# L3-Complexity-II

Tuesday, August 11, 2020 12:30 PM

Developing Timing Equation

```
                                                    Operations(Cost)  *  Freq
    //for (i=1 to n step 1)
1.  for (int i=1; i<=n; ++i) {                          c1          n+1
2.     for (int k= 1; k < 1000; ++k){                   c2          n*1000
3.          a = a * k;                                  c3          n*999
4.     }
5.  }
```

$T(n) = c1*(n+1) + c2*(n*1000) + c3*(n*999)$
$= n*(c1+1000*c2+999*c3) + c1$
$= n*c10 + c1$

```
                                                    Operations(Cost)  *  Freq
    //for (i=1 to n step 1)
1.  for (int i=1; i<=n; ++i) {                          c1              n+1
2.     for (int k= 1; k <= n; ++k){                     c2              n*(n+1)
3.          a = a * k;                                  c3              n*n
4.     }
5.  }
```

$T(n) = c1*(n+1) + c2*(n(n+1)) + c3(n*n)$
$= n^2*(c2+c3) + n*(c2+c1) + c1$

```
                                                    Operations(Cost)  *  Freq
    //for (i=1 to n step 1)
1.  for (int i=1; i<=n; ++i) {                          c1              n+1
2.     for (int k= 1; k <= i; ++k){                     c2              (n+3)*n/2
3.          a = a * k;                                  c3              (n+1)*n/2
4.     }
5.  }
```

Following is the way to help find the Frequency of Line 2
Let n=4
When
  i=1,  line 3 executes  1 times
  i=2,  line 3 executes  2 times
  i=3,  line 3 executes  3 times
  i=4,  line 3 executes  4 times
…
  i=n,  line 3 executes  n  times

Adding these numbers gives the frequency of Line 2

2+3+4+…+ (n-1) + (n) +(n+1)  // Arithmetic Series

Sum of Arithmetic Series:  (n/2)*(n+3) =($n^2$ +3n)/2

T(n) = c1*(n+1) + c2*(n*(n+3))/2 + c3*(n*(n+1))/2

= c10($n^2$) + c11n/2

| | operations(Cost) * Freq |
|---|---|
| //for (i=1 to n step 1) | |
| 1. for (int i=1; i<=n; ++i) { | 3 * n+1 |
| 2. for (int k= 1; k <= i; ++k){ | 3 * (n*(n+3))/2 |
| 3. a = a * k; | 2 * n*(n+1)/2 |
| 4. } | |
| 5. } | |