CS1010E Programming Methodology
Tutorial 7: Searching and Sorting

> Learning is not compulsory…
> neither is survival.
> *~ W. Edwards Deming*

I. Manual tracing

1. You are given the following sorted array:

```
int list[] = {7, 13, 20, 38, 44, 52, 88, 89, 90, 92};
```

For each of the following search keys, trace the change of variables *low*, *high* and *mid* using the binary search algorithm (refer to Week 8 lecture notes page 14 for an example). How many key comparisons are needed for each search key?

(a) **44** (b) **90**

(c) **20** (d) **93**

2. [CS1010 AY2011/2012 Semester 2 Exam, Q2b]

As mentioned in class, the Bubble Sort algorithm can be enhanced. If you detect no swap in a pass, it implies that the array is already sorted by then.

Given an array of integers:

```
int arr[] = {1, 3, 6, 5, 2, 4, 7};
```

We use the following enhanced bubble sort algorithm to sort the data in the array. Show the contents of the array **arr** at the end of each pass.

```
void bubble_sort_enhanced(int arr[], int size) {

  int i, limit, temp;
  int done = 0;

  for (limit = size-2; limit>=0 && !done; limit--) {
    done = 1;
    for (i = 0; i <= limit; i++) {
      if (arr[i] > arr[i+1]) {
        temp = arr[i];
        arr[i] = arr[i+1];
        arr[i+1] = temp;
        done = 0;
      } // end if
    } // end inner for
  } // end outer for
}
```

3. The running time of the enhanced Bubble Sort algorithm as shown in Q2 above is sensitive of the initial order of the data in the array. When does the best case occur? When does the worst case occur?

II. Programming

4. **[Problem Set 3 Exercise #15] Find Pair**

5. **[Problem Set 3 Exercise #16] Find Tuple**

6. **[Problem Set 3 Exercise #17] Sort Three Digits**

7. **Insertion Sort**

   Insertion Sort is another basic exchange sort besides Selection Sort and Bubble Sort. Your tutor will explain the idea of Insertion Sort to you in class.

   Implement Insertion Sort on an integer array.

8. **[Problem Set 3 Exercise #18] Certificate of Entitlement**