

Lab-03 Recursive Functions

Task Date: Monday, 17 October 2016

Total Marks: 50

Average expected time for completion: 3 hours

Instructions:

- Do not consult solution and descriptions of your code with your peers.
- In case of cheating and plagiarism a grade F will be awarded to student in particular course.
- Indent your code properly.
- Implement the task in programming language C++.
- Good Luck☺.

Task-1

Implement the following recursive functions: [40]

```
void printMessage(int n)
```

```
//function that print a message n times.
```

```
int factorial(int n)
```

```
// fuction that compute factorial of n.
```

```
int fibonacci(int number)
```

```
//function that compute first n Fibonacci numbers. 0 1 1 2 3 5 8 13 21 34
```

```
float power(float number, int n)
```

```
// function that compute nth power of number.
```

```
int gcf(int a, int b)
```

```
// function that compute greater common factor or GCD of two numbers.
```

```
int sumArray(int arr[], int n)
```

```
// function that compute sum of n sized array.
```

```
int MaxValue(int arr[], int n)
```

```
// function that compute maximum value in n sized array.
```

```
bool Palindrome(string str, int n)
```

```
// function that find either a given string is a palindrome or not.
```



Task-2**Activity: The Tower of Hanoi [10]**

An old legend tells of a Hindu temple where the pyramid puzzle might have been used for the mental discipline of young priests. The legend says that at the beginning of time, the priests in the temple were given a stack of 64 gold disks, each one a little smaller than the one beneath it. Their assignment was to transfer the 64 disks from one pole to another pole, with one important rule: a large disk can never be placed on top of a smaller one. If the priests work very efficiently, day and night, when they shall finish their work, the myth said, the temple would crumble into dust, and the world would vanish. In 1883, Edouard Lucas, a French mathematician, invented a game called the Tower of Hanoi. The game begins with a number of discs, i.e. 3 discs, arranged on first tower. Each disc is smaller than the disc below it. The object is to move all the discs from the starting tower to one of the remaining towers. This game follows following 3 rules:

1. Only one disc can be moved at a time
2. Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e. a disk can only be moved if it is the uppermost disk on a stack
3. A larger disc can never be placed on top of a smaller one. Use the lowest number of possible moves.

The following table records the minimum number of moves required for the number of original discs.

Number of Discs	Number of moves
3	7
4	15
5	31
6	
7	
..	..

With three disks, the puzzle can be solved in seven moves. The minimum number of moves required to solve a Tower of Hanoi puzzle is $2^n - 1$, where n is the number of disks.

1. Play the game with three and five discs. Did you accomplish the game in the minimum moves?
2. Complete the table shown above. Determine a rule for the minimum number of moves.
3. If you make one move every minute, what is the minimum number of minutes it should take to complete a game containing 7 discs?
4. If you make one move every minute, what is the minimum number of days it should take to complete a game containing 15 discs?
5. Working day and night and making one move per second, how long in years would it take the priests to complete the game?

Hint: it would require $(2^n - 1)$ or 18,446,744,073,709,551,615 moves.

6. Write a recursive function for this game having 8 discs.

<http://vornlocher.de/tower.html>

