Question Paper

Exam Date & Time: 05-May-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH. (INFORMATION TECHNOLOGY) DEGREE EXAMINATIONS - APRIL / MAY 2024
SUBJECT: ICT 2222/ICT_2222 - DESIGN AND ANALYSIS OF ALGORITHMS

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A) i) In priority scheduling, each process is assigned a priority value, and the scheduler selects the process with the highest priority for execution. When an existing process completes its execution, the scheduler selects the process with the next highest priority, and so on. Consider the processes P1 to P10 with their priority values {7, 6, 1, 5, 4, 3, 2, 10, 9, 8}. Consider priority 10 as the highest priority and priority 1 as the lowest priority. Analyse the given situation and discuss how heap can be used for scheduling of the given processes. Also, display the heap's initial contents and the heap's contents after the two processes of highest priorities finish their execution. (5)
ii) Construct AVL tree for the following data 100, 26, 30, 9, 4, 36, 58, 38,15.

1B) Apply the back substitution method to solve the recurrence relation (3)

$$T(n) = \begin{cases} 1, & \text{if } n = 1 \\ 2T(n/2) + n, & \text{if } n > 1 \end{cases}$$

1C) Prove or Disprove the following using ratio theorems (2)
i) $100n^3 + 2000 \neq O(n^2)$
ii) $19n3 + 6^{10}n^2 = O(n^3)$

2A) Solve the all pair shortest-path problem for the digraph with the following weighted matrix: (5)

	a	b	c	d
a	0	∞	3	∞
b	2	0	∞	∞
c	∞	7	0	1
d	6	∞	∞	0

2B) Write an algorithm for string matching using brute force method. Find its time complexity. (3)

2C) Elaborate the given list A=[8, 6, 14, 12, 23, 21] by applying the insertion sort algorithm on each pass. Demonstrate how elements are compared, shifted, and inserted to progressively construct the sorted array. Identify the best-case and worst-case time complexity. (2)

3A) Demonstrate Horspool Algorithm for String Matching. Trace & find the pattern "SELECTION" in the text "EDUCATION_ONLY_HELPS_IN_SELECTION". (5)

3B) Write the general working of quicksort algorithm. Demonstrate the tracing for the input: 10, 80, 30, 90, 40, 50, 70. (3)

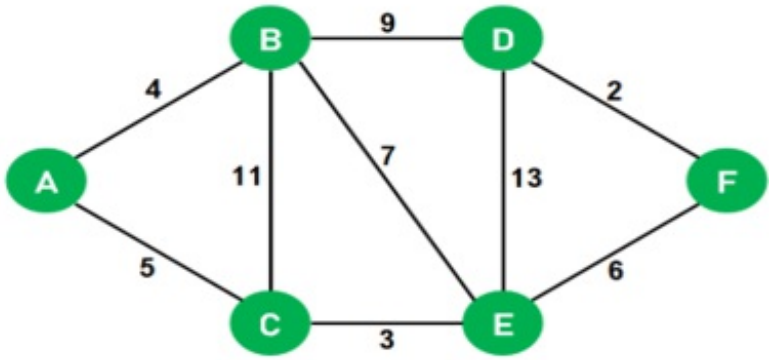
3C) Demonstrate Warshall's algorithm in dynamic programming. (2)

4A) Solve the following using Strassen's Matrix Multiplication using divide and conquer. (5)

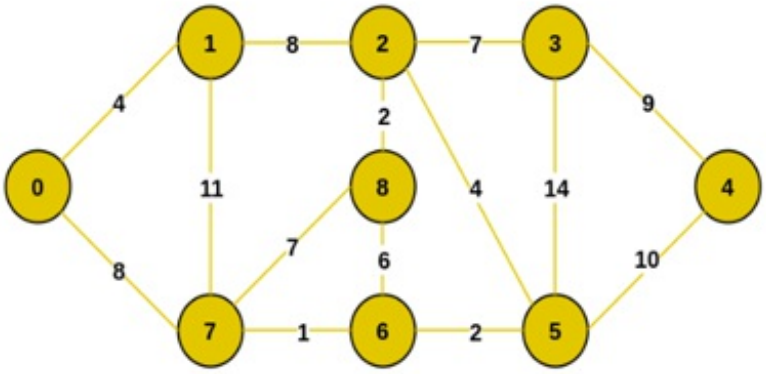
$$\mathbf{A} = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} 6 & 1 & 1 \\ 9 & 2 & 4 \\ 10 & 3 & 6 \end{bmatrix}$$

And test its time complexity by using master's method.

4B) Solve the shortest path for the given weighted graph using Dijkstra's algorithm. (3)



4C) Demonstrate the minimum spanning tree for the given weighted graph using prim's algorithm. (2)



5A) Solve the assignment problem given in Fig 2 using the backtracking method. Make use of appropriate bounding function. (5)

machines

jobs	I	II	III	IV
A	10	12	19	11
B	5	10	7	8
C	12	14	13	11
D	8	15	11	9

5B) Demonstrate that the problem of counting the paths in graph is equivalent to computing the appropriate power of its adjacency matrix. (3)

5C) Write short notes on NPH, NP-complete classes of problems. Using your understanding of P, NP, NPH, NP-complete classes of problems draw Venn diagram showing the relation between them. (2)

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