

The LNM Institute of Information Technology
Department of Computer Science & Engineering
CSE325 Design and Analysis of Algorithm

Midterm Exam

NOTE: No doubt clarifications in the exam hall. If assumptions are to be made, make your own assumptions, state it and use it. If the assumptions are relevant and it makes sense it will be considered. Answer in the same order as it appears in the question paper. If you change the order there will be penalty of 1 mark for each inverted pairs!

All the best!

Total Marks: 50

Feb 21, 2018

- ✓ 1. Frame a question in the said syllabus on your own and answer it correctly yourself. Also label your question *easy* if it is easy, *average* if it is with average difficulty, and *hard* if it is hard. If your question is relevant, your answer is correct for the question you framed and the label is also true to its difficulty you will be awarded marks. (2)
- ✓ 2. Use the master method to solve the recurrence equation $T(n) = 4T(n/2) + n$. Also show that $\log(n!)$ is $\Theta(n \log n)$. (5)
- ✓ 3. Consider the recurrence equation $T(n) = 3T((n/3) - 2) + n/2$. Show that $T(n) = \Theta(n \log n)$ by substitution method (6)
- ✓ 4. Explain why the worst-case running time for bucket sort is $\Theta(n^2)$. What changes you suggest to the algorithm so that it preserves its linear average-case running time and makes its worst-case running time $\mathcal{O}(n \log n)$. (6)
5. When RANDOMIZED-QUICKSORT runs, how many calls are made to the random number generator RANDOM in the worst case and in the best case? How? (6)
6. Show how to sort n integers in the range 0 to $n^3 - 1$ in $\mathcal{O}(n)$ time. Present the approach and the algorithm (5)
- ✓ 7. Illustrate how Huffman coding algorithm works for the following characters with the frequencies given as follows:

$$a:1 \quad b:1 \quad c:2 \quad d:3 \quad e:5 \quad f:8 \quad g:13 \quad h:21$$

Give the optimal codes for all the characters. (6)
- ✓ 8. Consider the quote given in the NOTES section of the question paper:

"Answer in the same order as it appears in the question paper. If you change the order there will be penalty of 1 mark for each inverted pairs!"

What is the maximum number of marks I can deduct by the above quote for this midterm exam and how? Does this quote have any relation to any of the algorithms that we have studied in the class? Name it and say why it is so? (4)
- ✓ 9. Present the CLOSEST-PAIR Divide and Conquer algorithm together with **Problem Statement** and elaborately discuss its running time complexity of the algorithm with focus on each step of your algorithm. What is the significance of sorting the points with respect to x and y -axis? (10)