

1. The runtime complexity of algorithm mathematically

Let's count the number of basic operations in terms of the input Size 'n'

The algorithm contains the nested loops

The innermost loop contains the operation  $x = x + 1$   
 $(x = x + 1) \Rightarrow$  executed  $n \times n$  times

$$\therefore \text{Sumtime } T(n) = 1 + \sum_{i=1}^n \sum_{j=1}^n 1$$

$$T(n) = 1 + \sum_{i=1}^n \left( \sum_{j=1}^n 1 \right)$$

$\therefore$  inner summation is constant

$$T(n) = 1 + \sum_{i=1}^n n$$

$$T(n) = 1 + n \sum_{i=1}^n 1$$

$$\therefore \sum_{i=1}^n 1 \Rightarrow n$$

$$T(n) = 1 + n \times n$$

$$T(n) = 1 + n^2$$

$\therefore$  Runtime of given algorithm is  $O(n^2)$