

CMPT 280

ASSIGNMENT 1

NAME : Jeet Agrawal
NSID : jea316
STUDNET ID : 11269096

QUESTION 1

PART	Expression	Most quickly growing term	Big-Oh (tight bound)
a)	$n \log_2 n + n^4 \log_{280} n + 2^n/42$	$2^n/42$	$O(2^n)$
b)	$0.4n^4 + n^2 \log n^2 + \log_2(2^n)$	$0.4n^4$	$O(n^4)$
c)	$4n^{0.7} + 29n \log_2 n + 280$	$29n \log_2 n$	$O(n \log_2 n)$

QUESTION 2

(A)

- 1) False
- 2) False
- 3) True
- 4) True

(B) The Big-Theta notation for:

$$T_A(n) = 1/280n^2 + 42\log n + 12n^3 + 280\sqrt{n} \text{ is } O(n^3)$$

QUESTION 3

PART	Expression	Big-Oh (tight bound)
a)	$O(n^2) + O(\log n) + O(n \log n)$	$O(n^2)$
b)	$O(2^n) \cdot O(n^2)$	$O(2^n n^2)$
c)	$42O(n \log n) + 18O(n^3)$	$O(n^3)$
d)	$O(n^2 \log_2 n^2) + O(m)$	$O(\text{MAX}(n^2 \log_2 n^2, m))$

QUESTION 4

(A)

1) For the first loop inside for there must be n steps and 1 step when it is false. Therefore, $(n+1)$ steps for the inner for loop but the inner loop will run n times because the outer for loop will run n times.

i.e. $n(n+1)$ for the entire inner for loop

2)

Now for the outer for loop it will run n times + 1 step when its false.

i.e. $(n+1)$ times

3)

And the print statement will work whenever it is within both the for loops

i.e. $n(n)$

Therefore , $1 + 2 + 3 = n(n+1) + (n+1) + n(n) = n^2 + n + n + 1 + n^2 = 2n^2 + 2n + 1$

(B)

Therefore, Big-Theta notation for this will be $\Theta(n^2)$.

QUESTION 5

(A)

1) $(n - i)$ and (1) step for the loop within the for loop because 1 time will be for every time its false.

Therefore, total of $(n - i + 1)$ steps.

Hence, the summation of this is:

$$\sum_{i=1}^{n-1} (n - i + 1) = \sum_{i=1}^{n-1} n + \sum_{i=1}^{n-1} i + \sum_{i=1}^{n-1} 1 = n \cdot (n-1) + n(n-1)/2 + n = n(n+1)/2$$

2) $n + 1$ steps for the outer for loop.

3) steps for the print statement running every time the loops are true:

$$\sum_{i=1}^{n-1} (n - i) = n(n-1) - n(n-1)/2 = n(n-1)/2 \text{ steps.}$$

4) And 1 step for the assignment of n to the length of array.

i.e. $T(n) = 1 + 2 + 3 + 4 = n+1 + n(n+1)/2 + n(n-1)/2 + 1 = n^2 + n + 2$.

(B)

Therefore, the Big Theta notation for it is $\Theta(n^2)$.

QUESTION 6

I choose my active operation as the inner for – loop which has a print statement within it , so the inner – for loop will run n times as the outer for starts from 0. And the inner for loop is running (n – i) times + 1 for the false condition,

Therefore,

Total Steps are

$$\sum_{i=1}^{n-1} (n - i + 1) = n*(n-1) + n(n-1)/2 + n = (n^2 + n)/2 \text{ using active approach.}$$

Therefore, the Big Theta notation for it is $\Theta(n^2)$.

QUESTION 7

I choose my active operation as the function call inside the while loop which is going to execute n times as the length of the list data. And, then the function call is a binarySearch algorithm on an array of length m, considering the time complexity for the function call to be $O(\log_2 m)$, the time complexity for the whole function must be n times $O(\log_2 m)$

Therefore, the time complexity for the given pseudocode is $O(n \log_2 m)$.

THE END.