CSE 3010 – Data Structures & Algorithms

Lecture #3

What will be covered today

- What are the different types of algorithms
- What is analysis of algorithm
- What is running time of a program (algorithm)
- How is running time measured

Analysis of algorithms

- Inputs are always of arbitrary length
  - Length of input may be 100,000 at time t1
  - Length of input may be 500,000 at time t2
- Efficiency (or running time) of an algorithm stated as a function of the size of the input
- Complexity of algorithms estimated for very large input dataset
- Complexity of algorithms is estimated in asymptotic sense

Understanding asymptotic

- Determines amount of resources for execution of the algorithm
  - Time
  - Space
- Run time is the time taken when a program is running or executing
- Run time does not include
  - Compile time
  - Link time
  - Load time

Asymptotic behavior

- Is a method to describe 'limiting' behavior

- Describes a function or expression with a defined limit
  - Function may approach this limit as function's input changes but never reaches it

Example:

$$f(n) = n^2 + 3n$$

$f(n)$ is said to be asymptotically equivalent to n^2

$3n$ becomes insignificant

Bubble sort algorithm 1

```
int i, j, temp;
for (i = 0; i < n-1; i++)
    for (j = 0; j < n-i-1; j++)
        if (list[j] > list[j+1]) {
            temp = list[j];
            list[j] = list[j + 1];
            list[j + 1] = temp;
        }
}
```

Bubble sort algorithm 2

```
int i, temp;
bool interchange;
interchange = true;
while (interchange) {
    interchange = false;
    for (i = 0; i < SIZE-1; i++)
        if (list[i] >= list[i+1]) {
            temp = list[i];
            list[i] = list[i+1];
            list[i+1] = temp;
            interchange = true;
        }
}
```