Assignment 4: Function, Recursion, Strings, and Pointers: C Programming

Demo Assignments

(1) A 5-digit positive integer is entered through the keyboard, write a function to calculate sum of digits of the 5-digit number:
   a. Without using recursion
   b. Using recursion

(2) Compute Fibonacci(n) given N using recursion. Print how many calls are required for obtaining this Nth number in the series?

(3) Write a program to measure the length of a string, which is read from the keyboard and display back the string and its length.

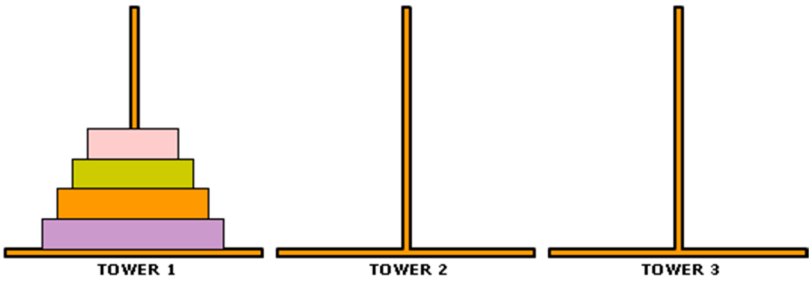
(4) Write a demo example for a **pointer passed to** and a **pointer return by** a function.

(5) Write a demo example for pointer to an array.

Exercise Assignments:

B.1.4.1 Write a program that takes 10 words (strings) from user and sorts elements in lexicographical (dictionary) order. The program will contain a function for sorting (function name **sorting**).

B.1.4.2 Solve the tower of Hanoi problem with N disks (N<7) and 3 towers (T1, T2, T3) using recursion from tower 1 (T1) to tower 3 (T3) as shown in the below figure. Display each and every move. Print how many moves do you have to make to solve a problem of N disks and 3 towers? It will have two function **movement** and **display**.

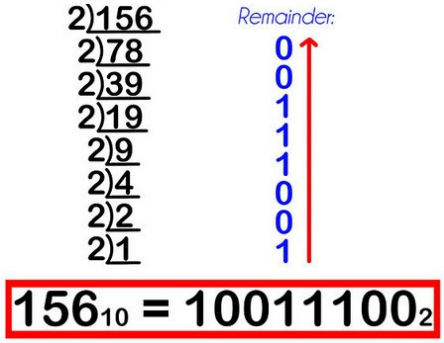


Remember:

1. Only one disk can be moved at a time.
2. Each move consists of taking the upper disk from one of the towers and placing it on top of another tower i.e. a disk can only be moved if it is the uppermost disk on a stack.
3. No disk may be placed on top of a smaller disk.

Extra Point: Attempt an iterative version of the Problem 2.

B.2.4.1 A positive integer is entered through the keyboard, write a function (function name: **binary**) to find the binary equivalent of this number using recursion. For example, if input is 156, then binary value is 10011100.



B.2.4.2 Write a function (function name: **gcd**) to compute the greatest common divisor (GCD) given by Euclid's algorithm, exemplified for **J = 1980, K = 1617** as follows:

1980 / 1617 = 1 1980 – 1 * 1617 = 363
1617 / 363 = 4 1617 – 4 * 363 = 165
363 / 165 = 2 363 – 2 * 165 = **33**
5 / 33 = 5 165 – 5 * 33 = 0

Thus, the greatest common divisor is 33. It will be a recursive solution.

Extra Point: Attempt an iterative version of the Problem 2.

B.3.4.1 N positive integers are entered through the keyboard. Write a function (function name: **prime**) to obtain the prime factors of this number. Also display the distinct prime factors of this number. For example, prime factors of 24 are 2, 2, 2 and 3, whereas prime factors of 35 are 5 and 7. The distinct prime factors of 24 are 2 and 3, whereas 35 are 5 and 7.

B.3.4.2 Write a function (function name: **distance**) to compute the distance between two points and use it to develop another function (function name: **area**) that will compute the area of the triangle whose vertices are A(x1, y1), B(x2, y2), and C(x3, y3). Use these to develop a function functions (function name: **tritest**) which returns a value 1 if the point (x, y) is inside the triangle ABC, otherwise a value 0 for N points, where N points are entered through the keyboard.

Extra Problem 1: Recursive function (function name: **binomial**) to find the value of Binomial Coefficient ${}^{n}C_{r}$ where the boundary conditions are ${}^{n}C_{r} = 1$ if $r=0$ and ${}^{n}C_{r} = 1$ if $r=n$

Extra Problem 2: Write a program to compute the area of a triangle. If the lengths of the sides of a triangle are denoted by a, b, and c, then area of triangle is given by:

$area = \sqrt{S(S-a)(S-b)(S-c)}$ where $S = (a+b+c)/2$.

Write a function to compute *S (function name: **funcS**)*.