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Experiment 2	
AIM :	**To learn and understand Static and Dynamic Linking**

Discussion & Output:	**1. Arithmetic.c**
	#include<stdio.h>
	// functions declaration
	int add(int n1, int n2);
	int subtract(int n1, int n2);
	int multiply(int n1, int n2);
	int divide(int n1, int n2);
	// function to add two integer numbers
	int add(int n1, int n2)
	{
	int result;
	result = n1 + n2;
	return result;
	}
	// function to subtract two integer numbers
	int subtract(int n1, int n2)
	{
	int result;
	result = n1 - n2;
	return result;
	}
	// function to multiply two integer numbers
	int multiply(int n1, int n2)
	{
	int result;
	result = n1 * n2;
	return result;
	}
	// function to divide two integer numbers
	int divide(int n1, int n2)
	{

```
int result;
result = n1 / n2;
return result;
}
```

2. log.c

```
# include <stdio.h>
# include <math.h>
double natural_log(int value)
{
return natural_log(value);
}
double log_base_10(int value)
{
return log_base_10(value);
}
```

3. trigo.c

```
# include <stdio.h>
# include <math.h>
double sine(int value){
double key = M_PI*value/180;
return sine(key);
}
double cosine(int value){
double key = M_PI*value/180;
return cosine(key);
}
double tangent(int value){
double key = M_PI*value/180;
return tangent(key);
}
```

4. expo.c

```
# include <stdio.h>
# include <math.h>
double exponential(int value){
return exponential(value);
}
double x_power_y(int x, int y){
```

return x_power_y(x, y);
}

5. fact.c

```
# include <stdio.h>
int fact(int y){
if (y == 0)
return 1;
return y * fact(y - 1);
}
```

6. lib_mylib.h

```
#include <math.h>
// Arithmetic Methods
int add(int n1, int n2);
int subtract(int n1, int n2);
int multiply(int n1, int n2);
int divide(int n1, int n2);
// Trigonometric Methods
double sine(int value);
double cosine(int value);
double tangent(int value);
// Logarithmic Methods
double log_base_10(int value);
double natural_log(int value);
// Exponential Methods
double exponential(int value);
double x_power_y(int x, int y);
// Factorial Method
int fact(int y);
```

7.driver.c

```
#include "lib_mylib.h"
#include <stdio.h>
int main() {
int choice;
int n1, n2;
int value;
int x, y;
do {
```

```
printf("\nMenu:\n");
printf("1. Add\n");
printf("2. Subtract\n");
printf("3. Multiply\n");
printf("4. Divide\n");
printf("5. Sine\n");
printf("6. Cosine\n");
printf("7. Tangent\n");
printf("8. Log base 10\n");
printf("9. Natural Log\n");
printf("10. Exponential\n");
printf("11. X to the power of Y\n");
printf("12. Factorial\n");
printf("0. Exit\n");
printf("Enter your choice: ");
scanf("%d", &choice);
switch (choice) {
case 1:
printf("Enter two numbers: ");
scanf("%d %d", &n1, &n2);
printf("Result: %d\n", add(n1, n2));
break;
case 2:
printf("Enter two numbers: ");
scanf("%d %d", &n1, &n2);
printf("Result: %d\n", subtract(n1, n2));
break;
case 3:
printf("Enter two numbers: ");
scanf("%d %d", &n1, &n2);
printf("Result: %d\n", multiply(n1, n2));
break;
case 4:
printf("Enter two numbers: ");
scanf("%d %d", &n1, &n2);
printf("Result: %d\n", divide(n1, n2));
break;
case 5:
printf("Enter an angle in degrees: ");
scanf("%d", &value);
```

```
printf("Result: %lf\n", sine(value));
break;
case 6:
printf("Enter an angle in degrees: ");
scanf("%d", &value);
printf("Result: %lf\n", cosine(value));
break;
case 7:
printf("Enter an angle in degrees: ");
scanf("%d", &value);
printf("Result: %lf\n", tangent(value));
break;
case 8:
printf("Enter a value: ");
scanf("%d", &value);
printf("Result: %lf\n", log_base_10(value));
break;
case 9:
printf("Enter a value: ");
scanf("%d", &value);
printf("Result: %lf\n", natural_log(value));
break;
case 10:
printf("Enter a value: ");
scanf("%d", &value);
printf("Result: %lf\n", exponential(value));
break;
case 11:
printf("Enter base (x) and exponent (y): ");
scanf("%d %d", &x, &y);
printf("Result: %lf\n", x_power_y(x, y));
break;
case 12:
printf("Enter a number: ");
scanf("%d", &y);
printf("Result: %d\n", fact(y));
break;
case 0:
printf("Exiting program. Goodbye!\n");
break;
```

```
default:
printf("Invalid choice. Please try again.\n");
}
} while (choice != 0);
return 0;
}
```

Static Linking:

```
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c arithmetic.c -o arithmetic.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c log.c -o log.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c expo.c -o expo.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c trigo.c -o trigo.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c fact.c -o fact.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ ar rcs lib_mylib.a arithmetic.o log.o fact.o trigo.o expo.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c driver.c -o driver.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -o driver driver.o -L. -l_mylib
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ ./driver
```

```
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ ./driver

Menu:
1. Add
2. Subtract
3. Multiply
4. Divide
5. Sine
6. Cosine
7. Tangent
8. Log base 10
9. Natural Log
10. Exponential
11. X to the power of Y
12. Factorial
0. Exit
Enter your choice: 12
Enter a number: 3
Result: 6

Menu:
1. Add
2. Subtract
3. Multiply
4. Divide
5. Sine
6. Cosine
7. Tangent
8. Log base 10
9. Natural Log
10. Exponential
11. X to the power of Y
12. Factorial
0. Exit
Enter your choice: 1
Enter two numbers: 28 9
Result: 37
```

Dynamic Linking:

```
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c arithmetic.c -fPIC -o arithmetic.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c trigo.c -fPIC -o trigo.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c log.c -fPIC -o log.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c fact.c -fPIC -o fact.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c expo.c -fPIC -o expo.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -shared -o libmath.so arithmetic.o trigo.o log.o fact.o expo.o
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ export LD_LIBRARY_PATH=$PWD:$LD_LIBRARY_PATH
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -c driver.c
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ gcc -o driver driver.o libmath.so -lm
students@CE-Lab4-606-U03:~/Desktop/Manish/os_exp2$ ./driver

Menu:
1. Add
2. Subtract
3. Multiply
4. Divide
5. Sine
6. Cosine
7. Tangent
8. Log base 10
9. Natural Log
10. Exponential
11. X to the power of Y
12. Factorial
0. Exit
Enter your choice: 3
Enter two numbers: 13 2
Result: 26
```

```
Menu:
1. Add
2. Subtract
3. Multiply
4. Divide
5. Sine
6. Cosine
7. Tangent
8. Log base 10
9. Natural Log
10. Exponential
11. X to the power of Y
12. Factorial
0. Exit
Enter your choice: 4
Enter two numbers: 10 2
Result: 5
```

```
Menu:
1. Add
2. Subtract
3. Multiply
4. Divide
5. Sine
6. Cosine
7. Tangent
8. Log base 10
9. Natural Log
10. Exponential
11. X to the power of Y
12. Factorial
0. Exit
Enter your choice: 12
Enter a number: 5
Result: 120
```

CONCLUSION:	Hence by completing this experiment I came to know about static linking and dynamic linking.