Home Work

CS221: Data Structures and Algorithms

Usman Institute of Technology

Fall 2018

Running Time and Asymptotic Analysis

1. Calculate the running time of the following:

A.

```
for(i = 1; i <= n*n; i=i+1)
        for (j = 1; j <= i; j++)
         print("Hello");
```

B.

```
for(i = 1; i <= n*n; i=i+1)
        for (j = 1; j <= i; j++)
                if( j == 100)
                        break;
```

C.

```
for(i = 1; i <= n; i=i*2)
        for (j = 1; j <= i; j++)
                print("Hello Again");
```

2. Write an algorithm to sum the all integers in the given array. Calculate the running time of the algorithm as well.
3. What do you understand by *rate of growth* or *order of growth*? Why it is important in analysis of an algorithm?
4. Calculate T(n) for Selection Sort algorithm. Also analyze the best and worst cases for Selection Sort.
5. Calculate Ω (lower bound) for different variations of Bubble Sort algorithms as discussed in the class.
6. Rank the following functions according to their growth rate, from slowest growing to fastest growing:
    a. $8n^3$
    b. $n \log n$
    c. 64
    d. $\log n$
    e. $5n$
    f. 2^n
    g. n^2
7. Prove or disprove the following for Big-O:
    a. $f(n) = n + 30, g(n) = n^2 + 3n$
    b. $f(n) = n^2 + 2n - 10, g(n) = n^4$
    c. $f(n) = n^3 * 3n\ , g(n) = 3n - 1$
8. For each of the following pairs of functions, either f(n) is O(g(n)), f(n) is Ω(g(n)), or f(n) = Θ(g(n)). Determine which relationship is correct.
    a. f(n) = log n^2; g(n) = log n + 5
    b. f(n) = n; g(n) = log n^2
    c. f(n) = log log n; g(n) = log n
    d. f(n) = n; g(n) = $\log^2$ n
    e. f(n) = n log n + n; g(n) = log n
    f. f(n) = 10; g(n) = log 10
    g. f(n) = 2^n; g(n) = $10n^2$
    h. f(n) = 2^n; g(n) = 3^n