    {
        printf("%d\n", arr[i]);
    }
}
```

Write a program to sort elements of an array in an ascending order (*Use Selection Sort*)

```
#include <stdio.h>
void main()
{
```

```
    int arr[100], n, i, j, p, t;

    printf("Enter array size: \n");
    scanf("%d", &n);

    for (i = 0; i < n; i++)
    {
        printf("Enter arr[%d]: ", i);
        scanf("%d", &arr[i]);
    }
    for (i = 0; i < (n - 1); i++)
    {
        p = i;
        for (j = i + 1; j < n; j++)
        {
            if (arr[p] > arr[j])
                p = j;
        }
        if (p != i)
        {
            t = arr[i];
            arr[i] = arr[p];
            arr[p] = t;
        }
    }

    printf("\nAfter Selection Sort\n");
    for (i = 0; i < n; i++)
        printf("%d\n", arr[i]);
}
```

Write a program to sort elements of an array in an ascending order (*Use Merge Sort*)

```
#include <stdio.h>

#define max 10

void merging(int, int, int);
void sort(int, int);
```

```
int a[11] = {10, 14, 19, 26, 27, 31, 33, 35, 42, 44, 0};
int b[10];

void main()
{
    int i;

    printf("List before sorting\n");
    for (i = 0; i <= max; i++)
        printf("%d ", a[i]);

    sort(0, max);

    printf("\n\nAfter Merge Sort\n");
    for (i = 0; i <= max; i++)
        printf("%d ", a[i]);

    printf("\n");
}

void merging(int low, int mid, int high)
{
    int l1, l2, i;
     for (l1 = low, l2 = mid + 1, i = low; l1 <= mid && l2 <=
high; i++)
    {
        if (a[l1] <= a[l2])
            b[i] = a[l1++];
        else
            b[i] = a[l2++];
    }

    while (l1 <= mid)
        b[i++] = a[l1++];

    while (l2 <= high)
        b[i++] = a[l2++];

    for (i = low; i <= high; i++)
        a[i] = b[i];
```

```
}

void sort(int low, int high)
{
    int mid;
    if (low < high)
    {
        mid = (low + high) / 2;
        sort(low, mid);
        sort(mid + 1, high);
        merging(low, mid, high);
    }
    else
    {
        return;
    }
}
```

Write a program to sort elements of an array in an ascending order (*Use Quick Sort*)

```
#include <stdio.h>

void quicksort(int[], int, int);
void main()
{
    int arr[50];
    int n, i;

    printf("Enter array size: ");
    scanf("%d", &n);
    for (i = 0; i < n; i++)
    {
        printf("Enter arr[%d]: ", i);
        scanf("%d", &arr[i]);
    }
    quicksort(arr, 0, n - 1);
    printf("\n\nAfter Quick Sort\n");
    for (i = 0; i < n; i++)
    {
```

```
        printf("%d ", arr[i]);
    }
    printf("\n");
}
void quicksort(int arr[], int low, int high)
{
    int pivot, i, j, temp;
    if (low < high)
    {
        pivot = low;
        i = low;
        j = high;
        while (i < j)
        {
            while (arr[i] <= arr[pivot] && i <= high)
            {
                i++;
            }
            while (arr[j] > arr[pivot] && j >= low)
            {
                j--;
            }
            if (i < j)
            {
                temp = arr[i];
                arr[i] = arr[j];
                arr[j] = temp;
            }
        }
        temp = arr[j];
        arr[j] = arr[pivot];
        arr[pivot] = temp;
        quicksort(arr, low, j - 1);
        quicksort(arr, j + 1, high);
    }
}
```

Write a program to sort elements of an array in an ascending order (*Use Heap Sort*)

```
#include <stdio.h>

void main()
{
    int arr[10], n, i, j, c, root, temp;

    printf("Enter array size: ");
    scanf("%d", &n);
    printf("\nEnter arr[%d]: ", i);
    for (i = 0; i < n; i++)
        scanf("%d", &arr[i]);
    for (i = 1; i < n; i++)
    {
        c = i;
        do
        {
            root = (c - 1) / 2;
            if (arr[root] < arr[c])
            {
                temp = arr[root];
                arr[root] = arr[c];
                arr[c] = temp;
            }
            c = root;
        } while (c != 0);
    }

    printf("\nUnsorted Array\n");
    for (i = 0; i < n; i++)
        printf("%d\t ", arr[i]);
    for (j = n - 1; j >= 0; j--)
    {
        temp = arr[0];
        arr[0] = arr[j];
        arr[j] = temp;
        root = 0;
        do
```

```
        {
            c = 2 * root + 1;
            if ((arr[c] < arr[c + 1]) && c < j - 1)
                c++;
            if (arr[root] < arr[c] && c < j)
            {
                temp = arr[root];
                arr[root] = arr[c];
                arr[c] = temp;
            }
            root = c;
        } while (c < j);
    }
    printf("\nAfter Heap Sort\n");
    for (i = 0; i < n; i++)
        printf("\n%d", arr[i]);
    printf("\n");
}
```

Lab 15

Write a program to read values in a two-dimensional array and print them in matrix form.

```
#include <stdio.h>
#define N 10
#define M 10
void main()
{
    int a[N][M];
    int i, j, n, m;

    printf("Enter row size of the matrix (max 10): ");
    scanf("%d", &n);
    printf("Enter column size of the matrix (max 10): ");
    scanf("%d", &m);

    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            printf("Enter a[%d][%d]: ", i, j);
            scanf("%d", &a[i][j]);
        }
    }
    printf("\nMatrix of size %d x %d\n\n", n, m);
    for (i = 0; i < n; i++)
    {
        printf("|");
        for (j = 0; j < m; j++)
        {
            printf("%3d", a[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
}
```

Write a program to count the number of positive, negative and zero elements from a 3 X 3 matrix.

```
#include <stdio.h>
void main()
{
    int a[3][3];
    int i, j, po = 0, ne = 0, ze = 0;

    for (i = 0; i < 3; i++)
    {
        for (j = 0; j < 3; j++)
        {
            printf("Enter a[%d][%d]: ", i, j);
            scanf("%d", &a[i][j]);
            if (a[i][j] > 0)
                po++;
            else if (a[i][j] < 0)
                ne++;
            else
                ze++;
        }
    }
    printf("\n\nMatrix of size 3 x 3\n\n");
    for (i = 0; i < 3; i++)
    {
        printf("|");
        for (j = 0; j < 3; j++)
        {
            printf("%3d", a[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
       printf("\nNumber of positive numbers = %d\nNumber of
negative numbers = %d\nNumber of zeroes = %d\n", po, ne, ze);
}
```

Write a program to read and store the roll no and marks of 20 students using an array.

```
#include <stdio.h>
void main()
{
    int rno[20], marks[20];
    int i, j;

    for (i = 0; i < 20; i++)
    {
        printf("Enter roll of student[%d]: ", i + 1);
        scanf("%d", &rno[i]);
        printf("Enter marks of student[%d]: ", i + 1);
        scanf("%d", &marks[i]);
    }

    printf("\n\nDetails of students is as follows\n");
    printf("RNo\tMarks\n");
    for (i = 0; i < 20; i++)
    {
        printf("%3d\t%3d", rno[i], marks[i]);
        printf("\n");
    }
    printf("\n\n");
}
```

Write a program to print Transpose of a matrix.

```
#include <stdio.h>
#define N 10
#define M 10
void main()
{
    int a[N][M], t[M][N];
    int i, j, n, m;

    printf("Enter row size of the matrix (max 10): ");
    scanf("%d", &n);
    printf("Enter column size of the matrix (max 10): ");
```

```
    scanf("%d", &m);

    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            printf("Enter a[%d][%d]: ", i, j);
            scanf("%d", &a[i][j]);
            t[j][i] = a[i][j];
        }
    }
    printf("\nMatrix of size %d x %d\n\n", n, m);
    for (i = 0; i < n; i++)
    {
        printf("|");
        for (j = 0; j < m; j++)
        {
            printf("%3d", a[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
     printf("\nTranspose of a Matrix of size %d x %d\n\n", m,
n);
    for (i = 0; i < m; i++)
    {
        printf("|");
        for (j = 0; j < n; j++)
        {
            printf("%3d", t[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
}
```

Write a program to perform Addition of two matrices.

```
#include <stdio.h>
#define N 10
#define M 10
```

```
void main()
{
    int a[N][M], b[N][M], c[N][M];
    int i, j, k, n, m, sum = 0;

    printf("Enter row and column size of the matrix: ");
    scanf("%d%d", &n, &m);

    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            printf("Enter a[%d][%d]: ", i, j);
            scanf("%d", &a[i][j]);
        }
    }
    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            printf("Enter b[%d][%d]: ", i, j);
            scanf("%d", &b[i][j]);
        }
    }

    printf("\nA - Matrix of size %d x %d\n\n", n, m);
    for (i = 0; i < n; i++)
    {
        printf("|");
        for (j = 0; j < m; j++)
        {
            printf("%3d", a[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
    printf("\nB - Matrix of size %d x %d\n\n", n, m);
    for (i = 0; i < n; i++)
    {
        printf("|");
        for (j = 0; j < m; j++)
```

```
        {
            printf("%3d", a[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
    printf("\nC - Matrix | After Multiplication (A X B)\n");
    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            c[i][j] = a[i][j] + b[i][j];
        }
    }
    for (i = 0; i < n; i++)
    {
        printf("|");
        for (j = 0; j < m; j++)
        {
            printf("%3d", c[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
}
```

Write a program to perform Multiplication of two matrices.

```
#include <stdio.h>
#define N 10
#define M 10
void main()
{
    int a[N][M], b[N][M], c[N][M];
    int i, j, k, n, m, p, q, sum = 0;

    printf("Enter row and column size of the first matrix: ");
    scanf("%d%d", &n, &m);
   printf("Enter row and column size of the second matrix: ");
```

```
    scanf("%d%d", &p, &q);

    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            printf("Enter a[%d][%d]: ", i, j);
            scanf("%d", &a[i][j]);
        }
    }
    if (m != p)
    {
         printf("\nMultiplication not possible for given matrix
sizes.\n");
    }
    else
    {
        for (i = 0; i < p; i++)
        {
            for (j = 0; j < q; j++)
            {
                printf("Enter b[%d][%d]: ", i, j);
                scanf("%d", &b[i][j]);
            }
        }
        printf("\nMultiplication of a Matrix");
        for (i = 0; i < n; i++)
        {
            for (j = 0; j < q; j++)
            {
                for (k = 0; k < p; k++)
                {
                    sum += a[i][k] + b[k][j];
                }
                c[i][j] = sum;
                sum = 0;
            }
        }
        printf("\nA - Matrix of size %d x %d\n\n", n, m);
        for (i = 0; i < n; i++)
        {
```

```
            printf("|");
            for (j = 0; j < m; j++)
            {
                printf("%3d", a[i][j]);
            }
            printf("|");
            printf("\n\n");
        }
        printf("\nB - Matrix of size %d x %d\n\n", n, m);
        for (i = 0; i < n; i++)
        {
            printf("|");
            for (j = 0; j < m; j++)
            {
                printf("%3d", a[i][j]);
            }
            printf("|");
            printf("\n\n");
        }
            printf("\nC - Matrix | After Multiplication (A X
B)\n");
        for (i = 0; i < n; i++)
        {
            printf("|");
            for (j = 0; j < m; j++)
            {
                printf("%3d", c[i][j]);
            }
            printf("|");
            printf("\n\n");
        }
    }
}
```

Lab 15

Write a program to read values in a two-dimensional array and print them in matrix form.

```
#include <stdio.h>
#define N 10
#define M 10
void main()
{
    int a[N][M];
    int i, j, n, m;

    printf("Enter row size of the matrix (max 10): ");
    scanf("%d", &n);
    printf("Enter column size of the matrix (max 10): ");
    scanf("%d", &m);

    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            printf("Enter a[%d][%d]: ", i, j);
            scanf("%d", &a[i][j]);
        }
    }
    printf("\nMatrix of size %d x %d\n\n", n, m);
    for (i = 0; i < n; i++)
    {
        printf("|");
        for (j = 0; j < m; j++)
        {
            printf("%3d", a[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
}
```

Write a program to count the number of positive, negative and zero elements from a 3 X 3 matrix.

```
#include <stdio.h>
void main()
{
    int a[3][3];
    int i, j, po = 0, ne = 0, ze = 0;

    for (i = 0; i < 3; i++)
    {
        for (j = 0; j < 3; j++)
        {
            printf("Enter a[%d][%d]: ", i, j);
            scanf("%d", &a[i][j]);
            if (a[i][j] > 0)
                po++;
            else if (a[i][j] < 0)
                ne++;
            else
                ze++;
        }
    }
    printf("\n\nMatrix of size 3 x 3\n\n");
    for (i = 0; i < 3; i++)
    {
        printf("|");
        for (j = 0; j < 3; j++)
        {
            printf("%3d", a[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
       printf("\nNumber of positive numbers = %d\nNumber of
negative numbers = %d\nNumber of zeroes = %d\n", po, ne, ze);
}
```

Write a program to read and store the roll no and marks of 20 students using an array.

```
#include <stdio.h>
void main()
{
    int rno[20], marks[20];
    int i, j;

    for (i = 0; i < 20; i++)
    {
        printf("Enter roll of student[%d]: ", i + 1);
        scanf("%d", &rno[i]);
        printf("Enter marks of student[%d]: ", i + 1);
        scanf("%d", &marks[i]);
    }

    printf("\n\nDetails of students is as follows\n");
    printf("RNo\tMarks\n");
    for (i = 0; i < 20; i++)
    {
        printf("%3d\t%3d", rno[i], marks[i]);
        printf("\n");
    }
    printf("\n\n");
}
```

Write a program to print Transpose of a matrix.

```
#include <stdio.h>
#define N 10
#define M 10
void main()
{
    int a[N][M], t[M][N];
    int i, j, n, m;

    printf("Enter row size of the matrix (max 10): ");
    scanf("%d", &n);
    printf("Enter column size of the matrix (max 10): ");
```

```
    scanf("%d", &m);

    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            printf("Enter a[%d][%d]: ", i, j);
            scanf("%d", &a[i][j]);
            t[j][i] = a[i][j];
        }
    }
    printf("\nMatrix of size %d x %d\n\n", n, m);
    for (i = 0; i < n; i++)
    {
        printf("|");
        for (j = 0; j < m; j++)
        {
            printf("%3d", a[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
     printf("\nTranspose of a Matrix of size %d x %d\n\n", m,
n);
    for (i = 0; i < m; i++)
    {
        printf("|");
        for (j = 0; j < n; j++)
        {
            printf("%3d", t[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
}
```

Write a program to perform Addition of two matrices.

```
#include <stdio.h>
#define N 10
#define M 10
```

```
void main()
{
    int a[N][M], b[N][M], c[N][M];
    int i, j, k, n, m, sum = 0;

    printf("Enter row and column size of the matrix: ");
    scanf("%d%d", &n, &m);

    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            printf("Enter a[%d][%d]: ", i, j);
            scanf("%d", &a[i][j]);
        }
    }
    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            printf("Enter b[%d][%d]: ", i, j);
            scanf("%d", &b[i][j]);
        }
    }

    printf("\nA - Matrix of size %d x %d\n\n", n, m);
    for (i = 0; i < n; i++)
    {
        printf("|");
        for (j = 0; j < m; j++)
        {
            printf("%3d", a[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
    printf("\nB - Matrix of size %d x %d\n\n", n, m);
    for (i = 0; i < n; i++)
    {
        printf("|");
        for (j = 0; j < m; j++)
```

```
        {
            printf("%3d", a[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
    printf("\nC - Matrix | After Multiplication (A X B)\n");
    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            c[i][j] = a[i][j] + b[i][j];
        }
    }
    for (i = 0; i < n; i++)
    {
        printf("|");
        for (j = 0; j < m; j++)
        {
            printf("%3d", c[i][j]);
        }
        printf("|");
        printf("\n\n");
    }
}
```

Write a program to perform Multiplication of two matrices.

```
#include <stdio.h>
#define N 10
#define M 10
void main()
{
    int a[N][M], b[N][M], c[N][M];
    int i, j, k, n, m, p, q, sum = 0;

    printf("Enter row and column size of the first matrix: ");
    scanf("%d%d", &n, &m);
   printf("Enter row and column size of the second matrix: ");
```

```
    scanf("%d%d", &p, &q);

    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
        {
            printf("Enter a[%d][%d]: ", i, j);
            scanf("%d", &a[i][j]);
        }
    }
    if (m != p)
    {
         printf("\nMultiplication not possible for given matrix
sizes.\n");
    }
    else
    {
        for (i = 0; i < p; i++)
        {
            for (j = 0; j < q; j++)
            {
                printf("Enter b[%d][%d]: ", i, j);
                scanf("%d", &b[i][j]);
            }
        }
        printf("\nMultiplication of a Matrix");
        for (i = 0; i < n; i++)
        {
            for (j = 0; j < q; j++)
            {
                for (k = 0; k < p; k++)
                {
                    sum += a[i][k] + b[k][j];
                }
                c[i][j] = sum;
                sum = 0;
            }
        }
        printf("\nA - Matrix of size %d x %d\n\n", n, m);
        for (i = 0; i < n; i++)
        {
```

```
            printf("|");
            for (j = 0; j < m; j++)
            {
                printf("%3d", a[i][j]);
            }
            printf("|");
            printf("\n\n");
        }
        printf("\nB - Matrix of size %d x %d\n\n", n, m);
        for (i = 0; i < n; i++)
        {
            printf("|");
            for (j = 0; j < m; j++)
            {
                printf("%3d", a[i][j]);
            }
            printf("|");
            printf("\n\n");
        }
            printf("\nC - Matrix | After Multiplication (A X
B)\n");
        for (i = 0; i < n; i++)
        {
            printf("|");
            for (j = 0; j < m; j++)
            {
                printf("%3d", c[i][j]);
            }
            printf("|");
            printf("\n\n");
        }
    }
}
```

Lab 17

Write a program to count simple interest using function

```
#include <stdio.h>

float calulateinterest(float, float, float);

void main()
{
    float pa, ri, ny, si;

    printf("Enter principal amount: ");
    scanf("%f", &pa);
    printf("Enter rate of interest: ");
    scanf("%f", &ri);
    printf("Enter number of years: ");
    scanf("%f", &ny);

    si = calulateinterest(pa, ri, ny);

    printf("\nSimple Interest = %f\n", si);
}

float calulateinterest(float pa, float ri, float ny)
{
    return ((pa * ri * ny) / 100);
}
```

Write a program that defines a function to add first n numbers

```
#include <stdio.h>

int calculatesum(int);

void main()
{
```

```
    int n, sum = 0;

    printf("Enter n: ");
    scanf("%d", &n);

    sum = calculatesum(n);
    printf("\nSum of first %d numbers is = %d\n", n, sum);
}

int calculatesum(int n)
{
    int sum = 0;
    int i = 1;

    while (i <= n)
    {
        sum += i;
        i++;
    }
    return sum;
}
```

Write a program to find maximum number from given two numbers using function

```
#include <stdio.h>
int findmax(int, int);
void main()
{
    int a, b, max;

    printf("Enter a: ");
    scanf("%d", &a);
    printf("Enter b: ");
    scanf("%d", &b);

    max = findmax(a, b);

    printf("\nMaximum from %d and %d is %d\n", a, b, max);
}
```

```
int findmax(int a, int b)
{
    return (a > b ? a : b);
}
```

Write a program using global variable, 'static' variable

```
#include <stdio.h>

//global variable
int gv = 1;

//static variable, initialized to 0 by default
static int a;

void myfunction();

void main()
{
    printf("\n\n1. Value of a and gv from inside main: ");
    printf("\nValue of a = %d\n", a++);
    printf("gv = %d\n", gv++);
    printf("\nValue of a (after change): ");
    printf("\na = %d\n", a);
    printf("\n-----------------------------\n");

    myfunction();
}

void myfunction()
{
    printf("2. Value of gv from inside myfunction(): ");
    printf("\ngv = %d\n\n", gv);
}
```

Write a program that defines a function which returns 1 'if' the number is prime otherwise 'return 0'

```
#include <stdio.h>
int isprime(int);
void main()
{
    int n, flag = 0;
    printf("Enter n: ");
    scanf("%d", &n);
    if (n == 1)
    {
        printf("\n1 is neither prime nor composite.\n");
        exit(0);
    }
    flag = isprime(n);
    if (flag == 1)
        printf("\n%d is a prime number.\n", n);
    else
        printf("\n%d is a composite number.\n", n);
}

int isprime(int n)
{
    int i, flag = 0;
    for (i = 2; i < n; i++)
    {
        if (n % i == 0)
        {
            flag++;
            break;
        }
    }
    if (flag == 0)
        return 1;
    else
        return 0;
}
```

Write a program that defines a function exchange to interchange the values of two variables, say x and y

```
#include <stdio.h>

void swap(int, int);

void main()
{
    int a, b;

    printf("Enter a: ");
    scanf("%d", &a);
    printf("Enter b: ");
    scanf("%d", &b);
    printf("\nValue of a and b 'before' swapping\n");
    printf("a: %d, b: %d\n", a, b);

    swap(a, b);
}
void swap(int a, int b)
{
    int t;
    t = a;
    a = b;
    b = t;

    printf("\nValue of a and b 'after' swapping\n");
    printf("a: %d, b: %d\n", a, b);
}
```

Write a program that will scan a character string passed as an argument and convert all lowercase character into their uppercase equivalents

```
#include <stdio.h>
void changecasetoupr(char[]);
void main()
```

```
{
    char s[100];
    int i;

    printf("\nEnter a string : ");
    gets(s);

    changecasetoupr(s);
}

void changecasetoupr(char s[])
{
    int i;

    for (i = 0; s[i] != '\0'; i++)
    {
        if (s[i] >= 'a' && s[i] <= 'z')
        {
            s[i] = s[i] - 32;
        }
    }
    printf("\nString in Upper Case = %s\n", s);
}
```

Write a program to generate Fibonacci series of N given numbers using the function name fibbo. ('e.g. 0 1 1 2 3 5 8...')

```
#include <stdio.h>
void fibbo(int);
void main()
{
    int n;
    printf("Enter n: ");
    scanf("%d", &n);

    fibbo(n);
}
void fibbo(int n)
```

```
{
    int a = 0, b = 1, c, i = 1;
    printf("%d %d ", a, b);
    while (i < n - 1)
    {
        c = a + b;
        printf("%d ", c);
        a = b;
        b = c;
        i++;
    }
    printf("\n");
}
```

// --- Using Recursion --- //

Write a program to find the factorial of a given number using 'recursion'

```
#include <stdio.h>

int factorial(int);

void main()
{
    int n, rv;

    printf("\nEnter n: ");
    scanf("%d", &n);

    rv = factorial(n);

    printf("%d! = %d\n", n, rv);
}
int factorial(int n)
{
    int i = 1, m = 1;
```

```
    if (n == 1)
        return 1;
    else
        return n * factorial(n - 1);
}
```

Write a program to convert decimal number into binary using 'recursion'

```
#include <stdio.h>

int tobinary(int);

void main()
{
    int n, bv;

    printf("\nEnter n: ");
    scanf("%d", &n);

    bv = tobinary(n);

    printf("Binary value for %d is = %d\n", n, bv);
}

int tobinary(int n)
{
    if (n == 0)
        return 0;
    else if (n == 1)
        return 1;
    else
    {
        return (n % 2 + 10 * tobinary(n / 2));
    }
}
```

Write a program to use recursive calls; to evaluate F(x) = x – x^3/3! + x^5/5! – x^7/7! + ... + x^n/n!

```
#include <stdio.h>

float series(float, int);
long factorial(int);
float power(float, int);

void main()
{
    float x;
    int n;

    printf("\nEnter X:");
    scanf("%f", &x);
    printf("\nEnter n:");
    scanf("%d", &n);

    printf("\nAns %f", series(x, n));
}


float series(float x, int n)
{
    float sum = 0;
    int i, s = 1;

    for (i = 1; i <= n; i += 2)
    {
        sum += (power(x, i) / factorial(i)) * s;
        s *= -1;
    }

    return sum;
}

float power(float x, int y)
{
    float p = 1;
```

```
    int i;

    for (i = 1; i <= y; i++)
        p *= x;

    return p;
}

long factorial(int p)
{
    long f = 1;
    int i;

    for (i = 1; i <= p; i++)
        f *= i;

    return f;
}
```

Lab 18

Write a program to create a structure of a book with book title, author name, publication, and price. Read data of n books and display them.

```
#include <stdio.h>
#define N 100

struct book
{
    char title[100];
    char author[100];
    char publication[50];
    float price;
};

void main()
{
    struct book b[N];

    int n, i;

    printf("Enter number of book your want to enter (<99): ");
    scanf("%d", &n);

    if (n > 99 || n < 1)
    {
        printf("Invalid Input! Try again...\n");
        exit(0);
    }
    for (i = 0; i < n; i++)
    {
        printf("Enter book title: ");
        scanf("%s", b[i].title);
        printf("Enter book author: ");
        scanf("%s", b[i].author);
        printf("Enter book publication: ");
```

```
        scanf("%s", b[i].publication);
        printf("Enter book price: ");
        scanf("%f", &b[i].price);
    }
    printf("\nSr.\tTitle\tAuthor\tPublication\tPrice\n");
    for (i = 1; i <= n; i++)
    {
            printf("%d\t%s\t%s\t%s\t\t%.2f\n", i, b[i].title,
b[i].author, b[i].publication, b[i].price);
    }
}
```

Define a structure Person that would contain person name, date of joining, and salary using this structure to read this information of 5 people and print the same on screen

```
#include <stdio.h>

struct employee
{
    char name[100];
    char dateofjoining[100];
    float salary;
} e[5];

void main()
{
    int i;

    for (i = 0; i < 5; i++)
    {
        printf("Enter employee name: ");
        scanf("%s", e[i].name);
        printf("Enter employee date of joining: ");
        scanf("%s", e[i].dateofjoining);
        printf("Enter employee's salary: ");
        scanf("%f", &e[i].salary);
```

```
    }
    printf("\nSr.\tName\tDate of Joining\tSalary\n");
    for (i = 1; i <= 5; i++)
    {
                printf("%d\t%s\t%s\t\t%f\n",  i,  e[i].name,
e[i].dateofjoining, e[i].salary);
    }
}
```

Define a structure time_struct containing three member's integer hour, integer minute and integer second.Write a program that would assign values to the individual number and display the time in the following format : 16 : 40 : 51

```
#include <stdio.h>

struct time
{
    int hours;
    int minutes;
    int seconds;
} t;

void main()
{
    printf("Enter hours: ");
    scanf("%d", &t.hours);
    printf("Enter minutes: ");
    scanf("%d", &t.minutes);
    printf("Enter seconds: ");
    scanf("%d", &t.seconds);

     printf("\n:: Entered time is ::\n %02d: %02d: %02d\n\n",
t.hours, t.minutes, t.seconds);
}
```

Define a *structure* cricket that will describe the following information: Player name, Team name, Batting average. Using cricket, declare an array player with 50 elements and write a program to read the information about all the 50 players and print "**team wise list**" containing names of players with their batting average.

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

struct players
{
    char name[100];
    char team[50];
    float average;
};

void main()
{
    struct players p[50], t;

    int i, j;

    for (i = 0; i < 50; i++)
    {
        printf("Enter player name: ");
        scanf("%s", p[i].name);
        printf("Enter player's team: ");
        scanf("%s", p[i].team);
        printf("Enter batting average: ");
        scanf("%f", &p[i].average);
    }
    for (i = 0; i < 49; i++)
    {
        for (j = i; j < 50; j++)
```

```
        {
            if (strcmp(p[i].team, p[j].team) > 0)
            {
                t = p[i];
                p[i] = p[j];
                p[j] = t;
            }
        }
    }

    j = 0;
    for (i = 0; i < 50; i++)
    {
        if (strcmp(p[i].team, p[j].team) != 0 || i == 0)
        {
            printf("\n Team Name: %s", p[i].team);
            j = i;
        }
        printf("\n Player Name     = %s", p[i].name);
        printf("\n Batting Average = %f", p[i].average);
    }
}
```

Define a structure student_record to contain name, branch, and total marks obtained. Write a program to read data for 10 students in a class and print them.

```
#include <stdio.h>

struct student_record
{
    char name[100];
    char branch[50];
    float totalmarks;
} s[10];

void main()
{
    int i;
```

```
    for (i = 0; i < 10; i++)
    {
        printf("Enter student's name: ");
        scanf("%s", s[i].name);
        printf("Enter student's branch: ");
        scanf("%s", s[i].branch);
        printf("Enter student's total marks: ");
        scanf("%f", &s[i].totalmarks);
    }
    printf("\nSr.\tStudent Name\tBranch\t\tTotal Marks\n");
    for (i = 0; i < 10; i++)
    {
                printf("%d\t%s\t\t%s\t\t%f\n",  i,  s[i].name,
s[i].branch, s[i].totalmarks);
    }
}
```

Lab 19

Write a program to print value and address of a variable

```
#include <stdio.h>
void main()
{
    int a = 10;

    printf("\nValue of a = %d with size %d and it is stored at address %u\n", a, sizeof(a), &a);
}
```

Write a program to calculate sum of two numbers using pointer

```
#include <stdio.h>
void main()
{
    int a = 5, b = 3;
    int *x, *y;

    x = &a;
    y = &b;

    printf("Addition of %d and %d = %d\n", *x, *y, *x + *y);
}
```

Write a program to swap value of two numbers using pointer

```
#include <stdio.h>
void main()
{
    int a = 5, b = 3, t;
```

```
    int *x, *y;
    printf("\nValue of a and b before swapping\n");
    printf("-----------------------------------------\n");
    printf("a = %d\tb = %d\n\n", a, b);

    x = &a;
    y = &b;

    t = *x;
    *x = *y;
    *y = t;

    printf("\nValue of a and b after swapping\n");
    printf("-----------------------------------------\n");
    printf("a = %d\tb = %d\n", *x, *y);
}
```

Write a program to calculate sum of elements of an array using pointer

```
#include <stdio.h>
#define N 100

int sum(int *, int);

void main()
{
    int n, arr[N], csum = 0;
    int i, *p;

    printf("Enter size of an array: ");
    scanf("%d", &n);

    for (i = 0; i < n; i++)
    {
        printf("Enter arr[%d]: ", i);
        scanf("%d", &arr[i]);
    }

    printf("\nElements of an array are: \n {");
```

```
    for (i = 0; i < n; i++)
    {
        printf("%d, ", arr[i]);
    }
    printf(" }\n");

    p = arr;
    csum = sum(p, n);
     printf("\n\nSum of the elements of an array is: %d\n\n",
csum);
}

int sum(int *p, int n)
{
    int i, csum = 0;

    for (i = 0; i < n; i++)
    {
        csum += *p;
        p++;
    }
    return csum;
}
```

Write a program to swap value of two variables using function

```
#include <stdio.h>

void swap(int *, int *);

void main()
{
    int a = 5, b = 3;

    printf("\nValue of a and b before swapping\n");
    printf("----------------------------------------\n");
    printf("a = %d\tb = %d\n\n", a, b);

    swap(&a, &b);
```

```
    printf("\nValue of a and b after swapping\n");
    printf("-----------------------------------------\n");
    printf("a = %d\tb = %d\n", a, b);
}

void swap(int *x, int *y)
{
    int t;
    t = *x;
    *x = *y;
    *y = t;
}
```

Write a program to print the address of character and the character of string using pointer

```
#include <stdio.h>
#include <string.h>
#define N 100

void main()
{
    int n, i, l = 0;
    char s[N];
    char *p;

    printf("Enter a string: ");
    gets(s);

    l = strlen(s);
    p = s;

    for (i = 0; i < l; i++)
    {
        printf("\n%c's address: %p\n", *p, p);
        p++;
    }
}
```

Write a program for sorting using pointer

```
#include <stdio.h>
#define N 100

void sort(int *, int);

void main()
{
    int n, arr[N];
    int i, *p;

    printf("Enter size of an array: ");
    scanf("%d", &n);

    for (i = 0; i < n; i++)
    {
        printf("Enter arr[%d]: ", i);
        scanf("%d", &arr[i]);
    }

    printf("\nElements of an array are: \n {");
    for (i = 0; i < n; i++)
    {
        printf("%d, ", arr[i]);
    }
    printf("}\n");

    p = arr;
    sort(p, n);
    printf("\nElements of an array after sorting are: \n {");
    for (i = 0; i < n; i++)
    {
        printf("%d, ", arr[i]);
    }
    printf("}\n");
}

void sort(int *p, int n)
{
    int i, j, t;
```

```
    for (i = 0; i < n; i++)
    {
        for (j = i + 1; j < n; j++)
        {
            if (*(p + j) < *(p + i))
            {
                t = *(p + i);
                *(p + i) = *(p + j);
                *(p + j) = t;
            }
        }
    }
}
```

Lab 20

Write a program to display content of a file

```
#include <stdio.h>
void main()
{
    FILE *p;
    char ch;

    p = fopen("lab20.c", "r");
    ch = getc(p);

    while (ch != EOF)
    {
        putchar(ch);
        ch = getc(p);
    }

    fclose(p);
}
```

Write a program to copy source file to destination file

```
#include <stdio.h>
void main()
{
    FILE *p, *q;
    char ch;

    p = fopen("lab20.c", "r");
    q = fopen("test.txt", "w");

    ch = getc(p);
    while (ch != EOF)
    {
        putc(ch, q);
        ch = getc(p);
    }
```

```
    printf("\nFile copied successfully...\n");

    fclose(p);
    fclose(q);
}
```

Write a program to count number of spaces, tabs & newlines in a file

```
#include <stdio.h>
#include <stdlib.h>
void main()
{
    FILE *fp;
    int lines = 0, tabs = 0, characters = 0, words = 0;
    char ch, filename[100];

    printf("Enter File Name: ");
    gets(filename);
    fp = fopen(filename, "r");

    if (fp == NULL)
    {
        printf("Cannot open %s for reading \n", filename);
        exit(1);
    }

    ch = getc(fp);
    while (ch != EOF)
    {
        if (ch == '\n')
            lines++;
        else if (ch == '\t')
            tabs++;
        else if (ch == ' ')
            words++;
        else
            characters++;
        ch = getc(fp);
```

```
    }

    fclose(fp);
     printf("\nLines = %d\nTabs = %d\nWords = %d\nCharacters =
%d\n", lines, tabs, words, characters);
}
```

Write a program to write a string in file

```
#include <stdio.h>
void main()
{
    FILE *fp;
    char ch, str[100];
    int i = 0;

    printf("Enter a String: ");
    gets(str);

    fp = fopen("stringfile.txt", "w");

    while (str[i] != '\0')
    {
        putc(str[i], fp);
        i++;
    }
    fclose(fp);
}
```

A file named data contains a series of integer numbers. Write a program to read all numbers from a file and then write all the odd numbers into a file named “odd” and write all even numbers into a file named “even”. Display all the contents of these files on screen.

```
#include <stdio.h>
void main()
{
    FILE *p, *odf, *evf;
    int ch;
    int i;

    p = fopen("stringfile.txt", "r");
    odf = fopen("odd.txt", "w");
    evf = fopen("even.txt", "w");

    ch = getw(p);
    while (ch != EOF)
    {
        if (ch % 2 == 0)
            putw(ch, evf);
        else
            putw(ch, odf);
        ch = getw(p);
    }
    fclose(p);
    fclose(odf);
    fclose(evf);

    odf = fopen("odd.txt", "r");
    evf = fopen("even.txt", "r");

    printf("\nOdd Numbers\n");
    ch = getw(odf);
    while (ch != EOF)
```

```
    {
        putchar(ch);
        ch = getw(odf);
    }

    printf("\n\nEven Numbers\n");
    ch = getw(evf);
    while (ch != EOF)
    {
        putchar(ch);
        ch = getw(evf);
    }
    fclose(odf);
    fclose(evf);
    printf("\n");
}
```