1. **Write a program to get input of two 3x3 matrices and find out the sum and product of the matrices and display the result of sum and product.**

a. PROGRAM

```c
#include <stdio.h>

int main() {
    int matrix1[3][3], matrix2[3][3], sum[3][3], product[3][3];

    printf("Enter the elements of first 3x3 matrix: \n");
    for (int i = 0; i < 3; i++) {
        for (int j = 0; j < 3; j++)
            scanf("%d", &matrix1[i][j]);
    }

    printf("Enter the elements of second 3x3 matrix: \n");
    for (int i = 0; i < 3; i++) {
        for (int j = 0; j < 3; j++)
            scanf("%d", &matrix2[i][j]);
    }

    // Sum of two matrices
    printf("Sum of two matrices: \n");
    for (int i = 0; i < 3; i++) {
        for (int j = 0; j < 3; j++) {
            sum[i][j] = matrix1[i][j] + matrix2[i][j];
            printf("%d ", sum[i][j]);
        }
        printf("\n");
    }

    // Product of two matrices
    printf("Product of two matrices: \n");
    for (int i = 0; i < 3; i++) {
        for (int j = 0; j < 3; j++) {
            product[i][j] = 0;
            for (int k = 0; k < 3; k++)
                product[i][j] += matrix1[i][k] * matrix2[k][j];
            printf("%d ", product[i][j]);
        }
        printf("\n");
    }
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2>
Enter the elements of first 3x3 matrix:
1 2 3
4 5 6
7 8 9
Enter the elements of second 3x3 matrix:
9 8 7
6 5 4
3 2 1
Sum of two matrices:
10 10 10
10 10 10
10 10 10
Product of two matrices:
30 24 18
84 69 54
138 114 90
```

2. Write a program to sort an array in ascending order.

a. PROGRAM

```c
#include<stdio.h>

int main() {
    int n, temp;

    printf("Enter the number of elements in the array: ");
    scanf("%d", &n);
    int arr[n];
    printf("Enter the elements of the array: ");
    for(int i = 0; i < n; i++) {
        scanf("%d", &arr[i]);
    }

    for(int i = 0; i < n; i++) {
        for(int j = i+1; j < n; j++) {
            if(arr[i] > arr[j]) {
                temp = arr[i];
                arr[i] = arr[j];
                arr[j] = temp;
            }
        }
    }

    printf("The array in ascending order is: ");
    for(int i = 0; i < n; i++) {
        printf("%d ", arr[i]);
    }
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2>
Enter the number of elements in the array: 4
Enter the elements of the array: 2 3 1 5
The array in ascending order is: 1 2 3 5
```

3. Write a program to find smallest element in an array.

a. PROGRAM

```c
#include<stdio.h>

int main() {
    int n;

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

    int arr[n];

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

    int smallest = arr[0];

    for(int i = 1; i < n; i++) {
        if(arr[i] < smallest) {
            smallest = arr[i];
        }
    }

    printf("The smallest element in the array is: %d", smallest);

    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2>
Enter the number of elements in the array: 5
Enter the elements of the array: 1 2 3 8 0
The smallest element in the array is: 0
```

4. **Write a program to get a string as input and print the length of string, reverse of the string.**

a. **Using String Library Function**

b. **Using your own function**

a. PROGRAM

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

void reverse(char *string, int length)
{
    for (int i = 0; i < length; i++)
    {
        char temp = string[i];
        string[i] = string[length - i - 1];
        string[length - i - 1] = temp;
    }

    printf("The reverse of the string is: %s\n", string);
}

void find_length(char *string)
{
    int length = 0;
    while (string[length] != '\0')
    {
        length++;
    }
    printf("The length of the string is: %d\n", length);
}

int main()
{
    char string[40];

    printf("Enter a string: ");
    fgets(string, 40, stdin);

    // length using library function
    int length = strlen(string);
    printf("The length of the string using library function is: %d\n",
length);

    // length using custom function
    find_length(string);
```

```
    // reverse of string using library function
    printf("The reverse of the string using library function is: %s\n",
strrev(string));

    // reverse of string using custom function
    reverse(string, length);

    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2> .\a.exe
Enter a string: suresh
The length of the string using library function is: 7
The length of the string is: 7
The reverse of the string using library function is:
hserus
The reverse of the string is:
hserus
```

5. Write a program that takes input of two numbers and any one operator in (+,-,*, /, %) as input and pass those numbers and an operator to the function. The function should calculate the result of two numbers as indicated by operator and return the result. Display the result of computation in your program.

a. PROGRAM

```
#include <stdio.h>

int calculate(float a, float b, char op)
{
    switch (op)
    {
    case '+':
        return a + b;
    case '-':
        return a - b;
    case '*':
        return a * b;
    case '/':
        if (b == 0)
        {
            printf("Error: Division by zero\n");
            return 0;
        }
```

```
            return a / b;
        default:
            printf("Error: Invalid operator\n");
            return 0;
        }
    }

    int main()
    {
        float num1, num2;
        char op;

        printf("Enter the first number: ");
        scanf("%f", &num1);
        printf("Enter the operator: ");
        scanf(" %c", &op);
        printf("Enter the second number: ");
        scanf("%f", &num2);

        float result = calculate(num1, num2, op);

        printf("The result is: %.2f\n", result);

        return 0;
    }
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2>
Enter the first number: 2
Enter the operator: +
Enter the second number: 3
The result is: 5.00
```

6. Write a program to find factorial of given integer using recursion.

a. PROGRAM

```c
#include<stdio.h>

int factorial(int n)
{
    if (n == 0)
    {
        return 1;
    }
    return n * factorial(n - 1);
}

int main() {
    int n;
    printf("Enter a number: ");
    scanf("%d", &n);
    printf("The factorial of %d is: %d\n", n, factorial(n));
    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2>
Enter a number: 6
The factorial of 6 is: 720
```

7. Write a program to find first 10 numbers in Fibonacci series using recursion.

a. PROGRAM

```c
#include <stdio.h>

int fibonacci(int n)
{
    if (n == 0)
    {
        return 0;
    }
    if (n == 1)
    {
        return 1;
    }

    return fibonacci(n - 1) + fibonacci(n - 2);
}

int main()
{

    for (int i = 0; i < 10; i++)
    {
        printf("%d ", fibonacci(i));
    }

    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2>
0 1 1 2 3 5 8 13 21 34
```

8. Write a program to find umber a times a vowel ‘e’ appears in a given string.

a. PROGRAM

```c
#include <stdio.h>

int main()
{
    char str[100];

    printf("Enter a string: ");
    fgets(str, 100, stdin);

    int count = 0;

    for (int i = 0; str[i] != '\0'; i++)
    {
        if (str[i] == 'e')
        {
            count++;
        }
    }

    printf("The number of 'e' in the string is: %d\n", count);

    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2>
Enter a string: suresh
The number of 'e' in the string is: 1
```

9. Write a program defining an array with dynamic memory allocation of integers and compute the sum of the array using function of your own.

a. PROGRAM

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

void sum(int *arr, int n)
{
    int sum = 0;
    for (int i = 0; i < n; i++)
    {
        sum += arr[i];
    }
    printf("The sum of the elements is: %d\n", sum);
}

int main()
{
    int n;
    printf("Enter the number of elements: ");
    scanf("%d", &n);

    int *arr = (int *)malloc(n * sizeof(int));

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

    sum(arr, n);

    free(arr);
    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2>
Enter the number of elements: 5
Enter the elements: 1 2 3 4 5
The sum of the elements is: 15
```

10. Write a program to swap two numbers defining a function swap(int, int) using:

a) Pass by value

i. PROGRAM

```c
#include<stdio.h>

void swap(int a, int b)
{
    int temp;
    temp = a;
    a = b;
    b = temp;

    printf("After swapping inside a swap function a = %d and b = %d\n", a, b);
}

int main()
{
    int a, b, temp;
    printf("Enter the value of a and b: ");
    scanf("%d %d", &a, &b);
    printf("Before swapping a = %d and b = %d\n", a, b);
    swap(a, b);
    printf("After swapping a = %d and b = %d\n", a, b);
    return 0;
}
```

ii. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2> .\a.exe
Enter the value of a and b: 2 4
Before swapping a = 2 and b = 4
After swapping inside a swap function a = 4 and b = 2
After swapping a = 2 and b = 4
```

b) Pass by reference

a. PROGRAM

```c
#include<stdio.h>

void swap(int *a, int *b)
{
    int temp;
    temp = *a;
    *a = *b;
    *b = temp;

    printf("After swapping inside a swap function a = %d and b = %d\n", *a,
*b);
}

int main()
{
    int a, b, temp;
    printf("Enter the value of a and b: ");
    scanf("%d %d", &a, &b);
    printf("Before swapping a = %d and b = %d\n", a, b);
    swap(&a, &b);
    printf("After swapping a = %d and b = %d\n", a, b);
    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2> .\a.e
Enter the value of a and b: 3 4
Before swapping a = 3 and b = 4
After swapping inside a swap function a = 4 and b = 3
After swapping a = 4 and b = 3
```

11. Write a program defining a structure to store the data for a student with fields (rollno, f_name, l_name, address, mobileno) , input the data for a student and display the record in appropriate format.

a. PROGRAM

```c
#include<stdio.h>

struct student
{
    int rollno;
    char f_name[20];
    char l_name[20];
    char address[50];
    char mobile_no[11];
};

void display(struct student s)
{
    printf("\nStudent details:\n");
    printf("Roll no: %d\n", s.rollno);
    printf("First name: %s\n", s.f_name);
    printf("Last name: %s\n", s.l_name);
    printf("Address: %s\n", s.address);
    printf("Mobile no: %s\n", s.mobile_no);
}

int main()
{
    struct student s1;
    printf("Enter roll no: ");
    scanf("%d", &s1.rollno);
    printf("Enter first name: ");
    scanf("%s", &s1.f_name);
    printf("Enter last name: ");
    scanf("%s", &s1.l_name);
    printf("Enter address: ");
    scanf("%s", &s1.address);
    printf("Enter mobile no: ");
    scanf("%s", &s1.mobile_no);
    display(s1);
    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2> .\a.exe
Enter roll no: 1
Enter first name: suresh
Enter last name: dahal
Enter address: jhapa
Enter mobile no: 98000000

Student details:
Roll no: 1
First name: suresh
Last name: dahal
Address: jhapa
Mobile no: 98000000
```

12. Write a program to pass array to a function using pointer and return array from a function using pointer.

a. PROGRAM

```c
#include <stdio.h>

int *fun(int arr[])
{
    for (int i = 0; i < 5; i++)
    {
        arr[i] = arr[i] * arr[i];
    }

    return arr;
}

int main()
{
    int arr[5] = {1, 2, 3, 4, 5};

    int *square_arr = fun(arr);

    printf("Square of array: ");

    for (int i = 0; i < 5; i++)
    {
        printf("%d ", *(square_arr + i));
    }

    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2>
Square of array: 1 4 9 16 25
```

13. Write a program that illustrates the similarity between array and pointer.

a. PROGRAM

```c
#include<stdio.h>

int main()
{
    int arr[5] = {1, 2, 3, 4, 5};

    int *ptr = arr;
    // int *ptr = &arr[0]; // Both are same
    // array name is a pointer to the first element of the array

    // arr[i] = *(arr + i) = *(ptr + i) = ptr[i]

    printf("Value of arr[0]: %d\n", *ptr);
    printf("Value of arr[1]: %d\n", *(ptr + 1));
    printf("Value of arr[2]: %d\n", ptr[2]);
    printf("Value of arr[3]: %d\n", *(ptr + 3));
    printf("Value of arr[4]: %d\n", *(ptr + 4));

    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab
Value of arr[0]: 1
Value of arr[1]: 2
Value of arr[2]: 3
Value of arr[3]: 4
Value of arr[4]: 5
```

14. Write a program using array of structure to store the data for 10 employees with fields (Essn, f_name, l_name, address, mobileno), input the data for n employees and display the record in appropriate format.

a. PROGRAM

```
#include<stdio.h>

struct Employee {
    int essn;
    char fname[20];
    char lname[20];
    char address[50];
    char mobile[11];
};

int main() {
    struct Employee emp[10];

    printf("Enter the details of 10 employees:\n");

    for (int i = 0; i < 10; i++) {
        printf("\nEnter the essn of employee %d: ", i + 1);
        scanf("%d", &emp[i].essn);

        printf("Enter the first name of employee %d: ", i + 1);
        scanf("%s", emp[i].fname);

        printf("Enter the last name of employee %d: ", i + 1);
        scanf("%s", emp[i].lname);

        printf("Enter the address of employee %d: ", i + 1);
        scanf("%s", emp[i].address);

        printf("Enter the mobile number of employee %d: ", i + 1);
        scanf("%s", emp[i].mobile);
    }

    printf("\nDetails of 10 employees:\n");

    printf("\nESSN\tFirst name\tLast name\tAddress\tMobile\n");

    for (int i = 0; i < 10; i++) {
        printf("%d\t%s\t%s\t%s\t%s\n", emp[i].essn, emp[i].fname,
emp[i].lname, emp[i].address, emp[i].mobile);
    }
}
```

b. OUTPUT

```
Enter the first name of employee 9: suresh
Enter the last name of employee 9: sharma
Enter the address of employee 9: jhapa
Enter the mobile number of employee 9: 9800000000

Enter the essn of employee 10: 10
Enter the first name of employee 10: ganesh
Enter the last name of employee 10: karki
Enter the address of employee 10: jhapa
Enter the mobile number of employee 10: 98000000

Details of 10 employees:

ESSN    Name            address Mobile
1       suresh dahal    jhapa   98000000
2       alisha bista    jhapa   98000000
3       johnson karki   jhapa   98000000
4       jenny kafle     jhapa   98000000
5       ayusha karki    jhapa   98000000
7       hari sharma     jhapa   98000000
6       smriti kafle    jhapa   98000000
8       john sharma     jhapa   98000000
9       suresh sharma   jhapa   9800000000
10      ganesh karki    jhapa   98000000
```

15. Write a program defining a union to store the data for a student with fields (rollno, f_name, l_name, address, mobileno). Illustrate the property of Union by accessing only one data member at a time.

a. PROGRAM

```c
#include <stdio.h>

union Student
{
    int roll_number;
    char fname[20];
    char lname[20];
    char address[50];
    char mobile[11];
};

int main()
{
    union Student std;
```

```
    printf("Enter the details of 10 students:\n");

    printf("\nEnter the roll_number of student: ");
    scanf("%d", &std.roll_number);

    printf("Roll number before entering name %d\n",
std.roll_number);

    printf("Enter the first name of student:");
    scanf("%s", std.fname);

    printf("First name before entering last name %s\n",
std.fname);

    printf("Enter the last name of student:");
    scanf("%s", std.lname);

    printf("Last name before entering address %s\n",
std.lname);

    printf("Enter the address of student:");
    scanf("%s", std.address);

    printf("Address before entering mobile number %s\n",
std.address);

    printf("Enter the mobile number of student:");
    scanf("%s", std.mobile);

    printf("\nDetails of 2 students:\n");

    printf("\nroll_number %d\n", std.roll_number);
    printf("First name %s\n", std.fname);
    printf("Last name %s\n", std.lname);
    printf("Address %s\n", std.address);
    printf("Mobile %s\n", std.mobile);

    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2> .\
Enter the details of 10 students:

Enter the roll_number of student: 1
Roll number before entering name 1
Enter the first name of student:suresh
First name before entering last name suresh
Enter the last name of student:dahal
Last name before entering address dahal
Enter the address of student:jhapa
Address before entering mobile number jhapa
Enter the mobile number of student:98000000

Details of 2 students:

roll_number 808466489
First name 98000000
Last name 98000000
Address 98000000
Mobile 98000000
```

16. Write a program to prompt user to input filename and read the content of file and display in screen.

a. PROGRAM

```c
#include<stdio.h>

int main() {
    FILE *fptr;
    char file_name[100];

    printf("Enter the file name: ");
    scanf("%s", file_name);

    fptr = fopen(file_name, "r");

    if (fptr == NULL) {
        printf("Error! File not found.");
        return 1;
    }

    printf("Content from the file: \n");
    printf("----------------------------\n");

    char ch;
    while ((ch = fgetc(fptr)) != EOF) {
        printf("%c", ch);
    }

    fclose(fptr);

    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2>
Enter the file name: test.txt
Content from the file:
---------------------------
This is content from test file.
And it has 2 lines.
```

17. Write a program to read from a text file and count the number of lines and characters in that file.

a. PROGRAM

```c
#include <stdio.h>

int main()
{
    FILE *fptr;
    char filename[100], ch;
    int total_character = 0, total_lines = 0;

    printf("Enter the filename to open: ");
    scanf("%s", filename);

    fptr = fopen(filename, "r");

    if (fptr == NULL)
    {
        printf("Error! File not found.");
        return 1;
    }

    while ((ch = fgetc(fptr)) != EOF)
    {
        total_character++;

        if (ch == '\n' || ch == '\0')
            total_lines++;
    }

    printf("Total characters: %d\n", total_character);
    printf("Total lines: %d\n", total_lines);

    fclose(fptr);

    return 0;
}
```

b. OUTPUT

```
Enter the filename to open: test.txt
Total characters: 51
Total lines: 1
```

18. Write a program to read a text file and copy all contents in the new file.

a. PROGRAM

```c
#include<stdio.h>

int main()
{
    FILE *fptr1, *fptr2;
    char filename[100], c;

    printf("Enter the filename to open for reading: ");
    scanf("%s", filename);

    fptr1 = fopen(filename, "r");
    if (fptr1 == NULL)
    {
        printf("Cannot open file %s \n", filename);
        return 0;
    }

    printf("Enter the filename to open for writing: ");
    scanf("%s", filename);

    fptr2 = fopen(filename, "w");
    if (fptr2 == NULL)
    {
        printf("Cannot open file %s \n", filename);
        return 0;
    }

    c = fgetc(fptr1);
    while (c != EOF)
    {
        fputc(c, fptr2);
        c = fgetc(fptr1);
    }

    printf("Contents copied to %s", filename);

    fclose(fptr1);
    fclose(fptr2);

    return 0;
}
```

b. OUTPUT

```
PS C:\Users\suresh\C programs\lab assignment 2> .\a.exe
Enter the filename to open for reading: test.txt
Enter the filename to open for writing: new.txt
Contents copied to new.txt
```