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Lab 6 - In Lab Assignment

Due end of the lab session

Acknowledge your collaborators or source of solutions, if any. **Submission by the end of the LAB is required.** Please type your answers, handwritten submission will not be accepted. Do all of the following. A subset of your solutions will be graded.

1. Write two use cases (usage scenarios) of Recursion.

It is method of solving problem where solution of larger problem depends upon same problem with smaller input. The recursive function calls itself until base case is true. It solves complex by solving smaller instance of large problems.

The two uses of recursion are:

- a. We can use it to solve complex problem like Euclid Algorithm to find GCD, solving Tower of Hanoi, finding factorial, finding Fibonacci series etc.
- b. It can also be used in search and sort techniques like Binary search, File system Traversal etc. It increases the efficiency in searching complex data structures. This technique makes our code more compact(short) and readable too.

2. Change the following recursion function into a loop.

Recursive solution

```
int A(int x) {
    if (x<0){
        return 0;
    }
    printf("%d\n",x);
    return A(x-1);
}

int main(){
    A(10);
    return (0);
}
```

Loop Solution

```
#include <stdio.h>

//implementing the solution using loop
int A(int x){
    for(int i = x; i >= 0; i--){
        printf("%d\n",i);
    }
    return 0;
}

int main(){
    //calling the A function
    A(10);
    return 0;
}
```

3. Write a program that prints out the fibonacci numbers for a given n . In mathematical terms, the sequence F_n of Fibonacci numbers is defined by the recurrence relation:

$$F_n = F_{n-1} + F_{n-2}$$

The program should take n as input from the user. Please use recursion in your program.

Example:

Input: Enter the number of terms (n): 10

Output: Fibonacci Series: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34

CODE:

```
//including required libraries
#include <stdio.h>

//function prototype for fibonacci
int fibonacci(int num);

int main(void){
    //initializing the required variables
    int n;
    int output;

    //taking input from the user
    printf("Enter the number of terms(n):");
    scanf("%d",&n);

    //calling the recursive function to find fibonacci
    //printing the nth fibonacci series
    printf("Fibonacci Series:");
    for(int i = 0; i < n - 1; i++){
        output = fibonacci(i);
        printf("%d,",output);

    }
    //to exclude , after last fibonacci term
    printf("%d",fibonacci(n-1));
    printf("\n");

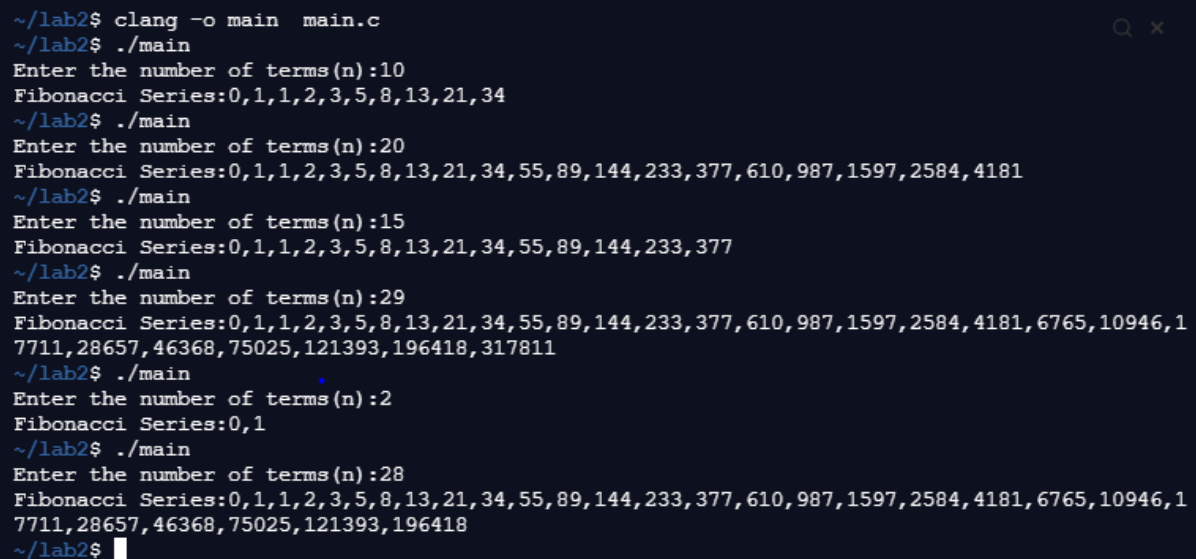
    return 0;
}

/*
NAME: fibonacci
INPUT ARGUMENT: int
RETURN TYPE: int
PRECONDITION: The input number n must be greater than 0.
```

SPECIFICATION: This function takes integer n as input and return nth fibonacci number of the series.

```
*/  
int fibonacci(int num){  
    if (num == 0){  
        return 0;  
    }  
    else if (num == 1){  
        return 1;  
    }  
    else{  
        return fibonacci(num-1) + fibonacci(num - 2);  
    }  
}
```

OUTPUT:



```
~/lab2$ clang -o main main.c  
~/lab2$ ./main  
Enter the number of terms(n):10  
Fibonacci Series:0,1,1,2,3,5,8,13,21,34  
~/lab2$ ./main  
Enter the number of terms(n):20  
Fibonacci Series:0,1,1,2,3,5,8,13,21,34,55,89,144,233,377,610,987,1597,2584,4181  
~/lab2$ ./main  
Enter the number of terms(n):15  
Fibonacci Series:0,1,1,2,3,5,8,13,21,34,55,89,144,233,377  
~/lab2$ ./main  
Enter the number of terms(n):29  
Fibonacci Series:0,1,1,2,3,5,8,13,21,34,55,89,144,233,377,610,987,1597,2584,4181,6765,10946,17711,28657,46368,75025,121393,196418,317811  
~/lab2$ ./main  
Enter the number of terms(n):2  
Fibonacci Series:0,1  
~/lab2$ ./main  
Enter the number of terms(n):28  
Fibonacci Series:0,1,1,2,3,5,8,13,21,34,55,89,144,233,377,610,987,1597,2584,4181,6765,10946,17711,28657,46368,75025,121393,196418  
~/lab2$
```