MA/CSSE 473 – Design and Analysis of Algorithms

Homework 6B (44 points total) **Updated for Summer, 2017**

Problems for enlightenment/practice/review (not to turn in, but you should think about them):

How many of them you need to do serious work on depends on you and your background. I do not want to make everyone do one of them for the sake of the (possibly) few who need it. You can hopefully figure out which ones you need to do.

4.1.8 [5.1.5]	(insertion sort sentinel)
5.1.12[5.1.10]	(Shell's sort) This may be review from 230. It’s in Weiss Section 8.4
4.2.1 [5.3.1]	(Topological sort examples)
4.2.2 [5.3.2]	(Theoretical properties of topological sort)
5.2.1 [4.2.1]	(quicksort example)
5.2.4 [4.2.4]	(quicksort sentinel)
5.2.6 [4.2.6]	(increasing arrays in quicksort)

Problems to write up and turn in:

1. (6) 3.5.3 [5.2.3] (independence of properties from specific DFS traversals) Explain your answers.

2. (10) 3.5.8a [5.2.8a] (Bipartite graph checking using DFS)

3. (5) 4.1.1 [5.1.1] (Ferrying Soldiers)

Previous questions and answers from Piazza:

Q: I am just wanting to clarify what joint possession means in this problem. Does it mean the boys get the boat back after the soldiers cross? **A:** Both boys must be on the same side of the river, with the boat, when the problem is complete.

4. (5) (not in 3rd) [5.1.9] (binary insertion sort efficiency).

Binary insertion sort uses binary search to find the appropriate position to insert A[i] among the previously sorted A[0] ≤ … ≤ A[I - 1]. Determine the worst-case efficiency class of this algorithm. I.e. get big-Θ time for number of comparisons and number of moves.

Previous questions and answers from Piazza:

Q: For this problem, do you want two big-thetas? One in terms of the number of comparisons, and one in terms of the number of moves (inserting into the array at position x)? **A:** Yes

5. (9) 4.2.6 [5.3.6] (finding dag sources) Be sure to do all three parts.

In the 3rd edition, it says "Prove that a **nonempty** dag must have at least one source." That additional word is necessary!

6. (9) 4.2.9 [5.3.9] (Strongly connected components of a digraph)

Previous questions and answers from Piazza:

Q: It seems that the definition of strongly connected components is separate from the definition of strongly connected. The question is, does a strongly connected component have to contain at least two distinct vertices that there exists a directed path from one to another and back?

A: No, it does not have to have two or more vertices. In some graphs, a strongly connected component could have just one vertex.