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Hands-ON 3

Q1
```
function x = f(n)
    x = 1;
    for i = 1 : n
        for j = 1 : n
            x = x + 1;
```

Find the runtime of the algorithm mathematically.

Ans The outer loop runs from 1 to n, and for each iteration of the outer loop, the inner loop also runs from 1 to n.

Analyzing the number of iterations:

For i = 1, the inner loop runs n times.
i = 2, the inner loop runs n times.
⋮
i = n, the inner loop runs n times.

The total number of iterations of both loops:

$$\Sigma (i = 1 \text{ to } n)\ \{$$

The total number of iterations of both loops :-

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

$$\Rightarrow \left[\sum_{j=1}^{n} 1 = n \right]$$

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

$$\Rightarrow n \times n = n^2$$

The runtime of the algorithm is $O(n^2)$.