**Program 1 :**   
  
Problem Statement : Create a scientific calculator to perform arithmetic operations using the concept of data types and switch case expression.

*#include* <stdio.h>

*#include* <math.h> *// For scientific functions like pow, sqrt, etc.*

int main() {

int choice;

double num1, num2, result;

printf("Welcome to the Scientific Calculator\n");

printf("Choose an operation to perform:\n");

printf("1. Addition (+)\n");

printf("2. Subtraction (-)\n");

printf("3. Multiplication (\*)\n");

printf("4. Division (/)\n");

printf("5. Modulus (%%)\n");

printf("6. Power (^)\n");

printf("7. Square Root (√)\n");

printf("\nEnter your choice (1-7): ");

scanf("%d", &choice);

*switch* (choice)

{

*case* 1: *// Addition*

printf("Enter two numbers: ");

scanf("%lf %lf", &num1, &num2);

result = num1 + num2;

printf("Result: %.2lf\n", result);

*break*;

*case* 2: *// Subtraction*

printf("Enter two numbers: ");

scanf("%lf %lf", &num1, &num2);

result = num1 - num2;

printf("Result: %.2lf\n", result);

*break*;

*case* 3: *// Multiplication*

printf("Enter two numbers: ");

scanf("%lf %lf", &num1, &num2);

result = num1 \* num2;

printf("Result: %.2lf\n", result);

*break*;

*case* 4: *// Division*

printf("Enter two numbers: ");

scanf("%lf %lf", &num1, &num2);

*if* (num2 != 0)

{

result = num1 / num2;

printf("Result: %.2lf\n", result);

}

*else*

{

printf("Error: Division by zero is not allowed.\n");

}

*break*;

*case* 5: *// Modulus*

printf("Enter two integers: ");

int int1, int2;

scanf("%d %d", &int1, &int2);

*if* (int2 != 0)

{

printf("Result: %d\n", int1 % int2);

}

*else*

{

printf("Error: Modulus by zero is not allowed.\n");

}

*break*;

*case* 6: *// Power*

printf("Enter base and exponent: ");

scanf("%lf %lf", &num1, &num2);

result = pow(num1, num2);

printf("Result: %.2lf\n", result);

*break*;

*case* 7: *// Square Root*

printf("Enter a number: ");

scanf("%lf", &num1);

*if* (num1 >= 0)

{

result = sqrt(num1);

printf("Result: %.2lf\n", result);

}

*else*

{

printf("Error: Square root of negative numbers is not allowed.\n");

}

*break*;

*default*:

printf("Invalid choice. Please try again.\n");

}

*return* 0;

}

/\*

OUTPUT:-

Choose an operation to perform:

1. Addition (+)

2. Subtraction (-)

3. Multiplication (\*)

4. Division (/)

5. Modulus (%)

6. Power (^)

7. Square Root (√)

Enter your choice (1-7): 7

Enter a number: 9

Result: 3.00

\*/

PROGRAM 2:-

// Problem Statement: Eligibility Checker

// Write a C program to determine the eligibility of a person to vote based on their age and citizenship status.

*#include* <stdio.h>

int main()

{

char nationality[20];

int age;

*// Ask for nationality*

printf("Enter your nationality (Indian or Other): ");

scanf("%s", &nationality);

*// Check if nationality is Indian*

*if* (nationality[0] == 'I' && nationality[1] == 'n' && nationality[2] == 'd' &&

nationality[3] == 'i' && nationality[4] == 'a' && nationality[5] == 'n' &&

nationality[6] == '\0')

{

*// If Indian, ask for age*

printf("Enter your age: ");

scanf("%d", &age);

*// Check age for voting eligibility*

*if* (age >= 18) {

printf("You are eligible for voting.\n");

}

*else*

{

printf("You are not eligible for voting.\n");

}

}

*else*

{

printf("You are not eligible for voting.\n");

}

*return* 0;

}

OUTPUT:-

Enter your nationality (Indian or Other): Indian

Enter your age: 20

You are eligible for voting.

**Program 3 :**

Problem Statement :Create a calculator to assign a grade based on the score of the student.

*#include*<stdio.h>

int main()

{

int plb, phy, m1, icc, eel, total;

float percentage;

printf("ENTER THE MARKS OBTAINED IN PHYSICS :- \n");

scanf("%d", &phy);

printf("ENTER THE MARKS OBTAINED IN PLB :- \n");

scanf("%d", &plb);

printf("ENTER THE MARKS OBTAINED IN MATHS :- \n");

scanf("%d", &m1);

printf("ENTER THE MARKS OBTAINED IN ICC :- \n");

scanf("%d", &icc);

printf("ENTER THE MARKS OBTAINED IN EEL :-\n");

scanf("%d", &eel);

total = phy + plb + m1 + icc + eel;

printf("TOTAL MARKS SCORED :- %d \n",total);

percentage = ((total \* 100)/500);

printf("PERCENTAGE SCORED :- %.2f \n",percentage);

*if*(percentage>=50 && percentage<=60)

{

printf("D \n");

}

*else* *if* (percentage>60 && percentage<=70)

{

printf("C \n");

}

*else* *if* (percentage>70 && percentage<=80)

{

printf("B \n");

}

*else* *if* (percentage>80 && percentage<=90)

{

printf("A\n");

}

*else*

{

printf("FAILED \n");

}

*return* 0;

}

OUTPUT:-

ENTER THE MARKS OBTAINED IN PHYSICS :-

60

ENTER THE MARKS OBTAINED IN PLB :-

70

ENTER THE MARKS OBTAINED IN MATHS :-

89

ENTER THE MARKS OBTAINED IN ICC :-

90

ENTER THE MARKS OBTAINED IN EEL :-

100

TOTAL MARKS SCORED :- 409

PERCENTAGE SCORED :- 81.00

A

**Program 4 (A) :**

Problem Statement : Create a structure named "Car" to store details like car ID, model, and rental rate per day.

Write a C program to input data for three cars, calculate the total rental cost for a specified number of days and display the results.

*#include* <stdio.h>

*#define* MAX\_CARS 3

*// Define the structure to store car details*

struct Car

{

int carID;

char model[50];

float rentalRate;

};

int main()

{

struct Car cars[MAX\_CARS];

int rentalDays, selectedCarID, carFound = 0;

float totalCost;

printf("Car Rental System\n");

*// Input car details*

*for* (int i = 0; i < MAX\_CARS; i++)

{

printf("\n Enter details for Car %d:\n", i + 1);

printf("Car ID: ");

scanf("%d", &cars[i].carID); *// Example: 101, 102, 103*

printf("Model: ");

scanf("%s", cars[i].model); *// Example: Sedan, SUV, Hatchback*

printf("Rental Rate per Day: ");

scanf("%f", &cars[i].rentalRate); *// Example: 50, 70, 40*

}

*// Display available cars*

printf("\nAvailable Cars:\n");

printf("Car ID\tModel\t\tRental Rate (per day)\n");

*for* (int i = 0; i < MAX\_CARS; i++)

{

printf("%d\t%s\t\t%.2f\n", cars[i].carID, cars[i].model, cars[i].rentalRate);

}

*// Select car and input rental days*

printf("\nEnter the Car ID you want to rent (e.g., 102): ");

scanf("%d", &selectedCarID);

printf("Enter the number of days you want to rent the car (e.g., 5): ");

scanf("%d", &rentalDays);

*// Calculate total cost*

*for* (int i = 0; i < MAX\_CARS; i++)

{

*if* (cars[i].carID == selectedCarID)

{

carFound = 1;

totalCost = rentalDays \* cars[i].rentalRate;

printf("\nRental Summary:\n");

printf("Car Model: %s\n", cars[i].model);

printf("Rental Days: %d\n", rentalDays);

printf("Total Cost: %.2f\n", totalCost);

*break*;

}

}

*if* (!carFound)

{

printf("\nError: Car with ID %d not found.\n", selectedCarID);

}

*return* 0;

}

OUTPUT:-

Car Rental System

Enter details for Car 1:

Car ID: 123

Model: ABX

Rental Rate per Day: 1000

Enter details for Car 2:

Car ID: 456

Model: DEY

Rental Rate per Day: 2000

Enter details for Car 3:

Car ID: FGZ

Model: Rental Rate per Day: 3000

Available Cars:

Car ID Model Rental Rate (per day)

123 ABX 1000.00

456 DEY 2000.00

0 FGZ 3000.00

Enter the Car ID you want to rent (e.g., 102): 456

Enter the number of days you want to rent the car (e.g., 5): 6

Rental Summary:

Car Model: DEY

Rental Days: 6

Total Cost: 12000.00

**Program 4 (B) :**

Problem Statement :

Write a program in C to

i. Count the total number of vowels or consonants in a string.

ii. Compare two strings without using string library functions.

iii. Count the total number of words in a string.

iv. Print individual characters of a string in reverse order.

*#include* <stdio.h>

*#include* <ctype.h>

*#include* <string.h> *// Used only for strlen, not for string comparison*

void countVowelsConsonants(const char \**str*);

void compareStrings(const char \**str1*, const char \**str2*);

void countWords(const char \**str*);

void printReverse(const char \**str*);

int main() {

char str[100], str1[100], str2[100];

printf("Enter a string: ");

fgets(str, sizeof(str), stdin);

*// Remove the newline character added by fgets*

str[strcspn(str, "\n")] = '\0';

printf("\n1. Count Vowels and Consonants\n");

countVowelsConsonants(str);

printf("\n2. Compare Two Strings\n");

printf("Enter first string: ");

fgets(str1, sizeof(str1), stdin);

str1[strcspn(str1, "\n")] = '\0';

printf("Enter second string: ");

fgets(str2, sizeof(str2), stdin);

str2[strcspn(str2, "\n")] = '\0';

compareStrings(str1, str2);

printf("\n3. Count Total Number of Words\n");

countWords(str);

printf("\n4. Print Characters in Reverse Order\n");

printReverse(str);

*return* 0;

}

*// Function to count vowels and consonants in a string*

void countVowelsConsonants(const char \**str*)

{

int vowels = 0, consonants = 0;

*for* (int i = 0; *str*[i] != '\0'; i++)

{

char ch = tolower(*str*[i]);

*if* (ch >= 'a' && ch <= 'z')

{

*if* (ch == 'a' || ch == 'e' || ch == 'i' || ch == 'o' || ch == 'u')

{

vowels++;

}

*else*

{

consonants++;

}

}

}

printf("Vowels: %d\nConsonants: %d\n", vowels, consonants);

}

*// Function to compare two strings without using string library functions*

void compareStrings(const char \**str1*, const char \**str2*)

{

int i = 0;

*while* (*str1*[i] != '\0' && *str2*[i] != '\0')

{

*if* (*str1*[i] != *str2*[i])

{

printf("Strings are not equal.\n");

*return*;

}

i++;

}

*if* (*str1*[i] == '\0' && *str2*[i] == '\0')

{

printf("Strings are equal.\n");

}

*else*

{

printf("Strings are not equal.\n");

}

}

*// Function to count the total number of words in a string*

void countWords(const char \**str*)

{

int count = 0, inWord = 0;

*for* (int i = 0; *str*[i] != '\0'; i++)

{

*if* (*str*[i] == ' ' || *str*[i] == '\t' || *str*[i] == '\n')

{

inWord = 0;

}

*else* *if* (!inWord)

{

inWord = 1;

count++;

}

}

printf("Total words: %d\n", count);

}

*// Function to print characters of a string in reverse order*

void printReverse(const char \**str*)

{

int length = 0;

*while* (*str*[length] != '\0')

{

length++;

}

printf("Reverse: ");

*for* (int i = length - 1; i >= 0; i--)

{

printf("%c", *str*[i]);

}

printf("\n");

}

OUTPUT:-

Enter a string: HELLO THERE

1. Count Vowels and Consonants

Vowels: 4

Consonants: 6

2. Compare Two Strings

Enter first string: TELL ME YOUR NAME

Enter second string: IM GAURAV

Strings are not equal.

3. Count Total Number of Words

Total words: 2

4. Print Characters in Reverse Order

Reverse: EREHT OLLEH

**Program 5 (A) :**

Problem Statement :

Create a union Measurement with members for length in meters, weight in kilograms, and

temperature in Celsius, and write a function to print the value.

*#include* <stdio.h>

*// Define the union*

union Measurement {

float length; *// Length in meters*

float weight; *// Weight in kilograms*

float temperature; *// Temperature in Celsius*

};

*// Function to print the value of the union*

void printMeasurement(union Measurement *m*, char *type*) {

*switch* (*type*) {

*case* 'L': *// Length*

printf("Length: %.2f meters\n", *m*.length);

*break*;

*case* 'W': *// Weight*

printf("Weight: %.2f kilograms\n", *m*.weight);

*break*;

*case* 'T': *// Temperature*

printf("Temperature: %.2f Celsius\n", *m*.temperature);

*break*;

*default*:

printf("Invalid type\n");

}

}

int main() {

union Measurement m;

char type;

float value;

printf("Enter the type of measurement (L for Length, W for Weight, T for Temperature): ");

scanf(" %c", &type);

*switch* (type) {

*case* 'L':

printf("Enter length in meters: ");

scanf("%f", &value);

m.length = value;

*break*;

*case* 'W':

printf("Enter weight in kilograms: ");

scanf("%f", &value);

m.weight = value;

*break*;

*case* 'T':

printf("Enter temperature in Celsius: ");

scanf("%f", &value);

m.temperature = value;

*break*;

*default*:

printf("Invalid type entered.\n");

*return* 1; *// Exit with an error code*

}

*// Print the measurement*

printMeasurement(m, type);

*return* 0;

}

OUTPUT:-

Enter the type of measurement (L for Length, W for Weight, T for Temperature): L

Enter length in meters: 99

Length: 99.00 meters

**Program 5(B) :**

Problem Statement :

Write a C program that uses a pointer to an array of integers and prints all elements of the

array using the pointer.

*#include* <stdio.h>

int main() {

int size;

*// Ask the user for the size of the array*

printf("Enter the number of elements in the array: ");

scanf("%d", &size);

int arr[size]; *// Declare an array of user-specified size*

int \*ptr = arr; *// Pointer to the first element of the array*

*// Input array elements*

printf("Enter %d elements:\n", size);

*for* (int i = 0; i < size; i++) {

printf("Element %d: ", i + 1);

scanf("%d", ptr + i); *// Using pointer arithmetic to store input*

}

*// Output array elements using the pointer*

printf("Elements of the array using a pointer:\n");

*for* (int i = 0; i < size; i++) {

printf("Element %d: %d\n", i + 1, \*(ptr + i)); *// Accessing elements using pointer arithmetic*

}

*return* 0;

}

OUTPUT:-

Enter the number of elements in the array: 4

Enter 4 elements:

Element 1: 2

Element 2: 4

Element 3: 6

Element 4: 8

Elements of the array using a pointer:

Element 1: 2

Element 2: 4

Element 3: 6

Element 4: 8

**Program 6 :**

Problem Statement :

Implement C programs to perform addition and multiplication of two 3X3 matrices using

Array.

*#include* <stdio.h>

int main() {

int r, c, a[100][100], b[100][100], sum[100][100], mul[100][100], i, j;

*// Input the number of rows and columns for the matrices*

printf("Enter the number of rows (between 1 and 100): ");

scanf("%d", &r);

printf("Enter the number of columns (between 1 and 100): ");

scanf("%d", &c);

*// Input elements of the first matrix row by row*

printf("\nEnter elements of 1st matrix (row-wise):\n");

*for* (i = 0; i < r; ++i) {

printf("Enter row %d elements: ", i + 1);

*for* (j = 0; j < c; ++j) {

scanf("%d", &a[i][j]);

}

}

*// Input elements of the second matrix row by row*

printf("\nEnter elements of 2nd matrix (row-wise):\n");

*for* (i = 0; i < r; ++i) {

printf("Enter row %d elements: ", i + 1);

*for* (j = 0; j < c; ++j) {

scanf("%d", &b[i][j]);

}

}

*// Adding two matrices*

*for* (i = 0; i < r; ++i) {

*for* (j = 0; j < c; ++j) {

sum[i][j] = a[i][j] + b[i][j];

}

}

*// Multiplying two matrices element-wise*

*for* (i = 0; i < r; ++i) {

*for* (j = 0; j < c; ++j) {

mul[i][j] = a[i][j] \* b[i][j];

}

}

*// Printing the sum of two matrices*

printf("\nSum of two matrices:\n");

*for* (i = 0; i < r; ++i) {

*for* (j = 0; j < c; ++j) {

printf("%d ", sum[i][j]);

}

printf("\n");

}

*// Printing the product of two matrices*

printf("\nMultiplication of two matrices (element-wise):\n");

*for* (i = 0; i < r; ++i) {

*for* (j = 0; j < c; ++j) {

printf("%d ", mul[i][j]);

}

printf("\n");

}

*return* 0;

}

*/\* OUTPUT:-*

*Enter the number of rows (between 1 and 100): 3*

*Enter the number of columns (between 1 and 100): 3*

*Enter elements of 1st matrix (row-wise):*

*Enter row 1 elements: 1 2 3*

*Enter row 2 elements: 4 5 6*

*Enter row 3 elements: 7 8 9*

*Enter elements of 2nd matrix (row-wise):*

*Enter row 1 elements: 9 8 7*

*Enter row 2 elements: 6 5 4*

*Enter row 3 elements: 3 2 1*

*Sum of two matrices:*

*10 10 10*

*10 10 10*

*10 10 10*

*Multiplication of two matrices (element-wise):*

*9 16 21*

*24 25 24*

*21 16 9*

*\*/*

**Program 7 (A) :**

Problem Statement :

Write a C program to check whether a number is palindrome or not using recursion.

Program will accept a number from the user and display whether the given number is

palindrome or not.

*#include* <stdio.h>

*// Function to reverse a number using recursion*

int reverseNumber(int *num*, int *rev*) {

*if* (*num* == 0)

*return* *rev*;

*return* reverseNumber(*num* / 10, *rev* \* 10 + *num* % 10);

}

*// Function to check if a number is a palindrome*

int isPalindrome(int *num*) {

*if* (*num* < 0) *num* = -*num*; *// Convert negative numbers to positive*

*return* *num* == reverseNumber(*num*, 0);

}

int main() {

int number;

*// Input from user*

printf("Enter a number: ");

scanf("%d", &number);

*// Check for palindrome*

*if* (isPalindrome(number)) {

printf("%d is a palindrome.\n", number);

} *else* {

printf("%d is not a palindrome.\n", number);

}

*return* 0;

}

OUTPUT:-

Enter a number: 121

121 is a palindrome.

**Program 7(B) :**

Problem Statement :

Write a C program for

i. Calculate the factorial of a number.

ii. Generate the nth Fibonacci

number.

*#include* <stdio.h>

*// Function to calculate the factorial of a number using recursion*

long long factorial(int *n*) {

*if* (n == 0 || n == 1) *// Base case: factorial of 0 or 1 is 1*

*return* 1;

*return* n \* factorial(n - 1); *// Recursive case*

}

*// Function to calculate the nth Fibonacci number using recursion*

int fibonacci(int *n*) {

*if* (n == 0) *// Base case: Fibonacci(0) = 0*

*return* 0;

*if* (n == 1) *// Base case: Fibonacci(1) = 1*

*return* 1;

*return* fibonacci(n - 1) + fibonacci(n - 2); *// Recursive case*

}

int main() {

int choice, num;

printf("Choose an operation:\n");

printf("1. Calculate the factorial of a number\n");

printf("2. Generate the nth Fibonacci number\n");

printf("Enter your choice (1 or 2): ");

scanf("%d", &choice);

*switch* (choice) {

*case* 1:

*// Calculate the factorial*

printf("Enter a number to calculate its factorial: ");

scanf("%d", &num);

*if* (num < 0) {

printf("Factorial is not defined for negative numbers.\n");

} *else* {

printf("The factorial of %d is %lld\n", num, factorial(num));

}

*break*;

*case* 2:

*// Generate the nth Fibonacci number*

printf("Enter the position (n) of the Fibonacci number: ");

scanf("%d", &num);

*if* (num < 0) {

printf("Fibonacci is not defined for negative positions.\n");

} *else* {

printf("The %dth Fibonacci number is %d\n", num, fibonacci(num));

}

*break*;

*default*:

printf("Invalid choice. Please select 1 or 2.\n");

}

*return* 0;

}

OUTPUT:-

Choose an operation:

1. Calculate the factorial of a number

2. Generate the nth Fibonacci number

Enter your choice (1 or 2): 1

Enter a number to calculate its factorial: 6

The factorial of 6 is 720

**Program 8 :**

Problem Statement :   
Create a C program to perform various file operations, including reading from a file,

writing to a file, and displaying the contents of a file.

*#include* <stdio.h>

*#include* <stdlib.h>

void writeToFile(const char \**filename*) {

FILE \*file = fopen(filename, "w"); *// Open file in write mode*

*if* (file == NULL) {

printf("Error opening file for writing.\n");

*return*;

}

char text[1000];

printf("Enter the text you want to write to the file (press Enter to finish):\n");

getchar(); *// Consume newline from previous input*

fgets(text, sizeof(text), stdin); *// Read text input*

fprintf(file, "%s", text); *// Write to file*

printf("Text written to file successfully.\n");

fclose(file); *// Close the file*

}

void readFromFile(const char \**filename*) {

FILE \*file = fopen(filename, "r"); *// Open file in read mode*

*if* (file == NULL) {

printf("Error opening file for reading. Make sure the file exists.\n");

*return*;

}

char ch;

printf("Contents of the file:\n");

*while* ((ch = fgetc(file)) != EOF) { *// Read character by character*

putchar(ch);

}

printf("\n");

fclose(file); *// Close the file*

}

void appendToFile(const char \**filename*) {

FILE \*file = fopen(filename, "a"); *// Open file in append mode*

*if* (file == NULL) {

printf("Error opening file for appending.\n");

*return*;

}

char text[1000];

printf("Enter the text you want to append to the file (press Enter to finish):\n");

getchar(); *// Consume newline from previous input*

fgets(text, sizeof(text), stdin); *// Read text input*

fprintf(file, "%s", text); *// Append to file*

printf("Text appended to file successfully.\n");

fclose(file); *// Close the file*

}

int main() {

char filename[100];

int choice;

*// Ask the user for the file name*

printf("Enter the file name: ");

scanf("%s", filename);

*do* {

*// Display menu*

printf("\nFile Operations Menu:\n");

printf("1. Write to a file\n");

printf("2. Read from a file\n");

printf("3. Append to a file\n");

printf("4. Exit\n");

printf("Enter your choice: ");

scanf("%d", &choice);

*switch* (choice) {

*case* 1:

writeToFile(filename);

*break*;

*case* 2:

readFromFile(filename);

*break*;

*case* 3:

appendToFile(filename);

*break*;

*case* 4:

printf("Exiting program.\n");

*break*;

*default*:

printf("Invalid choice. Please try again.\n");

}

} *while* (choice != 4);

*return* 0;

}

*/\**

*OUTPUT:-*

*Enter the file name: it1.txt*

*File Operations Menu:*

*1. Write to a file*

*2. Read from a file*

*3. Append to a file*

*4. Exit*

*Enter your choice: 1*

*Enter the text you want to write to the file (press Enter to finish):*

*writing on this file using file handling*

*Text written to file successfully.*

*File Operations Menu:*

*1. Write to a file*

*2. Read from a file*

*3. Append to a file*

*4. Exit*

*Enter your choice: 2*

*Contents of the file:*

*writing on this file using file handling*

*File Operations Menu:*

*1. Write to a file*

*2. Read from a file*

*3. Append to a file*

*4. Exit*

*Enter your choice: 4*

*Exiting program*

*\*/*