

Unit Six Lecture One:

Topic 1: Sorting

To sort means to arrange a list (array) of data elements in ascending or descending order.

Topic 2: Big O Notation

Big O Notation is a convenient shorthand way for computer scientists to show the efficiency of an algorithm.

Topic 3: Quadratic Sorts

Quadratic sorts are sorting algorithms whose Big O notation is $O(n^2)$. This means that when attempting to sort an array with n elements you will visit approximately n^2 array elements to get the job done. This also means that tripling the size of the data set will result in a nine-fold increase in processing time.

Example:	<u>Number of Elements</u>	<u>Processing Time</u>
	10,000	3.5 sec
	1,000,000	> 9 hours

For more information on how the Big O notation was determined for the Selection Sort, see pages 710 - 712 in your text.

Selection Sort - The selection sort algorithm sorts an array by repeatedly finding the smallest element of the unsorted tail region and moving it to the front. Below you will find the code for the selection sort (ascending order).

```
int minPos, temp;

for (int j=0; j<array.length-1; j++)
{
    minPos = j;

    for (int k=j+1; k<array.length; k++)
    {
        if (array[k] < array[minPos])
            minPos = k;
    }

    temp = array[j];
    array[j] = array[minPos];
    array[minPos] = temp;
}
```

Insertion Sort - The insertion sort algorithm sorts an array by keeping the beginning part of the array sorted and inserting each next element into the correct place in it. Below you will find the code for the insertion sort (ascending order).

```
int j, temp;

for (int n=1; n<array.length; n++)
{
    temp = array[n];
    j = n;

    while (j>0 && temp<array[j-1])
    {
        array[j] = array[j-1];
        j--;
    }

    array[j] = temp;
}
```

Although the insertion sort is also a quadratic sort it is slightly more efficient than the selection sort, especially if the array is already partially sorted. However, neither of these sorts is considered efficient. As you will see in the next set of lecture notes, we can dramatically improve the performance of the sorting process by choosing a more sophisticated algorithm.

Topic 4: A Random Number Generator Alternative

First you must import the following package and class.

```
import java.util.Random;
```

Next, in the method where you intend to generate these random numbers you must declare an object of type Random.

```
Random generator = new Random();
```

Lastly, generate the random number and place it's value in a variable.

```
int x = generator.nextInt(1000);           // 0 <= x < 1000
double x = generator.nextDouble() * 1000;
```

Unit 6 Assignment 1: Comparing the Selection & Insertion Sorts