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SUBMISSION DATE:- 2080/09/11

DSA LAB SHEET NO. 3

TITLE:- IMPLEMENTATION OF RECURSION ALGORITHMS

THEORY:-

Recursion:- Recursion is a method of solving a computational problem where the solution depends on solutions to smaller instances of the same problem.

1. Factorial using recursion

PROGRAM CODE:-

```
#include<stdio.h>
long long fact(int a) // to insert higher integer number
{
   if(a==0){return 1;}
   else {return a*fact(a-1);}
}
int main()
{
   int n;
   while(n>=0)
   {
   printf("Enter the number to obtain the factorial:-");
   scanf("%lld",&n);
   printf("Factorial calculated of %d is:- %lld\n",n,fact(n));
   }
   return 0;
}
```

OUTPUT:-

```
Enter the number to obtain the factorial:-10
Factorial calculated of 10 is:- 3628800
Enter the number to obtain the factorial:-15
Factorial calculated of 15 is:- 1307674368000
Enter the number to obtain the factorial:-20
Factorial calculated of 20 is:- 2432902008176640000
Enter the number to obtain the factorial:-
```

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2. n^{th} Fibonacci term using recursion

PROGRAM CODE:-

```
#include<stdio.h>
int fibo(int a)
{
   if(a==1||a==2)
   return 1;
   else
   return fibo(a-1)+fibo(a-2);
}
int main()
{
   int n=1;
   while(n){
   printf("Enter the place of Fibonacci number:-");
   scanf("%d",&n);
   printf("The Fibonacci number in palce %d is:- %d\n",n,fibo(n));
   }
   return 0;
}
//this program is not suitable for higher term so concept of memoization is used.
```

OUTPUT:-

```
Enter the place of Fibonacci number:-4
The Fibonacci number in palce 4 is:- 3
Enter the place of Fibonacci number:-7
The Fibonacci number in palce 7 is:- 13
Enter the place of Fibonacci number:-16
The Fibonacci number in palce 16 is:- 987
Enter the place of Fibonacci number:-19
The Fibonacci number in palce 19 is:- 4181
Enter the place of Fibonacci number:-35
The Fibonacci number in palce 35 is:- 9227465
Enter the place of Fibonacci number:-40
The Fibonacci number in palce 40 is:- 102334155
Enter the place of Fibonacci number:-
```

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3. Tower of Hanoi problem using recursion

PROGRAM CODE:-

```
#include <stdio.h>
void TOH(int n, char src, char dest, char temp)
{
   if (n == 1)
      printf("Move disk %d from '%c' to '%c'\n", n, src, dest);
   else
   {
      TOH(n - 1, src, temp, dest);
      printf("Move disk %d from '%c' to '%c' \n", n, src, dest);
      TOH(n - 1, temp, dest, src);
   }
}
int main()
{
   int n;
   printf("Enter number of disk:- ");
   scanf("%d", &n);
   TOH(n, 'A', 'C', 'B');
   return 0;
}
```

OUTPUT:-

```
Enter number of disk:- 3
Move disk 1 from 'A' to 'C'
Move disk 2 from 'A' to 'B'
Move disk 1 from 'C' to 'B'
Move disk 3 from 'A' to 'C'
Move disk 1 from 'B' to 'A'
Move disk 2 from 'B' to 'C'
Move disk 1 from 'A' to 'C'
```

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4. Greatest Common Divisor using recursion

PROGRAM CODE:-

```
//Greatest common divisor is also highest common factor
#include <stdio.h>
int gcd(int n1, int n2)
{
   if (n2 == 0)
      return n1;
   else
      return gcd(n2, n1 % n2);  //gcd(n2,remainder of n1/n2) using Euclidean
algorithm
}
int main()
{
   int num1, num2;
   printf("Enter 1st number to find G.C.D:- ");
   scanf("%d", &num1);
   printf("Enter 2nd number to find G.C.D:- ");
   scanf("%d", &num2);
   printf("G.C.D of %d and %d is %d.", num1, num2, gcd(num1, num2));
   return 0;
}
```

OUTPUT:-

```
Enter 1st number to find G.C.D:- 2080
Enter 2nd number to find G.C.D:- 1560
G.C.D of 2080 and 1560 is 520.
```

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5. Factorial using Tail recursion.

PROGRAM CODE:-

```
//tailed factorial
#include<stdio.h>
long tailFact(int n,long a)//a is accumulator
{
   if(n==0||n==1){return a;}//returns 1
   else {return tailFact(n-1,a*n);}//task stacking is eliminated drastically
}
int main()
{
   int n;
   while(n>=0){
   printf("Enter the number to obtain the factorial:-");
   scanf("%ld",&n);
   printf("Factorial calculated of %d is:- %ld\n",n,tailFact(n,1));}
   return 0;
}
```

OUTPUT:-

```
Enter the number to obtain the factorial:-16
Factorial calculated of 16 is:- 2004189184
Enter the number to obtain the factorial:-15
Factorial calculated of 15 is:- 2004310016
Enter the number to obtain the factorial:-14
Factorial calculated of 14 is:- 1278945280
Enter the number to obtain the factorial:-13
Factorial calculated of 13 is:- 1932053504
Enter the number to obtain the factorial:-
```