CST Fourth Semester Midterm Examination, April 2021

Analysis and Design of Algorithms (CS-2201)

Full Marks 30 Time 45 minutes

Answer **any three** questions

Marks distribution for each question is **4+6=10**.

Explanation and steps need to be mentioned for the problems.

Write your roll number in every page for ready reference.

- Let the last 3 digits of your registration number be x, y and z respectively, with z being the rightmost digit.
- In any problem, reference to these variable names are to be interpreted accordingly.
- Writing them side by side indicates unit place, tenth place etc. unless operation is mentioned.

1. (a) Compare the merits and demerits of choosing median of medians as pivotal element with randomizing the pivotal element.
   (b) Taking 5 elements per group, obtain the median of medians for the following 25 numbers and its distance from the middlemost number:
   $23, 71, 42, 37, xyz$,
   $59, 67, 35, 29, xy$,
   $17, 26, 34, 82, zx$,
   $12, 43, 61, 28, yx$,
   $25, 40, 51, 93, zy$.

2. (a) Briefly explain whether scheduling a set of unit execution time tasks with associated deadline and penalty for optimal penalty can be solved by employing greedy algorithm.
   (b) Consider the following tasks with deadlines and penalties given below and schedule them so that the penalty is minimized for tasks which cannot meet the deadline.

Task Id	Deadline	Penalty
T1	y+1	zx+30
T2	x+2	yz+20
T3	3	50
T4	2	60
T5	1	25
T6	4	35

3. (a) Briefly describe why matrix chain multiplication problem requires exponential time complexity when solved using brute force divide and conquer method. (b) Find the minimum number of operations needed along

with the corresponding order of multiplication for a matrix chain that has five matrices with the following dimensions:
2×3; 3×4; $4 \times \lfloor \frac{(|y-x|+4)}{2} \rfloor$;$\lfloor \frac{(|y-x|+4)}{2} \rfloor \times \lfloor \frac{(|z-y|+4)}{2} \rfloor$; $\lfloor \frac{(|z-y|+4)}{2} \rfloor \times 2$.

4. (a) Explain why Huffman coding can yield optimality in data compression. Consider the following source with five symbols having probabilities as shown below:
$P(A) = 0.12$
$P(B) = (\frac{|y-z|+1}{20})$
$P(C) = 0.06$
$P(D) = 0.22$
$P(E) = 1 - [P(A) + P(B) + P(C) + P(D)]$
(b) Find the average length of the code when Huffman coding is applied and compare it with the entropy of the source.