GTU Department of Computer Engineering
CSE 222/505 - Spring 2021
Homework 2
Due date: March 25 2021, 9:30 AM

Part 1:

Analyze the time complexity (in most appropriate asymptotic notation) of the following procedures by your solutions for the Homework 1:

    I.   Searching a product.

    II. Add/remove product.

    III. Querying the products that need to be supplied.

Attach the code of your solution for each part just before its analysis.

Part 2:

    a) Explain why it is meaningless to say: "The running time of algorithm A is at least $O(n^2)$".

    b) Let $f(n)$ and $g(n)$ be non-decreasing and non-negative functions. Prove or disprove that: $\max(f(n), g(n)) = \Theta(f(n) + g(n))$.

    c) Are the following true? Prove your answer.

        I. $2^{n+1} = \Theta(2^n)$

        II. $2^{2n} = \Theta(2^n)$

        III. Let $f(n)=O(n^2)$ and $g(n)= \Theta(n^2)$. Prove or disprove that: $f(n) * g(n) = \Theta(n^4)$.

Part 3:

List the following functions according to their order of growth by explaining your assertions.

$n^{1.01}, n\log^2 n, 2^n, \sqrt{n}, (\log n)^3, n2^n, 3^n, 2^{n+1}, 5^{\log_2 n}, \log n$

Part 4:

Give the pseudo-code for each of the following operations for an array list that has <u>n elements</u> and analyze the time complexity:

-   Find the minimum-valued item.
-   Find the median item. Consider each element one by one and check whether it is the median.
-   Find two elements whose sum is equal to a given value
-   Assume there are two ordered array list of n elements. Merge these two lists to get a single list in increasing order.

Part 5:

Analyze the time complexity and space complexity of the following code segments:

a)

```
int p_1 (int array[]):

{

        return array[0] * array[2])

}
```

b)

```
int p_2 (int array[], int n):

{

        Int sum = 0

        for (int i = 0; i < n; i=i+5)

                sum += array[i] * array[i])

        return sum

}
```

c)

```
void p_3 (int array[], int n):

{

        for (int i = 0; i < n; i++)

                for (int j = 0; j < i; j=j*2)

                        printf("%d", array[i] * array[j])

}
```

d)

```
void p_4 (int array[], int n):

{

        If (p_2(array, n)) > 1000)

                p_3(array, n)

        else

                printf("%d", p_1(array) * p_2(array, n))

}
```

RESTRICTIONS:

- Answer in detail the questions by using asymptotic notations.
- Yes / no answers and plagiarisation from the web will not be accepted.

GENERAL RULES:

- For any question firstly use course news forum in Moodle, and then the contact TA.
- You can submit assignment one day late and will be evaluated over sixty percent (%60).

REPORT RULES:

- All the analysis must be stated in the report/answer sheet in details.
- The report may be handwritten (only for this homework) if you want but, it must be scanned well and submitted to Moodle.

GRADING :

- **Part 1:**   **20 pts**
- **Part 2:**   **10 pts**
- **Part 3:**   **25 pts**
- **Part 4:**   **30 pts**
- **Part 5:**   **15 pts**
- Disobey restrictions: -100
- **Cheating:**   **-200**
- Your assignment is evaluated over 100 as your performance.

CONTACT :

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