Student Name: _____ J#: _____

CSC 323 Algorithm Design and Analysis
Fall 2016
Instructor: Dr. Natarajan Meghanathan

Quiz 3 (Take Home)

Total: 50 points

Due: October 4, 2016 (11.30 AM, in class). Quiz solutions submitted after 11.30 AM will not be accepted. Submit a printed hardcopy in class (with this quiz sheet as a cover page and your name and J# on the top of the sheet).

Note: Strictly, there should NOT be any copying. If the instructor finds that two or more quiz solutions involve some sort of copying, all the concerned students found to be involved in copying will get a zero.

Q1: 25 points) In this quiz, we will define a unimodal array as an array of 'distinct' integers wherein the array is a sequence of monotonically decreasing integers followed by a sequence of monotonically increasing integers. Design a Θ(logn) algorithm to determine the **minimum element** in the unimodal array.

(a) Show the pseudo code of your algorithm.
(b) Justify the correctness of the algorithm.
(c) Analyze the run-time complexity of the algorithm and show that it is Θ(logn).
(d) Show the working of the algorithm (along with the appropriate index values) for three different cases (in each case, the array should be of size at least 10 integers):

i) the array is a sequence of monotonically decreasing integers followed by a sequence of monotonically increasing integers
ii) the array is strictly a sequence of monotonically decreasing integers
iii) the array is strictly a sequence of monotonically increasing integers

Q2: 25 points) Consider a sorted, but rotated array of integers.
For example, the following sorted array

0	1	2	3	4	5	6	7	8	9
2	3	5	8	9	10	14	18	28	30

when rotated three elements to the right becomes:

0	1	2	3	4	5	6	7	8	9
8	9	10	14	18	28	30	2	3	5

Design a Θ(logn) algorithm to search for a given key K in a sorted, but rotated array of integers.

(a) Show the pseudo code of your algorithm.
(b) Justify the correctness of the algorithm.
(c) Analyze the run-time complexity of the algorithm and show that it is Θ(logn).
(d) Show the working of your algorithm for a search key chosen from the above sorted, but rotated array.
(e) Show the working of your algorithm for a search key that is not in the above sorted, but rotated array.