ஸ்ரீ-ல-ஸ்ரீ காசிவாசி சுவாமிநாத சுவாமிகள் கலைக் கல்லூரி

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S.K.S.S ARTS COLLEGE, THIRUPPANANDAL - 612504

QUESTION BANK

Title of the Paper

DATA STRUCTURES AND ALGORITHMS

Course: III B.Sc. (CS)
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CORE COURSE V
DATA STRUCTURES AND ALGORITHMS

Unit I

Arrays and sequential representations – ordered lists – Stacks and Queues – Evaluation ofExpressions – Multiple Stacks and Queues – Singly Linked List – Linked Stacks and queues – Polynomial addition.

Unit II

Trees – Binary tree representations – Tree Traversal – Threaded Binary Trees – Binary Tree Representation of Trees – Graphs and Representations – Traversals, Connected Components and Spanning Trees – Shortest Paths and Transitive closure – Activity Networks – Topological Sort and CriticalPaths.

Unit III

Algorithms – Priority Queues - Heaps – Heap Sort – Merge Sort – Quick Sort – Binary Search – Finding the Maximum and Minimum.

Unit IV

Greedy Method : The General Method – Optimal Storage on Tapes – Knapsack Problem – Job Sequencing with Deadlines – Optimal Merge Patterns.

Unit V

Back tracking: The General Method – The 8-Queens Problem – Sum of Subsets – Graph Coloring.

UNIT – I
Choose the Correct Answer

1. Which of these best describes an array?
   a) A data structure that shows a hierarchical behaviour
   b) Container of objects of similar types
   c) Arrays are immutable once initialised
   d) Array is not a data structure

2. Which matrix has most of the elements (not all) as Zero?
   a) Identity Matrix
   b) Unit Matrix
   c) Sparse Matrix
   d) Zero Matrix

3. What will be the resulting array after rotating arr[]={1, 2, 3, 4, 5} by 2?
   a) 2, 1, 3, 4, 5
   b) 3, 4, 5, 1, 2
   c) 4, 5, 1, 2, 3
   d) 1, 2, 3, 5, 4

4. Process of inserting an element in stack is called _____
   a) Create
   b) Push
   c) Evaluation
   d) Pop

5. Process of removing an element from stack is called _____
   a) Create
   b) Push
   c) Evaluation
   d) Pop

6. A linear list of elements in which deletion can be done from one end (front) and insertion can take place only at the other end (rear) is known as a ?
   a) Queue
   b) Stack
   c) Tree
   d) Linked list

7. The data structure required for Breadth First Traversal on a graph is?
   a) Stack
   b) Array
   c) Queue
   d) Tree

8. Which of the following is not a disadvantage to the usage of array?
   a) Fixed size
   b) There are chances of wastage of memory space if elements inserted in an array

are lesser than the allocated size
c) Insertion based on position
d) Accessing elements at specified positions

9. Which of the following is false about a doubly linked list?
a) We can navigate in both the directions
b) It requires more space than a singly linked list
c) The insertion and deletion of a node take a bit longer
d) Implementing a doubly linked list is easier than singly linked list

10. With what data structure can a priority queue be implemented?
a) Array
b) List
c) Heap
d) Tree

Answers:1.b   2.c   3.b   4.b   5.d   6.a   7.c   8.d   9. d   10.d

Short Questions (2 Marks)

11. What is a Data Structure?
12. What are linear and non linear data Structures?
13. How is an Array different from Linked List?
14. What is Stack and where it can be used?
15. What is a Queue, how it is different from stack and how is it implemented?
16. What are Infix, prefix, Postfix notations?
17. What is a Linked List?
18. What are Linked List types?
19. How to implement a stack using queue?
20. How to implement a queue using stack?

Paragraph Questions (5 Marks)

21. Explain the concept of Stack and Queue.
22. Explain the Recursion Application of Stack.
23. Write the procedure and explain the Delete Operation in a Queue.
24. What is list? How are data added, removed in linked lists?
25. With diagram explain, how pointers are updated in the doubly linked list.
26. How will you implement two queues in a single array? Explain.
27. State the difference between arrays and linked lists
28. Write a recursive algorithm to find the postfix operation of the expression Ab+cd*ef/ where a =5, b=8, c=3, d=2, e=4, f=8
29. Explain in detail any three applications of stack.
30. Explain how linked list is used for polynomial addition

Essay Type Questions (10 Marks)

31. What is Data Structure? Explain various types of Data Structure in detail.
32. What do you mean by Array? Describe the storage structure of Array. Also explain various types of Array in detail
33. What is Stack? Why it is known as LIFO? Write algorithm of PUSH, POP, PEEP and CHANGE operation on Stack
34. List the applications of Stack. What is Recursion? Explain Recursion for find a factorial of number in detail.
35. Write an algorithm for converting Unparenthesized Infix expression into Postfix expression
36. Write an algorithm for converting Parenthesized Infix expression into Postfix expression
37. What is Queue? Why it is known as FIFO? Write an algorithm to insert and delete an element from a simple Queue.
38. What are Circular Queue and Priority Queue? Write an algorithm to insert and delete an element from a Circular Queue.
39. What is Doubly Linked List? Write an algorithm to insert and delete a node in Doubly Linked List.
40. What is Circular Linked List? State the advantages and disadvantages of Circular Link List Over Doubly Linked List and Singly Linked List. Also write advantages of Linked List over an Array.

UNIT - II
Choose the Correct Answer

1. How many children does a binary tree have?
   a) 2
   b) any number of children
   c) 0 or 1 or 2
   d) 0 or 1

2. What is/are the disadvantages of implementing tree using normal arrays?
   a) difficulty in knowing children nodes of a node
   b) difficult in finding the parent of a node
   c) have to know the maximum number of nodes possible before creation of trees
   d) difficult to implement

3. Advantages of linked list representation of binary trees over arrays?
   a) dynamic size
   b) ease of insertion/deletion
   c) ease in randomly accessing a node
   d) both dynamic size and ease in insertion/deletion

4. Disadvantages of linked list representation of binary trees over arrays?
   a) Randomly accessing is not possible
   b) Extra memory for a pointer is needed with every element in the list
   c) Difficulty in deletion
   d) Random access is not possible and extra memory with every element

5. For the tree below, write the pre-order traversal.
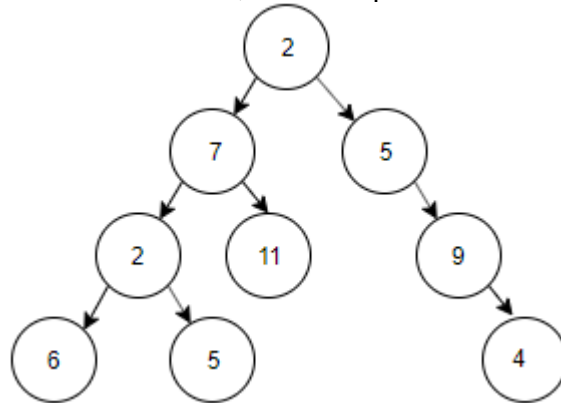
a) 2, 7, 2, 6, 5, 11, 5, 9, 4
b) 2, 7, 5, 2, 6, 9, 5, 11, 4
c) 2, 5, 11, 6, 7, 4, 9, 5, 2
d) 2, 7, 5, 6, 11, 2, 5, 4, 9

6. For the tree below, write the post-order traversal.
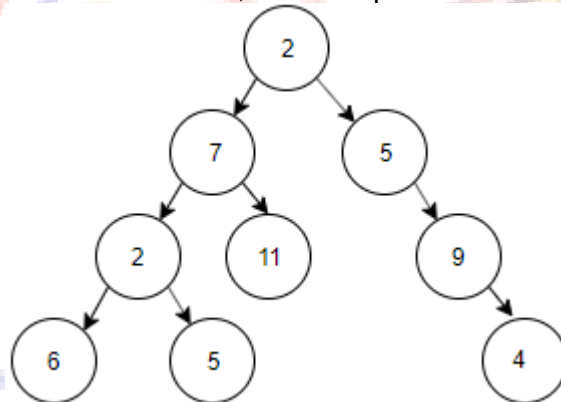
a) 2, 7, 2, 6, 5, 11, 5, 9, 4
b) 2, 7, 5, 2, 6, 9, 5, 11, 4
c) 2, 5, 11, 6, 7, 4, 9, 5, 2
d) 2, 7, 5, 6, 11, 2, 5, 4, 9

7. How many properties will an equivalent relationship satisfy?
   a) 1
   b) 2
   c) 3
   d) 4

8. Which of the following is the most widely used external memory data structure?
   a) AVL tree
   b) B-tree
   c) Red-black tree
   d) Both AVL tree and Red-black tree

9. B-tree of order n is a order-n multiway tree in which each non-root node contains _____
   a) at most (n – 1)/2 keys
   b) exact (n – 1)/2 keys
   c) at least 2n keys
   d) at least (n – 1)/2 keys

10. A B-tree of order 4 and of height 3 will have a maximum of _____ keys.
   a) 255
   b) 63
   c) 127
   d) 188

Answers: 1.c   2. c   3. d   4.d   5.a   6.c   7.b   8.d   9. a   10.a

Short Questions (2 Marks)

11. Define a tree
12. Define root
13. Define degree of the node
14. Define a binary tree
15. What is meant by binary tree traversal?
16. What do you mean by balanced trees?
17. Define adjacent nodes.
18. What is a directed graph?
19. What is a minimum spanning tree?
20. What do you mean by shortest path?

Paragraph Questions (5 Marks)

21. What is the use of threaded binary tree? Explain
22. Define Binary tree. Explain how to represent a binary tree in memory using array.
23. Explain any one application of tree.
24. Define a tree prove that a binary tree with n nodes has exactly (n-1) edges or branches
25. Explain the difference between general tree and binary tree with examples.
26. Write definition of binary tree, level of a tree, forest of a tree and sibling with an example
27. How to represent a binary tree in memory using linked list? Explain it with an example.
28. Explain topological sort with example
29. Explain in detail about critical paths
30. Briefly explain shortest paths and transitive closure

Essay Type Questions (10 Marks)

31. Explain Breadth First Search traversal of Graph using an example.
32. Explain Depth First Search traversal of Graph using an example.
33. What is Spanning Trees? Explain Spanning Tree in detail with example.

34. What is Binary Tree? Explain Representation of Binary tree. Also explain different operation that can be performed on Binary tree.
35. Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example.
36. List the types of Binary Search Tree. Explain Insertion and Deletion Operation on Binary Search Tree with Example.
37. What is the meaning of height balanced tree? How rebalancing is done in height balanced tree.
38. Construct a tree for the given inorder and postordertraversals.Inorder:DGBAHEICFPostorder: GDBHIEFCA
39. Discuss following with reference to trees.(i) Height of the tree (ii) Complete Binary Tree (iii) Expression tree(iv) Sibling (v) Full Binary Tree
40. Write detailed note on Dijkstra's Algorithm

UNIT –III
Choose the Correct Answer

1. In a max-heap, element with the greatest key is always in the which node?
   a) Leaf node
   b) First node of left sub tree
   c) root node
   d) First node of right sub tree
2. Heap exhibits the property of a binary tree?
   a) True
   b) False

3. What is the complexity of adding an element to the heap.
   a) O(log n)
   b) O(h)
   c) O(log n) & O(h)
   d) O(n)

4. The worst case complexity of deleting any arbitrary node value element from heap is _____
   a) O(logn)
   b) O(n)
   c) O(nlogn)
   d) $O(n^2)$

5. Heap can be used as _____
   a) Priority queue
   b) Stack
   c) A decreasing order array
   d) Normal Array

6. The time complexity of quick sort is ....
   a) O(n)
   b) O(n2)

c) O(n log n)
d) O(log n)

7. Which of the following sorting algorithms is the fastest?
   a) Merge sort
   b) Quick sort
   c) Insertion sort
   d) Shell sort

8. Quick sort follows Divide-and-Conquer strategy.
   a) True
   b) False

9. What is the worst case time complexity of a quick sort algorithm?
   a) O(N)
   b) O(N log N)
   c) $O(N^2)$
   d) O(log N)

10. Which of the following methods is the most effective for picking the pivot element?
    a) first element
    b) last element
    c) median-of-three partitioning
    d) random element

Answers: 1. c   2.a   3. c   4.a   5.a   6.c   7.b   8.a   9. c   10. c

Short Questions (2 Marks)

11. Define sorting
12. Mention the types of sorting
13. What are the steps in quick sort?
14. Define searching
15. What is binary search?
16. Define Heap.
17. What is the need for Priority queue?
18. Define Merge Sort
19. Define Quick Sort
20. What are the features of efficient algorithm?

Paragraph Questions (5 Marks)

21. Explain about merge sort.
22. Sort the following numbers using heap sort procedure. 23,5,6,9,12,4,8,3,1,2
23. Compare and contrast between linear search and binary search with an example.
24. Compare and contrast between sorting and searching with an example.
25. Explain binary search algorithm with an example.
26. Sort the following numbers using merge sort.56,8,90,11,21,34,62,14,45,38,98,66,82,70

27. Explain about binary search tree with an example
28. Explain the procedure of merge sort technique with suitable examples.
29. Explain tree sort with an example.
30. Explain tree search with an example.

Essay Type Questions (10 Marks)

31. Explain binary search with its algorithm also discuss about application of sorting and searching procedures.
32. Discuss Quick Sort
33. Explain Address Calculation Sort with the help of example.
34. What do you mean by Searching? Explain Sequential search and Binary search with help of example.
35. Discuss following with reference to graphs.(i) Directed graph (ii) Undirected graph (iii) Degree of vertex(iv)Null graph (v) Acyclic Graph
36. What is Graph? Explain matrix and linked list representation of a graph. Also give the application of Graph.
37. Create a Binary Search Tree for the following data and do in-order,Preorder and Post-order traversal of the tree.50, 60, 25, 40, 30, 70, 35, 10, 55, 65, 5
38. Explain in detail about maximum bipartite matching
39. What are the techniques of searching? Explain
40. Discuss about finding the maximum and minimum

UNIT – IV
Choose the Correct Answer

1. Which of the problems cannot be solved by backtracking method?
   a) n-queen problem
   b) subset sum problem
   c) Hamiltonian circuit problem
   d) travelling salesman problem

2. What is the objective of the knapsack problem?
   a) To get maximum total value in the knapsack
   b) To get minimum total value in the knapsack
   c) To get maximum weight in the knapsack
   d) To get minimum weight in the knapsack

3. Which of the following statement about 0/1 knapsack and fractional knapsack problem is correct?
   a) In 0/1 knapsack problem items are divisible and in fractional knapsack items are indivisible
   b) Both are the same
   c) 0/1 knapsack is solved using a greedy algorithm and fractional knapsack is solved using dynamic programming
   d) In 0/1 knapsack problem items are indivisible and in fractional knapsack items are divisible

4. Time complexity of fractional knapsack problem is _____
    a) O(n log n)
    b) O(n)
    c) O(n²)
    d) O(nW)

5. Which is not feasible solution in the case of job sequence problem item : 1 2 3 4 profit : 100 10 15 27 deadline : 2 1 2 1

a) (1,4)
b) (4,3)
c) (2,4)
d) (1,2)

6. Which is optimal value in the case of job sequence problem item : 1 2 3 4 5 profit : 20 15 10 51 deadline : 2 2 3 3 3

a) (1,3,4)
b) (4,2,3)
c) (1,2,4)
d) (1,5,2)

7. The advantage of selecting maxmin algorithm using divide and conquer method compared to straightmaxmin algorithm is _____

a) Less time complexity
b) High accuracy
c) Less space complexity
d) High time complexity

8. Which is not return optimal solution from the following methods

a) Dynamic programming
b) Backtracking
c) Branch and bound
d) Greedy method

9. In the case of sub problems share sub problems, which method is suitable

    a) Greedy method
    b) Branch and bound
    c) Dynamic programming
    d) Divide and conquer

10. The method which return different solutions from a single point, which is _____

    a) Greedy method
    b) Branch and bound
    c) Dynamic programming
    d) Divide and conquer

Answers:1. d   2. a   3. d   4.a   5.c   6.c   7.a   8.b   9.c   10. a

Short Questions (2 Marks)

11. What is optimal solution?
12. Define principle of optimality.
13. State fractional knapsack problem
14. Write the control abstraction greedy method
15. What is an algorithm design technique?
16. What is greedy technique?
17. Write any two characteristics of Greedy Algorithm?
18. What are the steps required to develop a greedy algorithm?
19. What is job sequence?
20. What does job sequencing with deadlines mean?

Paragraph Questions (5 Marks)

21. Explain in detail about Greedy algorithm with an example.
22. Explain in detail about Divide and conquer algorithm with an example also mark the difference between Greedy and divide and conquer algorithm.
23. Describe the backtracking problem using knapsack problem
24. Explain the Knapsack Problem using Greedy method with algorithm.
25. Explain Memory Function algorithm for the Knapsack problem
26. Write a greedy algorithm to the job sequencing with deadlines
27. Define merging and purging rules in 0/1 knapsack problem.
28. Find the optimal solution of the Knapsack instance n= 7, M=15, (p1, p2, ...p7) = (10,5,15,7,6,18,3) and (w1,w2,.....w7)=(2,3,5,7,1,4,1).
29. Write an algorithm to compute the Fibonacci series for 'n' terms.
30. Explain garbage collection with their variations.

Essay Type Questions (10 Marks)

31. Explain in detail about approximation algorithm for the Knapsack problem
32. Explain P, NP and NP complete problems.
33. Discuss in detailed optimal storage on tapes
34. Explain optimal merge patterns with example
35. Write short notes on Job Sequencing with deadlines.
36. Briefly describe on the stable marriage problem.
37. Find all the solution to the traveling salesman problem by exhaustive search. Give the optimal solutions.
38. What are the fundamental steps to solve an algorithm?

39. Describe in detail about the steps in analyzing and coding an algorithm.
40. Explain the basic efficiency classes with notations.

UNIT – V
Choose the Correct Answer

1. Who published the eight queens puzzle?
   a) Max Bezzel
   b) Carl
   c) Gauss
   d) Friedrich

2. When was the Eight Queen Puzzle published?
   a) 1846
   b) 1847
   c) 1848
   d) 1849

3. Under what condition any set A will be a subset of B?
   a) if all elements of set B are also present in set A
   b) if all elements of set A are also present in set B
   c) if A contains more elements than B
   d) if B contains more elements than A

4. What is a subset sum problem?
   a) finding a subset of a set that has sum of elements equal to a given number
   b) checking for the presence of a subset that has sum of elements equal to a given number and printing true or false based on the result
   c) finding the sum of elements present in a set
   d) finding the sum of all the subsets of a set

5. Which of the following is true about the time complexity of the recursive solution of the subset sum problem?
   a) It has an exponential time complexity
   b) It has a linear time complexity
   c) It has a logarithmic time complexity
   d) it has a time complexity of $O(n2)$

6. In how many directions do queens attack each other?
   a) 1
   b) 2
   c) 3
   d) 4

7. Placing n-queens so that no two queens attack each other is called?
   a) n-queen's problem
   b) 8-queen's problem

c) Hamiltonian circuit problem
d) subset sum problem

8. Where is the n-queens problem implemented?
a) carom
b) chess
c) ludo
d) cards

9. Not more than 2 queens can occur in an n-queens problem.
a) true
b) false

10. In n-queen problem, how many values of n does not provide an optimal solution?
a) 1
b) 2
c) 3
d) 4

Answers:1. a   2.c   3.b   4.b   5.a   6.c   7.a   8.b   9. b   10. b

Short Questions (2 Marks)

11. What is meant by n-queen Problem?
12. Define Backtracking
13. What is the Aim of Backtracking?
14. List out the implementation procedure of Backtracking
15. Draw the solution for the 4-queen problem
16. How many colors are needed to edge color the following graph?
17. What is proper coloring in graph theory?
18. Define dynamic programming
19. Define Subset-Sum Problem?
20. Define the Hamiltonian circuit.

Paragraph Questions (5 Marks)

21. Give solution to Subset sum problem using Backtracking technique
22. Explain the backtracking algorithm for the n-queens problem
23. Which type of algorithm is used to solve the 8 queens problem?
24. How many possible solutions exist for an 8 queen problem?
25. How do you solve the four queens problem?
26. Explain the backtracking in 8 queens problem?
27. Write short notes on the three color problem?
28. Explain a k4 graph?
29. What are the strengths of backtracking and branch-and-bound?
30. .What is meant by nondeterministic algorithm?

Essay Type Questions (10 Marks)

31. Explain why backtracking is the default procedure for solving problems.
32. State the subset-sum problem and Complete state-space tree of the backtrackingalgorithm applied to the instance A={3, 5, 6, 7} and d=15 of the subset-sum problem.
33. How do you compute maximum flow for the following graph using ford-Fulkerson method?
34. Write the procedure to compute Huffman code
35. Give solution to Hamiltonian circuit using Backtrackingtechnique
36. Explain Backtracking technique
37. Explain in detail about maximum bipartite matching
38. How can I graphically display a large amount of data?
39. Define a planar graph and explain graph coloring
40. Explain m Coloring Problem with suitable example