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CS1D

9/7/16

1. Prove 7n2 + 4n + 1 is O(n2)

**7n2 + 4n + 1 <= Cn2**

**7n2 + 4n + 1 <= (7+4+1)n2**

**7n2 + 4n + 1 <= (12)n2**

**C = 12 no = 1**

2. Prove 7n6 + 8n5 is O(n6)

**7n6 + 8n5 <= Cn6**

**7n6 + 8n5 <= (7+8)n6**

**7n6 + 8n5 <= (15)n6**

**C = 15 no = 1**

3. Prove (n+1)5 is O(n5)

**n5 + 5n4 + 10n3 + 10n2 + 5n + 1 <= Cn5**

**n5 + 5n4 + 10n3 + 10n2 + 5n + 1 <= (1+5+10+10+5+1)n5**

**n5 + 5n4 + 10n3 + 10n2 + 5n + 1 <= (32)n5**

**C = 32 n0 = 1**

4. Prove nis O(nlog(n))

**n <= Cnlog(n)**

**0 <= Clog(n)**

5. Prove nlog(n) is (n)

**nlog(n) >= Cn**

**log(n) >= C**

6. The number of operations executed by algorithm A is 192n5. The number of operations executed by algorithm B is 3n5\*2n. Determine no such that algorithm A is better than algorithm B for nno.

**192n5 > 3n5 \* 2n**

**192 > 3(2n)**

**64 > 2n**

**no < 6**

7. The number of operations executed by algorithm A is 25n3. The number of operations executed by algorithm B is 5n3\*log(n). Determine no such that algorithm A is better than algorithm B for nno.

**25n3 > 5n3 \* log(n)**

**5 > log(n)**

**no­ < 105**

8. **Give the big-Oh characterization in terms of n.**

**Input:** An array A storing n1of integers

**Output:** The sum of the prefix sums in A.

s ← A[0] 1

t ← s 1

for i ← 1 to n − 1 do n

s ← s + A[i] n

t ← t + s n

return t 1

**3n +3 is O(n)**

9. Given an n-element array X, Algorithm A calls Algorithm B on each element X[i]. The B Algorithm runs in O(i) time when it is called on element X[i]. What is the worse-case running time on Algorithm A?

**Algorithm B is O(n)**

**Algorithm A is O(n2)**

10. Order the following functions by asymptotic growth (fastest to slowest) rate: 214, nlog(n), 200n, n7+n3+10, 9n + 10log(n), 6nlog(n) + 2n, 2n ,log(n), n2+10n, 2log(n)

Fastest

**1. n7+n3+10**

**2. n7+n3+10**

**3. n2+10n**

**4. 6nlog(n) + 2n**

**5. nlog(n)**

**6. 200n**

**7. 9n + 10log(n)**

**8. 2log(n)**

**9. log(n)**

**10. 214**

Slowest