STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI - 600 086
(For candidates admitted during the academic year 2019 – 20 and thereafter)

SUBJECT CODE: 19CS/ME/AD45

B.C.A. DEGREE EXAMINATION – APRIL 2022
FOURTH SEMESTER

COURSE : MAJOR ELECTIVE
PAPER : ALGORITHM DESIGN TECHNIQUES
TIME : 3 HOURS **MAX. MARKS: 100**

SECTION A

ANSWER ALL THE QUESTIONS **(20 × 1 = 20)**

Choose the correct answer

1. In a knapsack problem, if the sum of all the weights is <= m, then $x_i = 1$, $1 < i < n$ is a(n) _____.
   a. Feasible solution b. Optimal solution
   c. Sub-optimal solution d. Cannot be determined
2. The time complexity of Strassen's Matrix multiplication is _____.
   a. $O(n^2)$ b. $O(n^3)$ c. $O(n^{2.81})$ d. O(n log n)
3. _____ holds for Dynamic programming.
   a. Always gives an optimal solution b. Faster than Greedy
   c. Requires more space and time d. both a and c
4. In an optimal binary search tree, there will be _____ equivalence classes.
   a. n b. n-1 c. n+1 d. n(n-1)/2
5. _____ are those problem states 's' for which the path from the root to 's' defines a tuple in the solution space.
   a. Problem states b. Answer states c. State space d. Solution space
6. The smallest integer m which is used to colour a graph G is referred to as _____.
   a. Chromatic number b. Colour number c. Edge count d. Vertex count
7. _____ branch-and-bound method utilizes a D-search approach.
   a. LC b. FIFO c. LIFO
   d. All the mentioned
8. What will be the cost of the reduced matrix?

$$\begin{bmatrix} \infty & 7 & 3 & 12 & 8 \\ 3 & \infty & 6 & 14 & 9 \\ 5 & 8 & \infty & 6 & 18 \\ 9 & 3 & 5 & \infty & 11 \\ 18 & 14 & 9 & 8 & \infty \end{bmatrix}$$

   a. 25 b. 22 c. 5 d. 27
9. _____ string sort algorithm works from left-to-right.
   a. MSD sort b. LSD sort c. Quick sort d. Radix sort
10. _____substring search algorithm makes use of hashing.
    a. Knuth-Morris-Pratt b. Boyer-Moore c. Rabin-Karp d. Brute force

….2

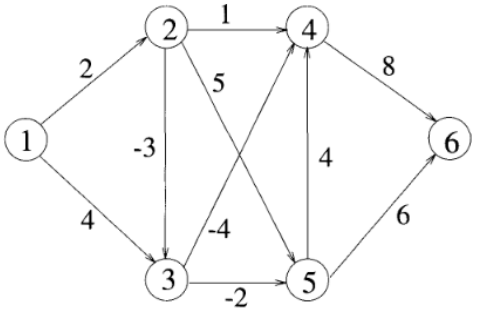
Fill in the blanks

11. The _____ technique involves making the locally optimal choice at each stage.
12. Recurrence relations can be solved using _____ method.
13. In Dijkstra's algorithm if the shortest path from v to u with at most k, k > 1, edges has no more than (k–1) edges, then $dist^k[u]$ = _____.
14. 0/1 knapsack belongs to _____ class of problems.
15. Backtracking yields a solution of _____ tuples.
16. For a graph with n vertices, the state space tree generated will be of height _____.
17. In a cost adjaceny matrix, the cost of the edge between edges <i, j>, c_{ij} = ___ if <i, j> ∉ G.
18. LC-search uses a _____ data structure.
19. _____ represents a set of characters from which a string takes its characters.
20. _____ compression is required for many types of files, such as numerical data or executable code.

SECTION B

ANSWER ALL THE QUESTIONS **(5 × 2 = 10)**

21. Explain Job sequencing with deadlines.
22. State the principle of optimality.
23. Color the following graph and find out the smallest value that m can take.



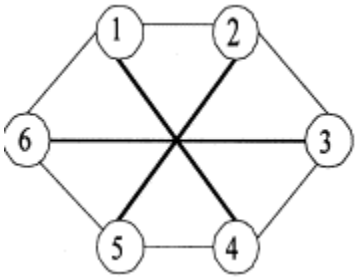
24. List at least 4 applications of 0/1 knapsack problem.
25. Differentiate decision and optimization problems.

SECTION C

ANSWER ANY EIGHT QUESTIONS **(8 × 5 = 40)**

26. Explain with an example how divide-and-conquer can be used to find the smallest and largest elements from a list of numbers. What would be the complexity of such an algorithm?
27. Explain Dijkstra's algorithm with an example.
28. How can an optimal binary search tree be constructed?
29. Explain with algorithm and example on how the principle of optimality holds for 0/1 knapsack.
30. What is backtracking? Explain the working with an example.

31. From the given graph, find out all the Hamiltonian cycles.



32. Give short notes on LC branch-and-bound.
33. Explain FIFO and LIFO branch-and-bound methods with an example.
34. Give short notes on NP-hard and NP-complete classes.
35. How does LSD and MSD Radix sort work with strings?

SECTION D

ANSWER ANY THREE QUESTIONS **(3 × 10 = 30)**

36. What is a spanning tree? What is a minimum cost spanning tree and how is it derived? Explain with an example the algorithm for forming a minimum cost spanning tree.
37. What are multistage graphs? Explain how the forward and backward approaches work.
38. How does the sum of subset algorithm work? Give an example.
39. Explain how 0/1 knapsack problem can be solved using branch-and-bound technique.
40. Explain in detail how substring search algorithms work.

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