Cmpe-300

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1 Introduction

Q2

The pseudocode describes a set of nested loops, and we'll analyze the number of iterations in each loop.

1. The outer loop runs n times (i goes from 1 to n). 2. The middle loop runs i^2 times for each iteration of the outer loop (j goes from 1 to i^2). 3. The innermost loop runs i times for each iteration of the middle loop (k goes from 1 to i).

So, the total number of iterations (a) is given by the sum:

$$a = \sum_{i=1}^{n} \sum_{j=1}^{i^2} \sum_{k=1}^{i} 1$$

$$a = \sum_{i=1}^{n} \sum_{j=1}^{i^2} i$$

$$a = \sum_{i=1}^{n} i \cdot i^2$$

$$a = \sum_{i=1}^{n} i^3$$

$$a = \left(\frac{n(n+1)}{2} \right)^2$$

Now, let's find the worst-case time complexity. The dominant term in the formula is n^4, so the worst-case time complexity is $O(n^4)$. $B(n) = W(n) = A(n) = f(n) \in O(n^4)$

$$\lim_{n \to \infty} \frac{n^4 \cdot 4}{n^2 \cdot (n+1)^2} = \lim_{n \to \infty} \frac{4}{\left(1 + \frac{1}{n}\right)^2} = 4 (constant)$$