Shivaji University , Kolhapur
Question Bank For Mar 2022 (Summer) Examination
Subject Code : 80797 Subject Name : Computer Algorithms

Q. 01 When an algorithm is written in the form of a programming language, it becomes a _____

A) Flowchart
B) Program
C) Pseudo code
D) Syntax

Q. 02 Consider the problem of computing min-max in an unsorted array where min and max are minimum and maximum elements of array. Algorithm A1 can compute min-max in a1 comparisons without divide and conquer. Algorithm A2 can compute min-max in a2 comparisons by scanning the array linearly. What could be the relation between a1 and a2 considering the worst case scenarios?

A) a1 < a2
B) a1 > a2
C) a1 = a2
D) Depends on the input

Q. 03 What is recurrence for worst case of QuickSort and what is the time complexity in Worst case?

A) Recurrence is T(n) = T(n-2) + O(n) and time complexity is O(n^2)
B) Recurrence is T(n) = T(n-1) + O(n) and time complexity is O(n^2)
C) Recurrence is T(n) = 2T(n/2) + O(n) and time complexity is O(nLog n)
D) Recurrence is T(n) = T(n/10) + T(9n/10) + O(n) and time complexity is O(nLog n)

Q. 04 What does it mean when we say that an algorithm X is asymptotically more efficient than Y?

A) X will be a better choice for all inputs
B) X will be a better choice for all inputs except possibly small inputs
C) X will be a better choice for all inputs except possibly large inputs
D) Y will be a better choice for small inputs

Q. 05 Suppose we modify the above function foo() and store the values of foo (i), 0 < = i < n, as and when they are computed. With this modification, the time complexity for function foo() is significantly reduced. The space complexity of the modified function would be:

A) O(1)
B) O(n)
C) O(n!)
D) O(n^n)

Q. 06 What is the time complexity of Huffman Coding?

A) O(N)
B) O(Nlog N)
C) O(N(log N)^2)
D) O(N^2)

Q. 07 Which of the following is true about Kruskal and Prim MST algorithms? Assume that Prim is implemented for adjacency list representation using Binary Heap and Kruskal is implemented using union by rank.

A) Worst case time complexity of both algorithms is same

B) Worst case time complexity of Kruskal is better than Prim
C) Worst case time complexity of Prim is better than Kruskal
D) None

Q. 08 Suppose the letters a, b, c, d, e, f have probabilities 1/2, 1/4, 1/8, 1/16, 1/32, 1/32 respectively. Which of the following is the Huffman code for the letter a, b, c, d, e, f?

A) 0, 10, 110, 1110, 11110, 11111
B) 11, 10, 011, 010, 001, 000
C) 11, 10, 01, 001, 0001, 0000
D) 110, 100, 010, 000, 001, 111

Q. 09 Consider a job scheduling problem with 4 jobs J1, J2, J3, J4 and with corresponding deadlines: (d1, d2, d3, d4) = (4, 2, 4, 2). Which of the following is not a feasible schedule without violating any job schedule?

A) J2, J4, J1, J3
B) J4, J1, J2, J3
C) J4, J2, J1, J3
D) J4, J2, J3, J1

Q. 10 What is the other name of Dijkstra algorithm?

A) single-source shortest path problem
B) multiple-source shortest path problem
C) multiple-destination shortest path problem
D) single-destination shortest path problem

Q. 11 The following paradigm can be used to find the solution of the problem in minimum time: Given a set of non-negative integer, and a value K, determine if there is a subset of the given set with sum equal to K:

A) Divide and Conquer
B) Dynamic Programming
C) Greedy Algorithm
D) Branch and Bound

Q. 12 What happens when a top-down approach of dynamic programming is applied to any problem?

A) It increases both, the time complexity and the space complexity
B) It increases the space complexity and decreases the time complexity
C) It increases the time complexity and decreases the space complexity
D) It decreases both, the time complexity and the space complexity

Q. 13 We use dynamic programming approach when

A) We need an optimal solution
B) The solution has optimal substructure
C) The given problem can be reduced to the 3-SAT problem
D) It's faster than Greedy

Q. 14 Which of the following standard algorithms is not Dynamic Programming based

A) Bellman–Ford Algorithm for single source shortest path
B) Floyd Warshall Algorithm for all pairs shortest paths

C) 0-1 Knapsack problem
D) Prim's Minimum Spanning Tree

Q. 15 The inorder and preorder traversal of a binary tree are d b e a f c g and a b d e c f g, respectively. The postorder traversal of the binary tree is:

A) d e b f g c a
B) e d b g f c a
C) e d b f g c a
D) d e f g b c a

Q. 16 Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are inserted in that order into an initially empty binary search tree. The binary search tree uses the reversal ordering on natural numbers i.e. 9 is assumed to be smallest and 0 is assumed to be largest. The in-order traversal of the resultant binary search tree is

A) 9, 8, 6, 4, 2, 3, 0, 1, 5, 7
B) 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
C) 0, 2, 4, 3, 1, 6, 5, 9, 8, 7
D) 9, 8, 7, 6, 5, 4, 3, 2, 1, 0

Q. 17 Which of the following algorithms can be used to most efficiently determine the presence of a cycle in a given graph ?

A) Depth First Search
B) Breadth First Search
C) Prim's Minimum Spanning Tree Algorithm
D) Kruskal' Minimum Spanning Tree Algorithm

Q. 18 Which of the following is not a backtracking algorithm?

A) Knight tour problem
B) N queen problem
C) Tower of hanoi
D) M coloring problem

Q. 19 In an adjacency list representation of an undirected simple graph G = (V, E), each edge (u, v) has two adjacency list entries: [v] in the adjacency list of u, and [u] in the adjacency list of v. These are called twins of each other. A twin pointer is a pointer from an adjacency list entry to its twin. If |E| = m and |V | = n, and the memory size is not a constraint, what is the time complexity of the most efficient algorithm to set the twin pointer in each entry in each adjacency list?

A) $\Theta(n2)$
B) $\Theta(m+n)$
C) $\Theta(m2)$
D) $\Theta(n4)$

Q. 20 Given two vertices in a graph s and t, which of the two traversals (BFS and DFS) can be used to find if there is path from s to t?

A) Only BFS
B) Only DFS

C) Both BFS and DFS
D) Neither BFS nor DFS

Q. 21 Let S be an NP-complete problem and Q and R be two other problems not known to be in NP. Q is polynomial time reducible to S and S is polynomial-time reducible to R. Which one of the following statements is true?

A) R is NP-complete
B) R is NP-hard
C) Q is NP-complete
D) Q is NP-hard

Q. 22 Let X be a problem that belongs to the class NP. Then which one of the following is TRUE?

A) There is no polynomial time algorithm for X
B) If X can be solved deterministically in polynomial time, then P = NP
C) If X is NP-hard, then it is NP-complete
D) X may be undecidable

Q. 23 Ram and Shyam have been asked to show that a certain problem Π is NP-complete. Ram shows a polynomial time reduction from the 3-SAT problem to Π, and Shyam shows a polynomial time reduction from Π to 3-SAT. Which of the following can be inferred from these reductions ?

A) Π is NP-hard but not NP-complete
B) Π is in NP, but is not NP-complete
C) Π is NP-complete
D) Π is neither NP-hard, nor in NP

Q. 24 Consider the following two problems of graph. 1) Given a graph, find if the graph has a cycle that visits every vertex exactly once except the first visited vertex which must be visited again to complete the cycle. 2) Given a graph, find if the graph has a cycle that visits every edge exactly once. Which of the following is true about above two problems

A) Problem 1 belongs NP Complete set and 2 belongs to P
B) Problem 1 belongs to P set and 2 belongs to NP Complete set
C) Both problems belong to P set
D) Both problems belong to NP complete set

Q. 25 For problems X and Y, Y is NP-complete and X reduces to Y in polynomial time. Which of the following is TRUE?

A) If X can be solved in polynomial time, then so can Y
B) X is NP-complete
C) X is NP-hard
D) X is in NP, but not necessarily NP-complete

Q. 26 which is not a constraints enforced on PRAM model

A) EREW
B) ERCW
C) CRCW

D) None

Q. 27 Which of the following models is more powerful than COMMON CRCW PRAM?

A) PRIORITY CRCW
B) COLLISION
C) CREW
D) EREW

Q. 28 bisection width for **p** processor mesh is

A) sqr root(p)
B) 2 p
C) p
D) p/2

Q. 29 Hypercube of dimension ‘d’ has how many processors

A) d^2
B) 2 d
C) 2^d
D) d/2

Q. 30 Hypercube of 3 dimensions requires how many bit binary number

A) 2
B) 3
C) 6
D) 8

Q. 31 Obtaining spanning tree for undirected graph G is application of

A) BFS
B)DFS
C)Both
D)None

Q. 32 In how many directions do queens attack each other?

A)1
B)2
C)3
D) 4

Q. 33 Running time of quick sort depends on selection of

A) No of inputs
B)size of elements
C) Arrangements of elements in array
D)Pivot element

Q. 34 Which of the following statements is true?

A) Recursion is always better than iteration
B) Recursion uses more memory compared to iteration
C) Recursion uses less memory compared to iteration
D) Iteration is always better and simpler than recursion

Q. 35 The time factor when determining the efficiency of algorithm is measured by

A) Counting microseconds
B) Counting the number of key operations
C) Counting the number of statements
D) Counting the kilobytes of algorithm

Unit 1: Divide and Conquer

1. What is time & space complexity? Explain with example.
2. Explain with example Big-oh, Big-omega and Theta, Also plot a graph for few functions.
3. What is algorithm, Explain different criteria's needed for the algorithm to satisfy.
4. Difference between priori and posteriori analysis.
5. Write a short note on Amortized complexity.
6. Explain Miller-Rabin primality testing algorithm.
7. Explain Divide and conquer Maxmin algorithm prove that its complexity is 3n/2-2.
8. Prove that complexity of binary search is O(log(n)).
9. Explain merge sort algorithm and show that its complexity O(n log n).
10. Prove that algorithm using divide and conquer approach to find minimum and maximum number in list save 25% efforts compare to straight forward approach to find minimum and maximum number in list?
11. Write algorithm to select nth smallest element in list. compute its complexity.
12. Explain general method of divide and conquer using example.
13. Difference between Las-Vegas and Monte Carlo Algorithm
14. Solve following recurrence relation by master method

    i)$T(n) = 9T(n/3) + n^{2.5}$

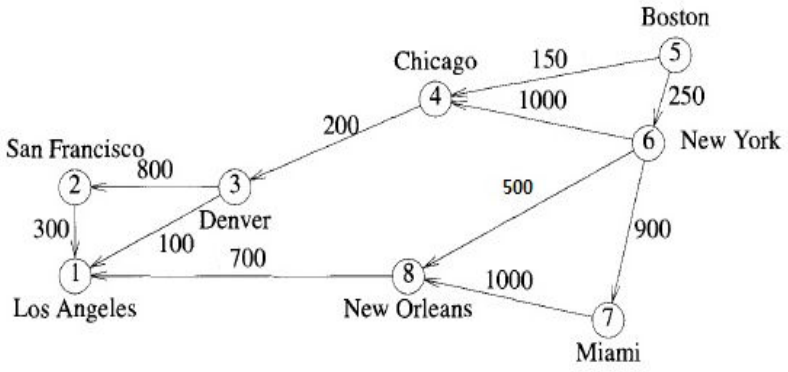
    ii)$T(n) = T(n/3) + n$
15. Show that following equalities are correct.

i) $5n^2 - 6n = O(n^2)$

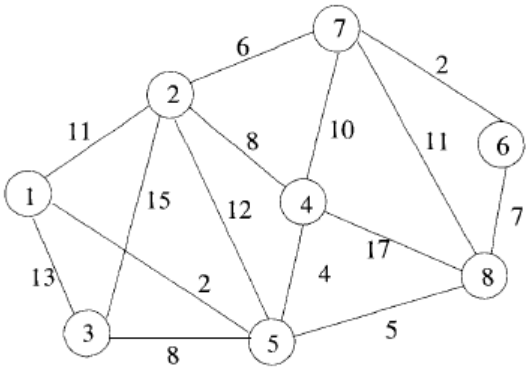
Unit 2: The Greedy Method

16. Solve job sequencing problem with deadlines using greedy approach for following instance n=7.
    (p1,p2,…,p7) = (50,15,18,16.8,25,60)
    (d1,d2,…,d7) = (1,3,4,3,2,1,2)
17. Find the optimal placement for programs on tapes T0,T1,T2 where programs are of length 12,5,8,32,7,15,18,26,4,3,11,10,6 also find MRT.
18. Explain greedy method in general with example.
19. Prove If l1 <= l2 <= … <= ln, then ordering $i_j = j$, 1<= j<= n, minimizes $\sum_{k=1}^{n}\sum_{j=1}^{k} l_{i_j}$. Over all possible permutations of i_j
20. Prove that if p1/w1>=p2/W2>=....>pn/Wn then greedy method generates an optimal solution to given instance of knapscak problem.
21. Compare Prim's and Kruskal's algorithm to find minimum cost spanning tree(MST)
22. Find an optimal merge pattern for 10 files whose lengths are 26,32,12,6,85,55,90,35,3,11 ?
23. Solve following problems.
    ii) Find out max profit of knapsack when (p1,p2,p3)= (1,4,5) and (w1,w2,w3) = (3,5,6) , m=10.

iii) Find Single source shortest path from Boston and draw final graph.

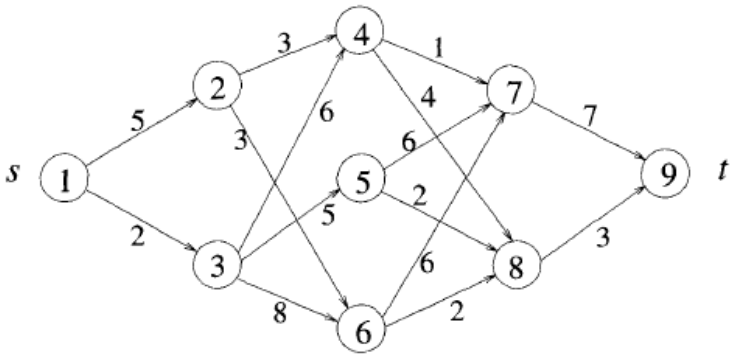


iv) Find minimum cost spanning tree by all 2 methods, step wise.

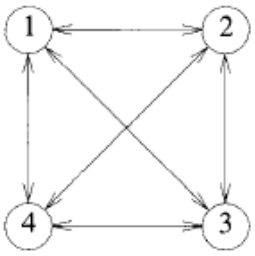


Unit 3: Dynamic Programming

24.Find minimum cost path from s to t in multistage graph given below

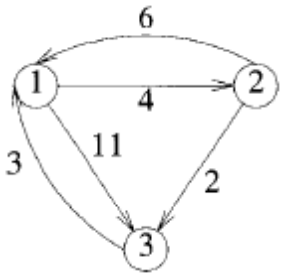


25. Explain dynamic programming solution to 0/1 knapsack problem.
26. Solve the instance of "Travelling sales person problem " to find tour of min-cost



$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$

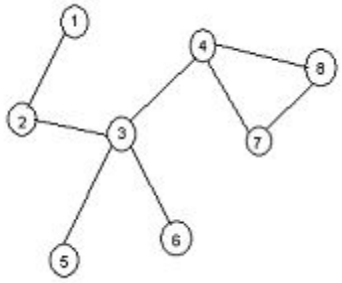
27. Explain reliability design problem with suitable example.
28. Find all pair shortest path for fallowing graph.



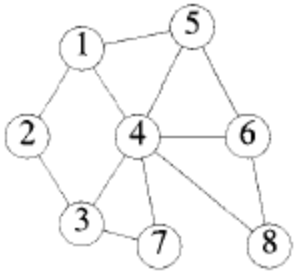
29. Generate the sets $S^i, 0 \leq i \leq 4$, when $(w_1, w_2, w_3, w_4) = (10, 15, 6, 9)$ and $(p_1, p_2, p_3, p_4) = (2, 5, 8, 1)$.

Unit 4: Basic Traversal and Search Techniques and Backtracking

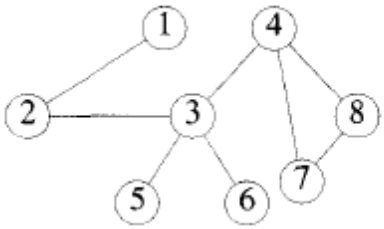
30. Define articulation point and biconnected component with suitable example. Identify articulation points using DFS Spanning Tree in following graph.



31. Find DFS and BFS spanning tree for following graph.



32. For the below graph identify articulation points and biconnected components and Write a Pseudocode to determine biconnected components



33. How can be a non biconnected graph converted into a biconnected graph.

34. Write an explain algorithm for Breadth first search & traversal.

35. Write a note on :

a. AND / OR graph
b. Game tree
c. techniques for binary tree traversal
d. Rearrangement

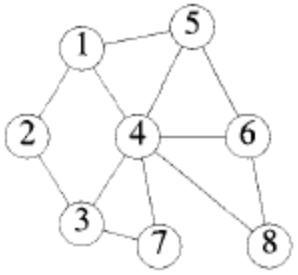
36. Draw and explain permutation tree generated for 4-Queens problems using backtracking.

37. Discuss Algorithm and conditions of 8 Queens problem.

38. What is backtracking? Explain sum of subset problem and algorithm with suitable example.

39. Explain solution to 0/1 knapsack problem using Backtracking method.

40. Explain solution to Hamiltonian cycle problem using Backtracking method.



41. Find out chromatic number of following graph

42. Explain with suitable example the terms- live node, E-node, dead node and bounding function with respect to backtracking.

43. Define following terms :

a. Criteria function
b. Bounding function
c. Explicit constraint
d. Implicit constraint
e. Solution state
f. Answer state

Unit 5: NP Hard and NP Complete Problems

44. Explain the relationship between P, NP, NP-Complete, NP-Hard problems with neat diagram.

45. List and explain NP-Hard graph problems.

46. Write a short note on chromatic number decision problems.

47. Write a note on flow shop scheduling.

48. Define and Explain Non-Deterministic algorithms.

49. Define and explain the following terms.

a. Deterministic and NonDeterministic algorithm.
b. Decision and optimization problem.
c. DHC problem.

d. Relationship between NCDP and CDP

Unit 6: Introduction to Parallel Algorithm

50. Write a note on Amdahl's law.
51. List and explain Variants of PRAM.
52. Write an algorithm & Explain Prefix computation problem with suitable example.
53. Write a note on Deterministic list ranking.
54. Write the difference between sequential computational models & shared memory models.
55. Explain how MESH computational model works.
56. Write a note on Broadcasting in MESH.
57. Write an algorithm for prefix computation on linear array.
58. Write an algorithm for prefix computation on mesh.
59. Compute the prefix sums on the mesh for the following indexing schemes row major, snakelike row major, column major and snakelike column major.

3	4	1	2
5	6	3	4
1	5	8	6
7	9	2	3

60. Explain Hypercube.
61. How three dimensional Butterfly network works?
62. Explain with example embedding of binary tree into hypercube.
63. Write algorithm for prefix computation on binary tree & explain with suitable example the working of it?