CSC 323 Algorithm Design and Analysis, Fall 2018
Instructor: Dr. Natarajan Meghanathan

Quiz 2 (Take Home) **Total: 50 points**

Due: September 25, 2018 (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 - 10 pts) Solve the following recurrence relation (without using Master Theorem)
$C(n) = C(n/2) + \log n$, for $n > 1$. $C(1) = 0$

Q2 - 20 pts) Two pairs of integers (a, b) and (c, d) are said to be symmetric if b = c and a = d. For example, given an array of pairs { {31, 57}, {80, 90}, {25, 70}, {90, 80}, {70, 25}, {11, 20}, {10, 5}, {30, 40} }, the symmetric pairs are:
{80, 90} and {90, 80}
{25, 70} and {70, 25}

Design a hash table-based algorithm of time complexity $\Theta(n)$ to identify the symmetric pairs in an array of 'n' pairs.
Show the working of your algorithm for the above array of pairs with a hash function H(K) = K mod 7.

Q3 - 20 pts) Develop a recursive version of the Bubble Sort algorithm.
(a) Write the pseudo code of the algorithm and justify that it is recursive and works correctly.
(b) Write the recurrence relation for the algorithm and solve it using one of the two approaches discussed in class, as appropriate. Solve the recurrence relation and show that the time complexity of the recursive algorithm is $\Theta(n^2)$.