CISC106 – Lab 07

This lab is due 07/27/2014 at 11:55 p.m. (submission via Sakai)

- **Please do all of the following problems in one file names lab7.py. This is an individual assignment, please do all work accordingly.**
- **Submit your report and graph for 11th question as a pdf file.**
- **Use comments to separate your program for each problem.**
- **Use design recipe to write functions and test cases. You need to provide at least 3 test cases for each function you implemented.**
- **The problems are worth 90 points + 10 points for attending the lab session.**

Problem 1: (10 points)

a) (3 points) Write a non-recursive function by using a **loop** that gets two numbers (a,b) as parameters and returns a to the power of b.

b) (7 points) Write a recursive function that gets two numbers (a,b) as parameters and returns a to the power of b.

Problem 3: (10 points)

a) (3 points) Write a non-recursive function by using a loop that gets a binary number as a string as a parameter and returns the decimal value of the binary number. So your function should return 3 for input “11”.

b) (7 points) Write a recursive function that gets a binary number as a string as a parameter and returns the decimal value of the binary number. So your function should return 3 for input “11”.

Problem 5: (10 points)

Write a recursive function that gets a string that consists of alphanumeric characters as a parameter (mystr) and returns the string that only consists of characters in mystr. So your function should return “aBc” for input “a2Bc3”.

Problem 6: (5 points)

Write a recursive function that gets a list (mylist) and returns the sum of the odd numbers in mylist.

Problem 7: (5 points)

Write a recursive function that gets a list (mylist) and returns a list that consists of the odd numbers in mylist.

Problem 8: (10 points)

Write a recursive function that gets a number (integer) and returns the sum of the digits of the number.

Problem 9: (10 points)

Write a recursive function that gets a list that consists of numbers and returns the minimum number in the list.

Problem 10: (10 points)

Write a recursive function that gets a nested list as a parameter and returns the sub-list that has minimum difference between its maximum and minimum elements. So your function should return [1,2] for input [[1,199,59], [1,2],[3,8]]. You can use built-in min, max functions.

Problem 11: (20 points)

Comparison of search algorithms:

a) Implement Quicksort, Insertion Sort and Merge Sort algorithms (You can use Internet to find implementations of sorting algorithms).

b) Create lists that consist of random numbers with sizes of 10,100,1000,10000 elements.

c) Sort lists with 3 algorithms and measure run times.

d) Create a graph with list sizes and run times (You can use Excel or a similar program for this).

e) Write your comments about the performances of sorting algorithms.

f) Create a sorted list with increasing order that consists of 1000 elements and run sorting algorithms. Compare the performances of sorting algorithms.

g) Create a sorted list with decreasing order that consists of 1000 elements and run sorting algorithms. Compare the performances of sorting algorithms.