**Problem Set #1 (Algorithms)**

Department: _____

Student ID: _____

Student Name: _____

For the following problems, consider the bubble sort whose input sequence has $n$ distinct numbers and time complexity for the best case is $O(n)$.

1. For the bubble sort, write your pseudocode with your comments.

2. For the following cases of your pseudocode, find the number of comparisons of adjacent elements. Justify your answers mathematically.
(a) The worst case
(b) The best case

3. For the following cases of your pseudocode, find the running time in Θ-notation. Justify your answers mathematically.
(a) The worst case
(b) The average case

4. To show the results and graphs in Problems 5, 6, and 7, write your program with your comments. Explain your program at least four lines.

5. For the following cases of your program, show the step-by-step results. Explain the results at least four lines.
(a) One example of input sequence for the worst case
(b) One example of input sequence for the best case
(c) One random input sequence

6. For the following cases of your program, draw the graphs for the number of comparisons of adjacent elements versus $n$. Explain the graphs at least four lines.
(a) The worst case
(b) The best case
(c) The average case

7. For the following cases of your program, draw the graphs for the actual running time in your PC versus $n$. Write the basic information about the PC (e.g., CPU, RAM, OS). Explain the graphs at least four lines.
(a) The worst case
(b) The best case
(c) The average case