Date

Expt. No. 1

Page No. 1

Experiment 1 - Installation of C on Windows

Objective → To install and setup C programming environment on a windows operating system using the GCC compiler via MINGW.

Procedure →

Step 1 → Download MINGW (minimalist GNU for windows)

Step 2 → Install MINGW

① Run downloaded mingw-get-setup.exe file

② Click install and choose a directory

③ Install, the MinGW Installation Manager

Step 3 → Install GCC compiler

① In the MinGW Installation Manager, select :-

- mingw32-base
- mingw32-gcc-g++
- mingw32-gcc

② Click "Apply Changes" in the installation menu.

③ Wait for the packages to download and install.

Step 4 → Add MinGW to System PATH

① Open Control Panel > System and Security > System > Advanced System settings

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② Click "Environment Variables"

③ Under System variables, find "Path", click "Edit", then "New"

④ Add the MinGW bin directory (eg. C:\MinGW)

⑤ Click OK to save changes

Step 5 → Verify Installation

① Open Command Prompt (Win+R, type cmd, press enter)

② Type:
gcc --version
Write a programme to print hello

⇒ The programme executed successfully

Observation:
The GCC compiler successfully compiles the C program.

The executable (hello.exe) runs without errors, displaying the output.

1. Write a C program to print "Hello world"

```
# include <stdio.h>
int main() {
    printf("Hello world!");
    return 0;
}
```

// Code executed successfully

2. Write a C program to print the address in multiple lines (new lines)

```
# include <stdio.h>
int main() {
    printf("Line 1\n");
    printf("Line 2\n");
    printf("Line 3\n");
    return 0;
}
```

3. Write a program that prompts the user to input their age and name

```
# include (stdio.h)
int main(){
    int a;
    printf("Enter your age : ");
```

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```
    scanf("%d", &a);
    return 0;
}
```

4. C program to add 2 numbers

Experiment 2.1 ⇒ Write a C program to calculate the area and perimeter of a rectangle based on its length and width.

```
#include<stdio.h>
int main(){
    int a, b, sum;
    printf("enter first num\n");
    scanf("%d", &a);
    printf("enter second num\n");
    scanf("%d", &b);
    sum = a+b;
    printf("your sum is %d", sum);
```

Date

Expt. No. 3

Page No. 6

Experiment 3

Q) WAP to check if a triangle is valid or not. If their validity is established, check if the triangle is isosceles, equilateral right angle, or scalene.

```
# include <stdio.h>

int main(){
float a,b,c;

printf("Enter side a: ");
scanf("%f",&a);
printf("Enta side b: ");
scanf("%f",&b);
printf("Enter side c:");
scanf("%f",&c);
 if(a==b&&b==c){
   printf("It is an equilateral triangle.\n");
 }
 else if(a==b||b==c||a==c){
 printf("It is an isosceles triangle\n");
 }

 else if((a*a)=(b*b)+(c*c)||(b*b)=(a*a)+(c*c)||(c*c)
        =(a*a)+(b*b))

 {
   printf("Triangle is right angled");
 }
  else {
```

Teacher's Signature

```
        printf("Triangle is scalene");
    }
    return 0;
}
```

OUTPUT :

a = 3
b = 4
c = 5

Triangle is right angled.

Date _____

Expt. No. 4 Page No. 8

Experiment 4

q) WAP to compute the BMI index of the person and print the BMI value.

```
#include <stdio.h>
int main(){
  float w,h,b;
  printf("Enter weight in kg :");
  scanf("%f",&w);
  printf("Enterheight in meters:");
  scanf("%f",&h);
  b = w/(h*h);
  printf("Your bmi is %2f\n",b);
if (bmi<15){
  printf("category :Starvation\n");
}
  else if (bmi>=15.1 && bmi<=17.5){
    printf("category: Anorexic");
}
  else if (bmi>=17.6 && bmi<= 18.5){
    printf("category : underweight"); }
  else if (bmi>=18.6 && bmi<=24.9){
    printf("Category :Ideal"); }
  else if (bmi>=30 && bmi<=39.9){
    printf("category:obese");
  }
  else if (bmi>=40.0){
    printf("category : Morbidly Obese");
  }
```

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```
    else {
        printf("Category : Unspecified");
    }
    return 0;
}
```

Output:

Enter weight in kg : 70
Enter height in meters : 1.75
Your BMI is : 22.86
Category : Ideal

Date _____

Expt. No. 5

Page No. 10

Experiment 5

WAP to check if 3 points are collinear or not

```
#include <stdio.h>
int main(){
float x1,y1,y2,x2,x3,y3;
printf("enter x & y:");
scanf("%f %f",&x1,&x2);
printf("enter x2 and y2:");
scanf("%f %f",&x2,&y2);
printf("enter x3 & y3:");
scanf("%f %f",&x3,y3);
if((y2-y1)*(x3-x2)==(y3-y1)*(x2-x1)
  {
    printf("the points are collinear");
  }
else{
    printf("points are not collinear");
  }
return 0;
}
```

OUTPUT:

$x_1 = 1, y_1 = 2$

$x_2 = 2, y_2 = 4$

$x_3 = 3, y_3 = 6$

The points are collinear

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OPERATORS

q) Program to calculate area and perimeter of rectangle

ans
```
# include <stdio.h>
int main () {
    float l, w;
    printf (" Enter length and width: ");
    scanf (" %f %f, &l &w);
    printf (" Area = %2f \n", l * w);
    printf (" Perimeter = %2f \n", 2(l+w));
    return 0;
}
```

q) Program to convert temperature in celsius to fahrenheit

ans
```
# include <stdio.h>
int main () {
    float c, f;
    printf (" Enter celsius temperature: ");
    scanf ("%f", &c);
    f = ( c * 9/5) +32;
    printf (" Temperature is: %2f \n", f);
    return 0;
}
```

Teacher's Signature

Date _____

Expt. No. 4

Page No. 12

Q) Write a C program to add 2 numbers.

```
#include <stdio.h>
int main()
{
    int a, b, sum;
    printf("Enter first num \n");
    scanf("%d", &a);
    printf("Enter second number \n");
    scanf("%d", &b);
    sum = a+b;
    printf("sum of 2 numbers %d", sum);
    return 0;
}
```

Teacher's Signature _____

Date _____

Expt. No. _____ Page No. 13

Experiment 6

Q) Write a C program on Bitwise operator - OR, AND or NOT

```
# include <stdio.h>
int main()
{
    int a = 12;
    int b = 7;
    printf ("Bitwise a or b is %d \n", a|b);
    printf("Bitwise a and b is %d \n", a&b);
    printf ("Bitwise not of a is %d \n", ~a);
```

OUTPUT :-

Bitwise a or b is 15
Bitwise a and b is 4
Bitwise not of a is -13

Q) Write a C program on left shift and right shift operator.

```
# include <stdio.h>
int main()
{
    int a = 5;
    int b = 7;
    printf ("Right shift operator of a %d \n", a>>1);
    printf ("Right shift operator of a %d \n", a>>2);
    printf ("Left shift operator of a %d \n", a<<1);
```

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```
    printf("Left shift operator of a %d \n", a<<2);
    return 0;
}
```

OUTPUT:

Right shift operator of a = 2
Right shift operator of a = 1
Left shift operator of a = 10
Left shift operator of a = 20.

Q) According to the Gregorian calendar, it was monday on the date 01/01/01. If any year is input through the program, find what day it was for other years.

Ans.

```
#include <stdio.h>
int main()
{
    int year, i, day = 1;
    printf("Enter year:");
    scanf("%d", &year);
    for (i=1; i<year; i++)
    {
        if ((i%400==0)||(i%4==0&&i%100!=0))
            day += 2;
        else {
            day += 1;
```

Teacher's Signature _____

```
}
day = day%7;
switch (day) {
case 0: printf("Day on 1st Jan %d: Sunday \n", year);
case
```

Experiment - Loops

Q) WAP to enter the numbers till the user wants. At the end, it should display the count of positive, negative and zeroes entered

Ans
```
#include <stdio.h>
int main()
{
    int limit, num, zero=0, pos=0, neg=0;
    printf("Enter the limit of numbers:");
    scanf("%d", &limit);
    printf("Enter the numbers:");
    for(int i=1; i<=limit; i++)
    {
        scanf("%d", &num);
        if(num>0) {
        pos++;
        else if
            neg++;
        else
            zero++;
    }
    printf("zeroes=%d\n", zero);
    printf("positive=%d\n", pos);
    printf("Negative=%d\n", neg);
}
    return 0;
}
```

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9) WAP to print the multiplication table of the number ~~to~~ entered by the user.

```
#include <stdio.h>
int main()
{
    int num;
    printf("Enter the number: ");
    scanf("%d", &num);
    printf("\n Multiplication table of %d; \n", num);
    for(i=1; i<=10; i++)
    {
        printf("%d * %d = %d \n", num, i, num*i);
    }
    return 0;
}
```

OUTPUT:

Enter the number: 5
Multiplication table of 5

5 * 1 = 5
5 * 2 = 10
5 * 3 = 15
5 * 4 = 20
5 * 5 = 25
5 * 6 = 30
5 * 7 = 35
5 * 8 = 40
5 * 9 = 45
5 * 10 = 50

Teacher's Signature _____

Expt. No. _____ Date _____

Page No. 18

Q) WAP to generate the following set of output :

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

Ans
```
#include <stdio.h>
int main()
{
  int n;
  printf("enter number of rows : ");
  scanf("%d", &n);
  int num = 1;
  for (int i = 1; i <= n; i++)
  {
    for (int j = 1; j <= i; j++)
    {
      printf("%d", num);
      num++;
    }
    printf("\n");
  }
  return 0;
}
```

OUTPUT :

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

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Q) Printf :-

```
    1
   1 1
  1 2 1
 1 3 3 1
1 4 6 4 1
```

Ans

```
# include <stdio.h>
int main()
{
  int n;
  printf("Input the number of rows:");
  scanf("%d",&n);
  for(int i=0; i<n; i++)
  {
    long coeff=1;
    for(int j=0; j<=i; j++)
    {
      printf("%6d", coeff);
      coeff = coeff * (i-j)/(j+1);
    }
    printf("\n");
  }
  return 0;
}
```

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Q) The population of a town is 100000. The population has increased steadily at the rate of 10% per year for the last 10 years. WAP to determine the population at the end of each year in the last decade.

Ans.
```
# include <stdio.h>
int main()
{
    double current_pop = 100000.0;
    double growth_rate = 0.10;
    printf("Population for each year of the last 10 years: \n");
    for(int year = 10; year >= 1; year--);
    {
      current_pop = current_pop / (1.0 + growth_rate);
      printf("Population %2d years ago: %6.0f \n", year,
                                                  current_pop);
    }
    return 0;
}
```

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Experiment - Arrays

Q) WAP to read a list of integers and store it in a single dimensional array. WAP to find the second largest integer :"

```
# include <stdio.h>
# include <limit.h>
int main()
{
  int n;
  printf ("Enter the number of elements in list:");
  scanf ("%d", &n);
  int arr[n];
  printf("enter %d integers :\n", n);
  for (int i=0; i<n; i++)
  {
    printf ("element %d:", i++);
    scanf ("%d", &arr[i]);
  }
  int largest = INT_MIN;
  int largest2 = INT_MIN;
  for (int i=0, i<n; i++)
  {
    if (arr[i] > largest)
    {
      largest2 = largest
      largest = arr[i]
    }
```

```
    else if ( arr[i] > largest2 && arr[i] != largest)
    {
        largest2 = arr[i];
    }
}
    if ( largest2 == INT_MIN)
    {
        printf(" There is no distinct second largest number:");
    }
    else
    {
        printf (" second largest number is :%d \n" , largest2);
    }
        return 0;
}
```

OUTPUT:

```
enter the number of elements in list : 5
Enter 5 integers
element 1 : 1
element 2 : 2
element 3 : 3
element 4 : 4
element 5 : 5
Second largest number is : 4
```

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q2) WAP to read a list of integers and store it in a single dimension array : WAP to count and display positive, negative, odd and even numbers in an array.

Ans.
```
# include <stdio.h>
int main()
{
int n, pos=0, neg=0, even=0, odd=0;
printf("Enter the limit :");
scanf("%d",&n);
int arr[n];
printf("Enter the numbers :");
for(int i=0; i<n; i++)
{
  scanf("%d",&arr[i]);
}
  for(int i=0; i<n; i++)
  {
   if(arr[i]>0)
   pos++;
   else if(arr[i]<0)
   neg++;
   if(arr[i]%2==0)
   even++;
   else
   odd++;
  }
```

```
printf("Positive = %d \n", pos);
printf("Negative = %d \n", neg);
printf("Even = %d \n", even);
printf("Odd = %d \n", odd);
}
return 0;
}
```

9) WAP to read list of integers and store it in a single dimensional array. WAP to find frequency of a particular number in a list of integers

```
#include <stdio.h>
int main()
{
  int n, search_num, count = 0;
  printf("Enter the number of elements:");
  scanf("%d", &n);
  int arr[n];
  printf("Enter the numbers:");
  for(int i = 0; i < n; i++)
  {
    scanf("%d", &arr[i]);
  }
  printf("Enter the no to find its frequency:");
  scanf("%d", &search_num);
```

```
for (int i=0; i<n; i++)
{
  if (ar[i] == search_num)
    count++;
}
printf("The number %d appears %d times in array\n",
                search_num, count);
}
return 0;
}
```

Experiment - Functions

Q1) Develop a recursive function fact(num) to find the factorial of number n! defined by fact(n) = 1;

Ans
```
# include <stdio.h>
int fact (int a)
{
  int fact = 1
  for(int i = 1; i<= a; i++)
  {
    fact = fact * i;
  }
    return fact;
  }
    int main()
    {
      int a;
      printf (" enter values of a:");
      scanf ("%d", &a);
      int b = fact(a);
      printf ("Factorise = %d", b);
  }
```

q2) Develop a recursive function GCD(num1, num2) that accepts two integers arguments. WAP that this function to find the GCD of 2 given integers.

Ans.
```
# include <stdio.h>
int gcd(int a, int b)
 {
    if (b==0)
    return a;
    else
    return gcd(b, a%b);
 }
int main()
{
  int a,b;
  printf("Enter the number:");
   scanf("%d %d", &a, &b);
   int c = gcd(a,b);
   printf("Greatest Common Divisor = %d", c);
}
  return 0;
}
```

Teacher's Signature

Expt. No. _____ Date _____

Page No. 28

Q3) Develop a recursive function fibo(num) that accepts an integer argument. WAP that invokes this function to generate the fibonacci sequence upto num.

Ans.
```
# include < stdio.h>
int fibo ( int num)
{
  if (num == 0)
  return 0;
  if ( num == 1)
   return 1;
   else
   return fibo (num - 2) + fibo (num - 1);
}
int main()
{
  int num;
  printf(" enter the number :");
  scanf(" %d ", & num);
  for (int i = 0; i <= num ; i ++)
   {
     int t = fibo (i)
     printf (" %d ", t);
   }
}
```

Teacher's Signature _____

9) Develop a C function isPrime(num) that accepts an integer argument and returns 1 if the argument is Prime, a 0 otherwise. WAP that invokes this function to generate prime no's between the given ranges.

```
# include <stdio.h>
int isPrime (int num)
{
  int i;
  if (num <= 1)
  return 0;
  for (i = 1; i <= num; i++)
  {
    if (num % i == 0)
      return 0;
      else
      return 1;
  }
}
int main()
{
  int lower, upper, i;
  printf ("Enter lower limit :");
  scanf ("%d", &lower);
  printf ("Enter the upper limit :");
  scanf ("%d", &upper);
  printf ("Prime no's are :");
```

```
for (i = lower ; i <= upper ; i++)
{
  if (isPrime(i))
  {
    printf ("%d", i);
  }
printf ("\n");
}
```

Experiment - Pointers

q) Declare different pointer int, float, char and initialize them with addresses. Print values of both pointers and variables they point to.

Ans.
```
# include < stdio.h>
void main()
{
  int a=10;
  float b = 5.25;
  char b = 'A';
  int * pte 1 =21a;
  float * pte 2 =21b;
  float * pte 3 =21c;
  printf ("Values of variables :\n");
  printf ("a =%d", a);
  printf ("b =%df \n", b);
  printf ("c =%c \n\n", c);
  printf ("Address stored in pointers :\n");
  printf ("pte 1 = %p\n", pte 1);
  printf ("pte 2 =%p\n", pte 2);
  printf ("pte 3 = %p \n\n", pte 3);
  printf ("Values accessed using pointers :\n");
  printf ("* pte 1 = %d \n", * pte 1);
  printf ("* pte 2 = %2f.\n", * pte 2);
  printf ("* pte 3 = %2f. \n", * pte 3);
```

Teacher's Signature _____

q2) Perform pointer arithmetic i.e increment and decrement on pointers of different data types observe how the memory addresses change and the effect on data access.

Ans.

```
#include <stdio.h>
void main()
{
int a=10;
float b=5.5;
char c='x';
int *p1=&a;
float *p2=&b;
char *p3=&c;
printf("Initial pointer address:\n");
printf("p1=%p\n",p1);
printf("p2=%p\n",p2);
printf("p3=%p\n\n",p3);
p1++;
p2++;
p3++;
printf("After incrementing pointers:\n");
printf("p1=%p\n",p1);
printf("p2=%p\n",p2);
printf("p3=%p\n",p3);
p1--;
p2--;
p3--;
```

Teacher's Signature

Date _____

Expt. No. _____ Page No. 33

```
printf ("After decrementing pointers : \n");
printf ("p1 = %p \n", p1);
printf ("p2 = %p \n", p2);
printf ("p3 = %p \n", p3);
}
```

Teacher's Signature _____

Date

Expt. No.

Page No. 35

EXPERIMENT : File Handling in C.

1. Write a program to create a new file and write text into it.

```
#include <stdio.h>
int main() {
FILE *fp = fopen("sample.txt", "w");
fprintf(fp, "This is a test file");
fclose(fp);
return 0;
}
```

Teacher's Signature

2. Open an existing file and read its content characters ... the file.

```
#include <stdio.h>
int main(){
FILE *fp= fopen("sample.txt","r");
char ch;
while((ch= fgetc(fp)) != EOF)
    printf("%c",ch);
fclose(fp);
return 0;
}
```

3. Open a file, read its content line by line, and display each line on the console.

```
# include <stdio.h>
int main(){
FILE *fp = fopen("sample.txt", "r");
  char line[200];
  while(fgets(line, sizeof(line), fp))
      printf("%s", line);
  fclose(fp);
  return 0;
}
```

Date _____

Expt. No. _____ Page No. 37

EXPERIMENT: Dynamic Memory allocation

1. Write a program to create a simple linked list in C using pointers and structure.

```
#include <stdio.h>
#include <stdlib.h>
struct Node {
    int data;
    struct Node * next;
};
int main() {
    struct Node * head = NULL, * newNode, * temp;
    int n, value;
    printf("Enter number of nodes: ");
    scanf("%d", &n);
    for (int i = 0; i < n; i++) {
        printf("Enter value: ");
        scanf("%d", &value);
        newNode = (struct Node *) malloc(sizeof(struct Node));
        newNode -> data = value;
        newNode -> next = NULL;
        if (head == NULL) head = newNode;
        else {
            temp = head;
            while (temp -> next != NULL) temp = temp -> next;
            temp -> next = newNode;
        }
    }
```

Teacher's Signature _____

```
printf ("Linked list:");
temp = head;
while (temp != NULL) {
    printf ("%d -> ", temp -> data);
    temp = temp -> next;
}
return 0;
```

2. Write a program to insert them in middle of linked list.

```
# include <stdio.h>
# include <stdlib.h>
struct Node{
    int data;
    struct Node *next;
};
int main(){
    struct Node *head =NULL, *newNode, *temp;
    int pos, value;
    for( int i=1 ; i<=3; i++){
        newNode = (struct Node*) malloc(sizeof(struct Node));
        newNode->data = i*10;
        newNode->next =head;
        head =newNode;
    }
printf("enter value to insert:");
scanf("%d", &value);
printf("enter position:");
scanf("%d", &pos);
newNode =(struct Node*) malloc(sizeof(struct Node));
newNode->data = value;
temp = head;
for(int i=1; i<pos-1; i++) temp =temp->next;
newNode->next = temp->next;
temp->next =newNode;
```

Teacher's Signature _____

```
printf("Updated list: ");
temp = head;
while(temp != NULL) {
    printf("%d -> ", temp -> data);
    temp = temp -> next;
}
return 0;
}
```

Expt. No. _____ Page No. ☐ Date ☐☐☐☐☐☐

Experiment-12

Q1) Write a program to define some constant variable in preprocessor.

Ans.
```
#include <stdio.h>
#define PI 3.14
#define MAX 100
#define MIN 1

int main()
{
    printf("PI = %2f \n", PI);
    printf("MAX = %d \n", MAX);
    printf("MIN = %d \n", MIN);
    return 0;
}
```

Teacher's Signature _____

Expt. No. _____ Page No. ☐ Date ☐☐☐☐☐☐

Q2) Write a program to define a function in directives

Ans
```
#include <stdio.h>
#define square (z) (z)*(z))
int main()
{
int num=5;
printf("square of %d is %d \n" ; num, square(num));
return 0;
}
```

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Expt. No. _____ Page No. ☐ Date ☐☐☐☐☐☐

Experiment -13

Q) Write a program to define multiple macros to perform arithmetic functions

```
#include <stdio.h>
#define ADD(a,b) ((a)+(b))
#define SUB(a,b) ((a)-(b))
#define MUL(a,b) ((a)*(b))
#define DIV(a,b) ((a)/(b))

int main()
{
    int x=20, y=4;
    printf("Addition = %d\n", ADD(x,y));
    printf("Subtraction = %d\n", SUB(x,y));
    printf("Multiplication = %d\n", MUL(x,y));
    printf("Division = %d\n", DIV(x,y));
    return 0;
}
```

Teacher's Signature _____

Expt. No. _____ Page No. ☐ Date ☐☐☐☐☐☐

Experiment -14

Q) Write a program to write a static library for performing arithmetic function.

arith.h

```
int add (int , int);
int sub (int , int);
int mul (int , int);
int divide (int , int);
```

arith.c

```
int add (int a, int b)
{
   return a+b;
}
int sub (int a, int b)
{
   return a+b;
}
  int sub (int a, int b)
{
    return a-b;
}
```

Teacher's Signature _____

Expt. No. _____ Page No. ☐ Date ☐☐☐☐☐☐

```
int mult (int a, int b)
{
    return a*b;
}
int divide (int a, int b)
{
    return a/b;
}
```

Teacher's Signature _____

Expt. No. _____ Page No. ☐ Date ☐☐☐☐☐☐

9) Write a program to use static library in three program file: main_static.c

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

int main()
{
    int a=10,b=5;
    printf("Add = %d\n", add(a,b));
    printf("Sub = %d\n", sub(a,b));
    printf("MUL = %d\n", mul(a,b));
    printf("Div = %d\n", divide(a,b));
    return 0;
}
```

Compilation

```
gcc main_static -a -I arith -O static_app
```

Run

```
./static_app
```

Teacher's Signature _____

Expt. No. _____ Page No. ☐ Date ☐☐☐☐☐☐

Experiment -15

9) Write a program to create a shared library for performing arithmetic functions.

FILE 1: with - shared.h

```
int add(int ,int);
int sub( int ,int);
int mul(int ,int);
int divide (int ,int);
```

FILE 2: with - shared.c

```
int add (int a, int b)
{
   return a+b;
}
 int sub (int a ,int b)
{
    return a-b;
}
int mul (int a ,int b)
{
     return a*b;
}
```

Teacher's Signature _____

Expt. No. _____ Page No. ☐ Date ☐☐☐☐☐☐

```
int divide (int a, int b)
{
    return a/b;
}
```

Teacher's Signature _____

Expt. No. _____ Page No. ☐ Date ☐☐☐☐☐☐

9) Write a program to use shared library in other program

FILE : main-shared.c

```
# include <stdio.h>
# include "arithmetic-shared.h"

int main()
{
  int a=10, b=5;
  printf("Add = %d\n", add(a,b));
  printf("Sub = %d\n", sub(a,b));
  printf("Mul = %d\n", mul(a,b));
  printf("Div = %d\n", divide(a,b));
  return 0;
}
```

Compilation

gcc main-shared.c -o -l arith -O shared.app

Run

export LD_LIBRARY_PATH = ./shared.app.

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