DAA - Hands on - 3

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1) Function x = f(n)

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x = 1;
For i = 1:n
For j = 1:n
x = x + 1;
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1. Find the runtime of the Algorithm Mathematically

Functions	Run Time	
x = 1 ;	# 1	$= 1$
For i = 1:n	# n+1	$= \sum_{i=1}^{n+1} 1$
For j = 1:n	# n(n+1)	$= \sum_{i=1}^{n} \sum_{j=1}^{n+1} 1$
x = x+1 ;	# n^2	$= \sum_{i=1}^{n} \sum_{j=1}^{n} 1$

∴ The Runtime would be calculated with the summation Formula :-

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

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

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

$$= 2 + 2n + 2n^2$$

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

The run time For the Algorithm mathematically we got that $T(n) = 2n^2 + 2n + 2$

3) Find Polynomials that are upper and lower bounds on your curve From #2. From this specify a big-O, a big-omega, and what big-theta is

we know that $c_1 = 1/2$, $c_2 = 5$

$$\frac{1}{2} n^2 \leq 2n^2 + 2n + 2 \leq 5n^2$$

From This we derive that the Following notations are:-

$$f(n) = O(n^2)$$

$$F(n) = \Omega(n^2)$$

$F(n) = \Theta(n^2)$

$\therefore$ From This big-O is $O(n^2)$

$\therefore$ From This big Omega is $\Omega(n^2)$

$\therefore$ From This big Theta as $\Theta(n^2)$

4) Find the APProximate (eye ball it) location of "n-0". Do This by zooming in on your Plot & indicating on the Plot where n-0 is & why you Picked this value.

n-0 is 1

$n \geq 2$ is inequality

$\therefore$ The All the values which are greater than or equal to 1.

$n > 1$

$\therefore$ At the Point $x = 1.4$, it states the upper bound is larger than the T(n).

$\therefore$ n-0 = 2 is the integer That T(n) Represents the both bounds.

5) will This increase how long it takes the Algorithm to run

We came to know that

Time

$x = 1;$ $\rightarrow 1$

$y = 1;$ $\rightarrow 1$

For $i = 1:n$ # $n+1$ $\rightarrow \sum_{i=1}^{n} 1$

For $j = 1:n$ # $n(n+1)$ $\rightarrow \sum_{i=1}^{n} \sum_{j=1}^{n} 1$

$x = x+1;$ # n^2 $\rightarrow \sum_{i=1}^{n} \sum_{j=1}^{n} 1$

$y = i+j;$ # n^2 $\rightarrow \sum_{i=1}^{n} \sum_{j=1}^{n} 1$

$$T(n) = 2 + \sum_{i=1}^{n+1} 1 + \sum_{i=1}^{n} \sum_{j=1}^{n+1} 1 + 2 \sum_{i=1}^{n} \sum_{j=1}^{n} 1$$

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

$$= 2 + n + 1 + n^2 + n + 2n^2$$

$$= 3 + 2n + 3n^2$$

$$T(n) = 3n^2 + 2n + 3$$

5) will it effect your results From #1?

Ans No, Overall time complexity will remains Remain same $O(n^2)$, The no. of steps in Functions increases. there is only change in the constant values & not the structure of $T(n)$.