Due Date: 11-30-2018 (F), BEFORE the class begins

This assignment covers textbook Chapter 8 and Chapter1~7.

1. Sorting Algorithm Property (25 points)
Exercise 8.3-2, textbook p200

2. Counting Sort, Radix Sort, Bucket Sort (30 points)
Illustrate the execution of each of the following sorting methods on the given input:

(1) COUNTING-SORT (show as in Figure 8.2): A = <5, 0, 5, 2, 0, 8>

(2) RADIX-SORT (show as in Figure 8.3): Exercise 8.3-1, textbook P199.

(3) BUCKET-SORT (show as in Figure 8.4): A = < 0.78. 0.94, 0.21, 0.56, 0.98, 0.71>

3. **Counting Sort, Radix Sort** (25 points)
(1) (15 points) Show how to sort n integers in the range 0 to n^4 -1 in O(n) time.
(2) (10 points) What is the running time if we use Counting Sort? Justify your answer.

4. **Sorting** (20 points)
Exercise 8.4-2, textbook p204

5. **Algorithm Design and Analysis** (**Extra credits:** 30 points)

Suppose that you are given *n* red and *n* blue buckets, all of different shapes and sizes. All red buckets hold different amounts of water, as do the blue ones. For every red bucket, there is a blue bucket that holds the same amount of water, and vice versa. Your task is to find a grouping of the buckets into pairs of red and blue bucket that hold the same amount of water. To do so, you may perform the following operation: pick a pair of buckets in which one is red and one is blue, fill the red bucket with water, and then pour the water into the blue bucket. This operation will tell you whether the red or the blue jug can hold more water, or that they have the same volume. Assume that such a comparison takes one time unit. Remember that you are not allowed to directly compare two red buckets or two blue buckets.

Your goal is to design a randomized algorithm that makes a minimum number of comparisons to determine the grouping. The algorithm's expected number of comparisons should be O(nlgn).

(1) (25 points) Please describe your algorithm clearly or write in **pseudocode** (*use textbook conventions*).
(2) (5 points) What is the worst-case number of comparisons for your algorithm?

Algorithms -- COMP.4040 Honor Statement
(Courtesy of Prof. Tom Costello and Karen Daniels with modifications)

Must be attached to each submission

Academic achievement is ordinarily evaluated on the basis of work that a student produces independently. Infringement of this Code of Honor entails penalties ranging from reprimand to suspension, dismissal or expulsion from the University.

Your name on any exercise is regarded as assurance and certification that what you are submitting for that exercise is the result of your own thoughts and study. Where collaboration is authorized, you should state very clearly which parts of any assignment were performed with collaboration and name your collaborators.

In writing examinations and quizzes, you are expected and required to respond entirely on the basis of your own memory and capacity, without any assistance whatsoever except such as what is specifically authorized by the instructor.

I certify that the work submitted with this assignment is mine and was generated in a manner consistent with this document, the course academic policy on the course website on Blackboard, and the UMass Lowell academic code.

Date: _____

Name (please print): _____

Signature: _____