KUMARAGURU
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MCA DEGREE EXAMINATIONS: NOV/ DEC 2018
(Regulation 2017)
Third Semester
MASTER OF COMPUTER APPLICATIONS

P17CAT3102 : Analysis of Algorithms

COURSE OUTCOMES
CO1: Understand the behavior of algorithms
CO2: Explain different algorithm design strategies
CO3: Analyze and determine the appropriate algorithm methodology for a problem
CO4: Apply the algorithms and design techniques to solve problems
CO5: Analyze the complexities of various problems in different domains
CO6: Evaluate the algorithms efficiency for a problem

Time: Three Hours   **Maximum Marks: 100**
Answer all the Questions:-
PART A (10 x 1 = 10 Marks)

1. Match list-I (Algorithm) with the list-II (Strategies) and select the correct answer using the codes given below.   CO2 [K_2]

List I	List II
A. Floyd's algorithm	i. Greedy Method
B. Assignment algorithm	ii. Divide & Conquer
C. Dijkstra's algorithm	iii. Dynamic Programming
D. Quick sort	iv. Branch & Bound

	A	B	C	D
a)	iii	iv	i	ii
b)	iii	iv	ii	i
c)	ii	iv	i	ii
d)	i	iii	ii	iv

2. The time factor when determining the efficiency of algorithm is measured by counting ____.   CO5 [K_2]
   a) microseconds   b) the number of key operations
   c) the number of statements   d) the kilobytes of algorithm

3. State which of the following statements are true for Hamiltonian circuits: CO5 [K_4]
     i) Every connected graph has a Hamiltonian circuit.
     ii) Every graph that has a Hamiltonian circuit also has a Hamiltonian path.
     iii) A given graph may contain more than one Hamiltonian circuit.
   a) i only   b) i and ii only
   c) ii and iii only   d) i , ii and iii

4. The time complexity of quick sort algorithm in average case is _____.   CO6 [K_2]
   a) O(nlog n)   b) O(log n)
   c) $O(n^2)$ d) $O(n^2 log n)$

5. Assertion (A): Dijkstra's algorithm is applicable to graphs with non-negative weights only. CO2 [K₄]
   Reason (R) : Dijkstra's algorithm is the best known algorithm for all pairs source shortest path problems.
   a) Both A and R are individually true and R is the correct explanation of A
   b) Both A and R are individually true but R is not the correct explanation of A
   c) A is true but R is false
   d) A is false but R is true

6. Prim's algorithm is based on _____ method. CO2 [K₁]
   a) divide & conquer
   b) greedy
   c) dynamic programming
   d) branch & bound

7. Arrange the following algorithms in the increasing order of their worst case time complexity: CO6 [K₂]
   i) Sequential search   ii) Binary search   iii) Merge sort   iv) Quick sort
   a) ii - i - iv - iii
   b) i - ii - iv - iii
   c) ii - i - iii - iv
   d) i - ii - iii - iv

8. Match list-I (algorithms) with the list-II (their time complexity) and select the correct answer using the codes given below: CO3 [K₂]

List I	List II
A. Finding the largest element in the array	1. $\Theta(\log n)$
B. Quick Sort	2. $\Theta(n)$
C. Merge sort	3. $\Theta(n^2)$
D. Binary Search	4. $\Theta(n \log n)$

   a) A-2, B-3, C-4,D-1
   b) A-1, B-2, C-4,D-3
   c) A-3, B-2, C-4,D-1
   d) A-2, B-1, C-3,D-4

9. Assertion (A): All NP-complete problems are not NP-hard. CO1 [K₄]
   Reason (R) : Some NP-hard problems are not known to be NP-complete.
   a) Both A and R are individually true and R is the correct explanation of A
   b) Both A and R are individually true but R is not the correct explanation of A
   c) A is true but R is false
   d) A is false but R is true

10. A _____ is a round trip path along *n* edges of G that visits every vertex once. CO1 [K₂]
    a) minimum spanning tree
    b) Hamiltonian cycle
    c) multistage graph
    d) tree

Answer any TEN Questions:-
**PART B (10 x 4 = 40 Marks)**
(Answer not more than 80 words)

11. Solve the following recurrence relation: CO4 [K₃]
    $$x (n) = x (n-1) + 1 \quad \text{for } n > 0$$
    $$x (0) = 0$$

12. Enumerate the general plan for analyzing the time efficiency of recursive algorithms. CO3 [K₂]

13. Write the nonrecursive algorithm for binary search. CO2 [K₂]

14. Apply merge sort algorithm to sort the following numbers in ascending order: CO4 [K₃]
    8 3 2 9 7 1 5 4

15. Compute the binomial coefficient for 5C₃ using dynamic programming. CO4 [K₅]

16. Multiply 27 * 49 using divide and conquer method. CO4 [K₃]

17. Bring out the similarities and differences between dynamic programming and divide & conquer method. CO5 [K₅]

18. Compare the orders of growth of the following using limits :   CO6   [K_4]
     i) ½ n(n-1) and n^2
     ii) n! and 2^n

19. Write Floyd's algorithm.   CO1   [K_2]

20. Given the set S= { 3,5,6,7} and d = 15. Find the possible solutions from the set S whose sum   CO4   [K_3]
is equal to the given integer 'd' using backtracking.

21. Apply Warshall's algorithm to find the transitive closure of the following graph :   CO4   [K_3]
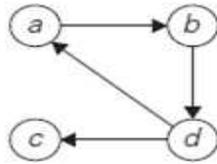
22. Write a note on P & NP problems.   CO1   [K_2]

Answer any FIVE Questions:-
PART C (5 x 10 = 50 Marks)
(Answer not more than 250 words)

23. a)   Write Kruskal's algorithm for finding the minimum spanning tree.   (4)   CO2   [K_2]

    b)   Apply the algorithm on the following graph to find the minimum spanning tree :   (6)   CO4   [K_3]
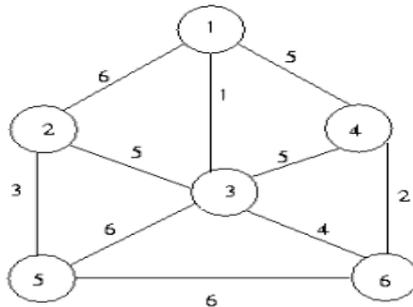
24. a)   Solve the recurrence relation for Tower of Hanoi problem.   (5)   CO6   [K_3]
   b)   Find a Hamiltonian circuit of the following graph using backtracking.   (5)   CO3   [K_3]
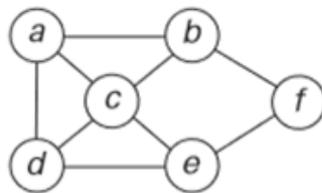
25. a)   Compute the product of the following two matrices using Strassen's algorithm: CO4   [K_3]

$$\begin{pmatrix} 1 & 0 & 2 & 1 \\ 4 & 1 & 1 & 0 \\ 0 & 1 & 3 & 0 \\ 5 & 0 & 2 & 1 \end{pmatrix} \quad \text{x} \quad \begin{pmatrix} 0 & 1 & 0 & 1 \\ 2 & 1 & 0 & 4 \\ 2 & 0 & 1 & 1 \\ 1 & 3 & 5 & 0 \end{pmatrix}$$

26. a) Draw the state space tree for 4 - Queen's problem. (5) CO3 [K₃]

b) Apply Dijkstra's algorithm to find the shortest path from vertex A to all other vertices in the following graph : (5) CO4 [K₃]
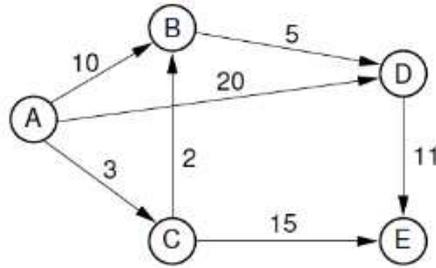
27 Find an optimal solution for the assignment problem using branch and bound technique. CO4 [K₃]

	Job 1	Job 2	Job 3	Job 4
Person A	9	2	7	8
Person B	6	4	3	7
Person C	5	8	1	8
Person D	7	6	9	4

28. A thief enters a house for robbing it. He can carry a maximal weight of 5 kg into his bag. There are 4 items in the house with the following weights and values. What items should thief take if he either takes the item completely or leaves it completely? Use dynamic programming approach. CO3 [K₃]

Item	Weight in Kg	Value in $
Mirror	2	3
Silver nugget	3	4
Painting	4	5
Vase	5	6

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