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 n elements 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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