

CS302-Design and Analysis of Algorithm (Answer Sheet)

Saturday, July 4, 2020

Course Instructor

Mr. Adeel Ashraf Cheema

Mr. Muhammad Haris

Mr. Shoaib Saleem

Serial No:

Final Term Exam
Spring Semester 2020

Max Time: 3 Hour

Max Marks: 60

Roll No: 18F-0128

Name: Hassan Ashas

Section: D

General Instructions:

1. There are Six (6) Questions in total.
2. Questions reading and understanding are also part of the exam, only answer what is asked.
3. Read the questions carefully for clarity of context and understanding of meaning and make assumptions wherever required, **for neither the invigilator will address your queries, nor the teacher/examiner will respond to any of your queries.**

Guidelines for Submission:

1. You must solve/attempt it on **A-4 white paper** in your **own handwriting** and take the **picture of that solution** and insert it in provided answer sheet docx file. The image can be pasted inside that document under the appropriate question.
2. You should submit only one **PDF answer sheet file** Containing All Six(6) questions answers images.
3. Naming Convention of file must be followed.
4. Example:
 - a. Rollnumber_Section.pdf
 - b. **18f0123_C.pdf**
5. You must submit your answer sheet before due time in Assignment Section through **LMS (Slate <http://203.124.42.218:8080/portal>)**, and also to be **emailed** to your class teacher within the deadline.
6. Use your **university provided email** for email purpose.
7. Subject of email must be **"Algo Final Exam Files"**
8. The email addresses of class teachers are
 - a. adeel.cheema@nu.edu.pk Section- BCS-8A and BCS-4A
 - b. m.haris@nu.edu.pk Section- BCS-4B
 - c. shoaib.saleem@nu.edu.pk Section- BCS-4C and BCS-4D
9. **Slate and Email submissions submitted after the due time shall not be considered.**
10. If you don't finish every part of a question, don't worry! You can still submit what you've done to get marks based on your efforts.
11. **In case of copied or plagiarized solutions in exam Or If a student provided help to another student during exam both will be awarded "F" grade and it will affect the student CGPA.**
12. Viva of any student can be conducted by the instructor after conducting an online exam in case of any doubt.

Guidelines for attempting:

1. Your answer sheet (Every Image File) must contain your Full name, Roll number and Section and Clearly written in top of the page and must be in readable form.
2. Handwriting must be readable.
3. Proper explain the steps.
4. **Answer without steps or explanation (Direct Calculated answer) will get ZERO marks.**

	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Total
Total Marks	10	10	10	10	10	10	60
Marks Obtained							

Question 1:

Solution: Upload Images of your work here

Marks = 2+2+6 = 10

Answer without steps or explanation (Direct Calculated answer) will get ZERO marks.

QUESTION 1

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1A) Reason:-

(For sorting in ascending order, as example)

→ In selection sort, we insert minimum value in first index and maximum of the two values in second index.

→ By the time we reach last index, max value is already on last index and hence, we don't have to check that.

1B) for $(i=1; i \leq n-1; i++) \rightarrow 13$ operations
 for $(j=0; j \leq n-1; j++) \rightarrow 52$ operations
 if $(A[j] > A[j+1]) \rightarrow 64$ operations
 swap $(A[j], A[j+1]) \rightarrow 9$ operations

Total operations = $13 + 52 + 64 + 9$

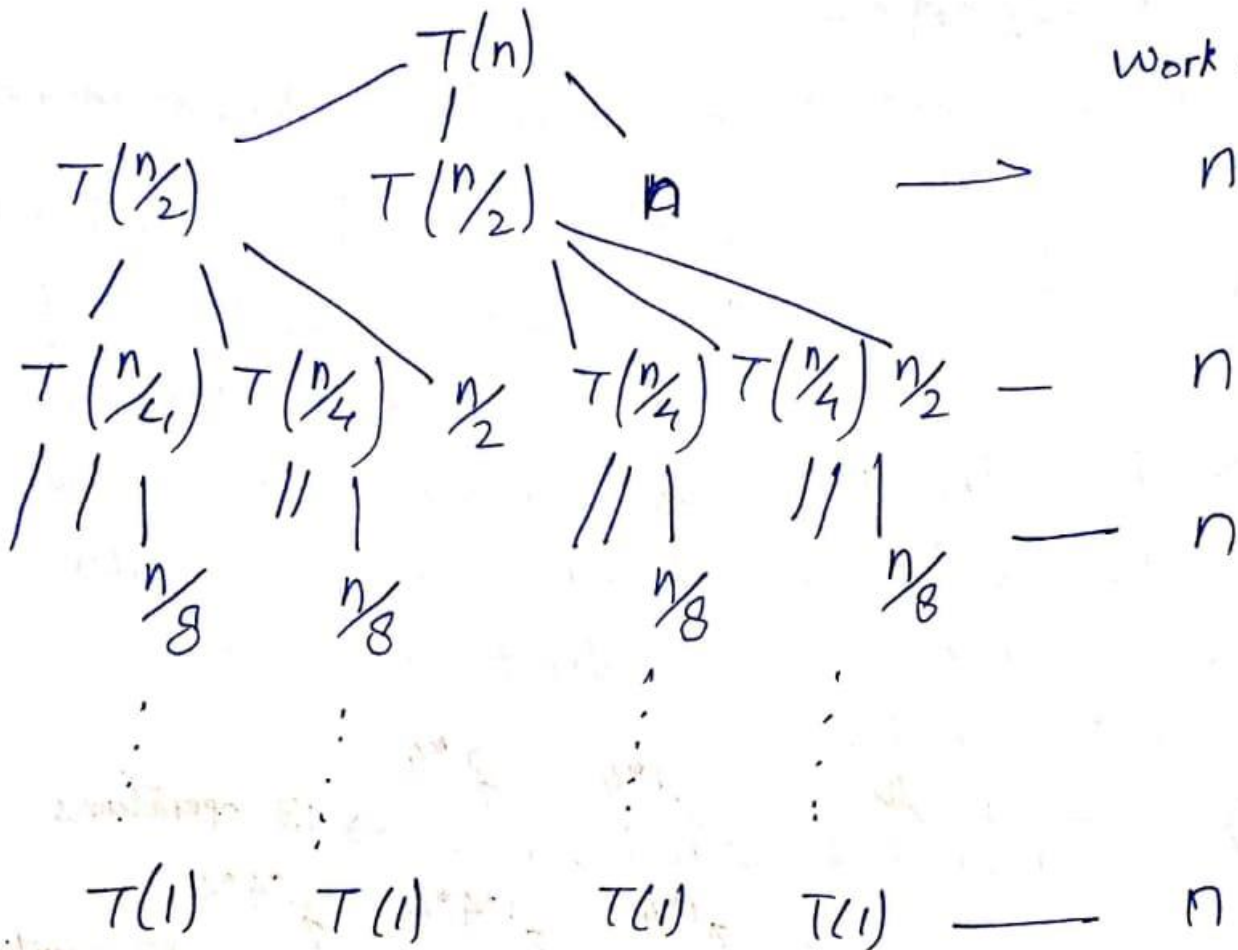
= 138 operations

1c) $T(n) = 2T(n/2) + cn$

→ Ignoring c as it is constant.

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Work Done



Depth :-

As $\frac{n}{2^k} = 1 \Rightarrow n = 2^k$

$\Rightarrow \log_2 n = \log_2 2^k \Rightarrow k = \log_2 n$

Complexity :-

Since work is same for all levels,
Complexity = work \times depth

$\Rightarrow T(n) = O(n \log_2 n)$

Question 2: Solution: Upload Images of your work here

Marks = 10

Answer without steps or explanation (Direct Calculated answer) will get ZERO marks.

Question 2

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$$1) T(n) = 0.5T(n/2) + \frac{1}{n}$$

Here, $a = 0.5 < 1$

Hence, Master's theorem is not applicable

$$2) T(n) = 16T(n/4) + n!$$

Here $a = 16$, $b = 4$, $f(n) = n!$

$$\log_4 16 = 2$$

 \rightarrow We know that $n!$ is greater than n^2 , hence we can conclude that, $\log_b a < k \Rightarrow$ meaning Case 3Now, $p = 0$ so, we know,if $p \geq 0 \Rightarrow \Theta(n^k \log^p n)$ \Rightarrow Hence, required answer is, $\Theta(n!) \rightarrow$ Case 3
where $p \geq 0$

$$3) T(n) = \sqrt{2} T(n/2) + \log n$$

$$a = \sqrt{2}, b = 2, f(n) = \log n$$

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Here,

$$\log_2 \sqrt{2} = 0.5, k = 0$$

$$\Rightarrow \log_b a > k \Rightarrow \text{Case 1}$$

~~As~~ So, complexity is,

$$\Rightarrow \Theta(\sqrt{n})$$

$$4) T(n) = 3 T(n/2) + n$$

$$a = 3, b = 2, f(n) = n$$

$$\log_2 3 = 1.5, k = 1 \Rightarrow \log_b a < k$$

\Rightarrow Case 1

\rightarrow Complexity is $\Theta(n^{\log_2 3})$

$$5) T(n) = 3 T(n/3) + \sqrt{n}$$

$$\text{Here } a = 3, b = 3, f(n) = \sqrt{n}$$

$$\Rightarrow \log_3 3 = 1, k = 0.5 \Rightarrow \log_b a > k$$

\Rightarrow Case 1

\rightarrow Complexity is $\Theta(n)$

Question 3: Solution: Upload Images of your work here

Marks = 10

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Question 3

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→ Given graph is a directed graph.

→ Since Kruskal algorithm can't be applied on directed graph, so this solution is not possible.

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Question 4:	Solution: Upload Images of your work here	Marks = 10
<u>Answer without steps or explanation (Direct Calculated answer) will get ZERO marks.</u>		

Question 5:

Solution: Upload Images of your work here

Marks = 10

Answer without steps or explanation (Direct Calculated answer) will get ZERO marks.

Question 6: Solution: Upload Images of your work here

Marks = 10

Answer without steps or explanation (Direct Calculated answer) will get ZERO marks.

Question 6

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Step 1:-

We have $n=5$, $m=10$ \Rightarrow Here, $i=n$ and $j=m$

$$\rightarrow T[i][j] \neq T[i-1][j]$$

$$\Rightarrow T[5][10] \neq T[4][10]$$

$$\text{Hence, } x[5] = 1$$

$$\text{So } i = i - 1 \Rightarrow i \text{ becomes } 4$$

$$j = j - w[5] \Rightarrow j \text{ becomes } 6$$

Step 2:-

$$i = 4, \quad j = 6$$

Now,

$$T[4][6] \neq T[3][6]$$

$$\Rightarrow x[4] = 1$$

$$\text{So } i = i - 1 \Rightarrow i \text{ becomes } 3$$

$$j = j - w[4] \Rightarrow j \text{ becomes } 2.$$

Step 3:-

$$i = 3, \quad j = 2$$

Now,

$$\cancel{T[3][2]} \neq$$

$$T[3][2] = T[2][2]$$

$$\text{Hence, } x[3] = 0$$

$$\Rightarrow i = i - 1 \Rightarrow i \text{ becomes } 2$$

j remains unchanged.

Step 4:-

$$i = 2, \quad j = 2$$

Now,

$$T[2][2] \neq T[1][2]$$

$$\text{Hence, } x[2] = 1$$

$$\Rightarrow i = i - 1 \Rightarrow i \text{ becomes } 1$$

$$j = j - w[2] \Rightarrow j \text{ becomes } 0.$$

→ Hence, sack is full and now loop will be broken.

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