**WIA1002/WIB1002/WXES1117 Data Structure**

**Lab 3**

**Remarks:   
(a) Submit one package for each problem. ZERO mark for other format;**

**(b) Include your name and student ID in the source file as well as the package filename;**

**(c) Submission deadline: 12 March 2016 before 12:00am on Spectrum.**

**Question 1 – Binary search**

Binary search is one of the most efficient ways (logarithmic time complexity) to locate an item in a **sorted list** . The basic steps for searching for the targeted item are:

Step 1. Compute the number of items N in the list .

Step 2. If (N == 0)

// Targeted item is not in the list

// Output message

Step 3. Look at item at position N/2 and call it

Step 4. If ()

Step 5. return position of

Step 6. Else if ()

Step 7. Construct left array and call it *leftL*

Step 8. Goto step (1) using *leftL* as

Step 9. Else // ()

Step 10. Construct right array and call it *rightL*

Step 11. Goto step (1) using *rightL* as

(a) What to do when is an odd number?

(b) What is (are) the base condition(s) case for binary search?

(c) Write a program that reads a sequence of positive numbers from the file “numbers.txt” and perform the following operations:

1. Sort the integers in ascending order using any sorting algorithm. Display the sequence before and after sorting.
2. Perform binary search to find a specific value , where user inputs this value. Print the index (viz., position) of the value if it is found, otherwise inform the user accordingly (i.e., not there). Trace all steps by printing the items considered for comparison.

**Question 2 – (Related to tutorial question)**

The recurrence relation in Tutorial #3 is given by the expression below:

(to be announced during lab.)

Write a recursive method that finds the value , and .

**Question 3 – Binomial expansion**

Recall that

= ,

where can be found recursively using the relation below:

,

with the base cases of . Write a method that performs binomial expression when (i.e., an integer) is input from the user. For example, if the input is , your method should print the following:

(x+y)^3 = 1x^3y^0 + 3x^2y^1 + 3x^1y^2 + 1x^0y^3.

**End of Lab. #3**