

CCI - Assignment # 1

Question 1 - Prove the tighter bounds of the following.

Prove all the thetas using (halving technique or any way you like). Both find out its lower (Omega) and upper (Big O) bound by the same function so that you can declare it to be theta of the given function.

1. $1^2 + 2^2 + 3^2 + 4^2 + \dots + N^2$
2. $1 + 2 + 3 + 4 + \dots + N^2$
3. $1 + 3 + 5 + 7 + 9 + \dots + (2N + 1)$
4. $2 + 4 + 6 + 8 + \dots + 2N$
5. $1 + 2 + 3 + 4 + \dots + (N/2)$
6. $N/2 + N/4 + \dots + 1 = 1 + 2 + 4 + 8 + 16 + \dots + N/2 = N$ **Hint:** Watch This - https://youtube.com/shorts/m0AdvBZ_CzU
7. $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots = 2$ **Hint:** Watch This - https://youtube.com/shorts/m0AdvBZ_CzU

Question 2 - Compute the Time Complexity

Find the time complexity and the value inside the Sum in terms of tight bound i.e. O and Ω and Θ .

<pre>for(int i = 1; i*i ≤ N*N*N*N; i++) Sum+=i*i;</pre> What is Sum after the loop ends? What is the time complexity?	<pre>for(int i = 1; i ≤ N*N; i += 1) Sum+=i;</pre> What is Sum after the loop ends? What is the time complexity?	<pre>for(int i = 1; i ≤ N; i += 1) Sum+=i*i*i;</pre> What is Sum after the loop ends? What is the time complexity?
<pre>for(int i = 1; i*i ≤ N; i++) Sum+=i*i*i;</pre> What is Sum after the loop ends? What is the time complexity?	<pre>for(int i = 1; i ≤ N; i++) for(int j = 1; j ≤ i; j++) Sum+=i;</pre> What is Sum after the loop ends? What is the time complexity?	<pre>for(int i = 1; i ≤ N; i += 3) for(int j = 1; j ≤ i; j++) Sum++;</pre> What is Sum after the loop ends? What is the time complexity?
<pre>int IntSqrt(int N) { int i; for(i = 0; i*i ≤ N; i++) {} return i; } bool isPrimeStupid(int N) { for(int d = 2; d ≤ IntSqrt(N); d++) if(N % d == 0) return false; return true; } bool isPrimePerfect(int N) { int K = IntSqrt(N); for(int d = 2; d ≤ K; d++) if(N % d == 0) return false; return true; }</pre>		