

Reg. No. :

Question Paper Code : 70070

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Computer Science and Engineering

CS 3301 — DATA STRUCTURES

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Outline a linear and a nonlinear data structure with an example.
2. Outline a circular linked list with a diagram.
3. Convert the infix expression $(a + b) * (c - d)$ to prefix expression.
4. What is a queue data structure?
5. Construct a binary tree for the expression $(a + b) * (c - d)$.
6. What is a heap? Outline the properties of a heap.
7. Outline the difference between a B tree and a B+ tree data structure with respect to storing — keys and records.
8. Outline a directed graph with an example.
9. Outline divide-and conquer algorithm design paradigm.
10. What is a hash function?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Outline the steps to search a linked list with an example and relevant diagrams. (7)
- (ii) Outline the steps to delete from a linked list with an example and relevant diagrams. (6)

Or

- (b) How can a polynomial be represented as a linked list? Outline the algorithm for addition of two polynomials using linked lists with an example. (13)
12. (a) Outline the algorithm for evaluating a postfix expression using stack data structure with an example. (13)

Or

- (b) What is a deque? Outline the operations that can be performed on a deque with an algorithm, example and relevant diagrams. (13)
13. (a) Outline preorder, inorder and postorder traversal on a binary tree with an algorithm and an example. (13)

Or

- (b) State the binary search tree property and outline the algorithm to search a binary search tree with an example. (13)
14. (a) Outline breadth first search traversal and depth first search traversal of a graph with an example. (13)

Or

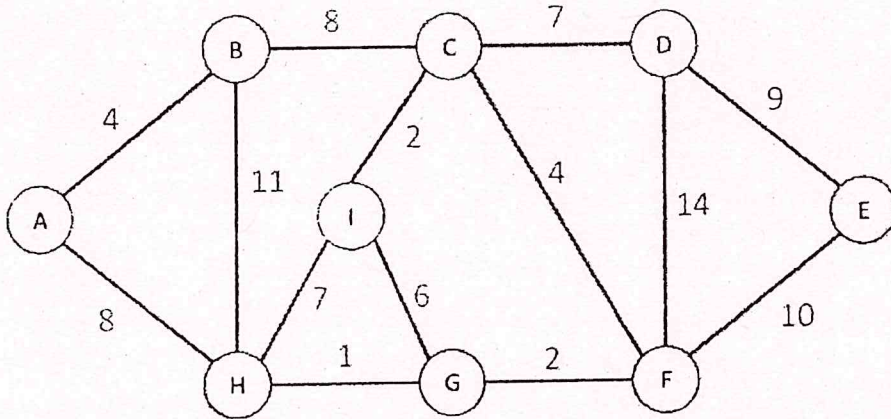
- (b) Outline the steps in the Dijkstra's shortest path algorithm with an example. (13)
15. (a) Outline the algorithm to perform linear search on an array of 'N' numbers. Illustrate each step of the algorithm with an example. (13)

Or

- (b) Outline the algorithm to sort an array of 'N' numbers using bubble sort. Illustrate each step of the algorithm with an example. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Outline the steps in constructing a minimal spanning tree using kruskal's algorithm and apply the algorithm for the weighted undirected graph presented below. (15)



Or

- (b) Outline the steps in the insertion sort algorithm and apply the algorithm for the numbers given below. (15)

12, 06, 14, 02, 01, 04, 03

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Question Paper Code : 30116

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Computer Science and Engineering

CS 3301 – DATA STRUCTURES

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the uses of Abstract Data Type (ADT).
2. List the advantages of doubly linked list.
3. Give the limitations of linear queue.
4. Write the underflow and overflow conditions in stack?
5. Mention the types of rotations performed on AVL tree.
6. State the properties of binary search tree.
7. Define critical path.
8. State the uses of topological sort.
9. Outline perfect minimal hashing function.
10. Identify the principle behind the external sorting algorithms.

PART B — (5 × 13 = 65 marks)

11. (a) Explain how list operations can be implemented using Arrays.

Or

- (b) Explain how polynomial expression can be represented using linked list.

12. (a) Write an algorithm for Push and Pop operations on Stack using Linked list.

Or

- (b) Explain the addition and deletion operations performed on a circular queue with necessary algorithms.
13. (a) Identify the types of Priority Queue. Explain about min heap insertion and deletion operations.

Or

- (b) Explain Heap tree ADT in detail.
14. (a) Write and explain the prim's algorithm and depth first search algorithm.

Or

- (b) Explain about B+ trees with algorithms to insert a node into a B+ tree.
15. (a) Write an algorithm to implement Bubble sort with suitable example.

Or

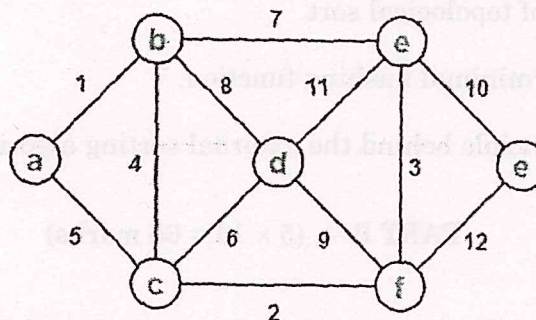
- (b) Discuss the common collision resolution strategies used in closed hashing system.

PART C — (1 × 15 = 15 marks)

16. (a) The keys 12,18,13,2,3,23,5, and 15 are inserted into an initially empty hash table of length 10 using linear probing with hash function $h(k) = k \text{ mod } 10$. What is the resultant hash table?

Or

- (b) Using Prim's Algorithm, find the cost of minimum spanning tree (MST) of the given graph.



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Question Paper Code : 20863

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Third Semester

Computer Science and Engineering

CS 3301 – DATA STRUCTURES

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define abstract data type.
2. Infer the usage of multilists.
3. Recall when an overflow and underflow condition occur during stack operations.
4. List some applications of queues.
5. Indicate the properties of binary tree.
6. Distinguish binary search tree and AVL tree.
7. Define B+ Tree with an example.
8. Express how a graph differs from a spanning tree with an example.
9. Distinguish internal and external sorting.
10. State hashing function.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Infer how lists and linked list are stored in memory with an example and write a function to check current position is last in a linked list. (7)
(ii) Distinguish circular linked list and doubly linked list during insertion and deletion operation. (6)

Or

- (b) (i) Express an algorithm to add two polynomials having m and n terms respectively using linked list with an example. (7)
- (ii) Explain how linked list are used for sorting the following set of numbers using radix sort. (6)
- $A = [432, 8, 530, 90, 88, 231, 11, 45, 677, 199]$
12. (a) (i) Outline the pseudo-code for performing the following operations in stacks using array implementation. (8)
- (1) Create (2) Push
(3) Pop (4) Stack Top
- (ii) Identify how stacks are used for checking whether an expression is balanced or not for every right and left brace, bracket and parenthesis. (5)

Or

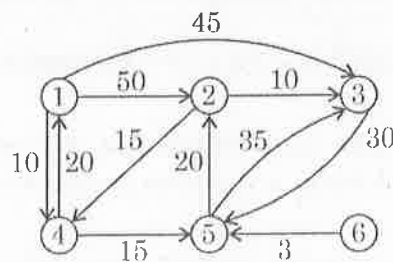
- (b) (i) State the procedure for performing enqueue, dequeue, Isempty, and Isfull operations in a queue data structure with example data. (8)
- (ii) Recognize the differences between circular queue and dequeue. (5)
13. (a) (i) Classify the three types of binary tree traversal and write the pseudo-code for in-order traversal with an example. (7)
- (ii) Explain how a postfix expression is converted into an expression tree with an example. (6)

Or

- (b) (i) Write the insertion algorithm for binary search tree and analyze its complexity. (7)
- (ii) Summarize how rebalancing occurs in AVL trees during double rotation with an example. (6)
14. (a) (i) List the principles of B-trees and explain how a node can be inserted into a B-Tree with an example. (7)
- (ii) Outline an algorithm for traversing a graph using breadth -first method with an example. (6)

Or

- (b) (i) State dijkstra's algorithm and identify the minimum cost and shortest path for the following graph. (7)



- (ii) Describe topological sorting with a pseudo-code. (6)

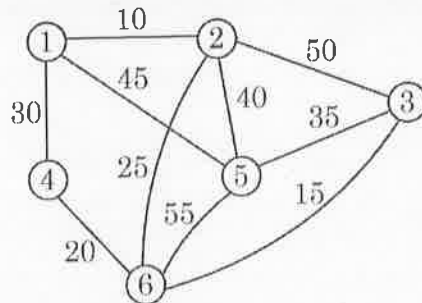
15. (a) (i) Defend how binary search logic is better than linear search with an algorithm and an example. (7)
- (ii) Indicate the function for insertion sort with an example. (6)

Or

- (b) (i) Write the merge sort algorithm and show how it arranges the following array of ten elements in sorted order. Analyze the complexity of the algorithm. (7)
- $A[1:10] = (31, 28, 17, 65, 35, 42, 86, 25, 45, 52)$.
- (ii) Discuss about linear probing collision resolution technique with an example. (6)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Demonstrate how minimum cost spanning tree can be obtained by Prim's method with an algorithm. (10)
- (ii) Trace the above algorithm for the following graph and analyze the time and space complexity. (5)



Or

- (b) (i) Convert the following infix expression to postfix expression with a neat sketch using stacks. (5)
- $((A - (B + C) * D) \$(E + F))$.
- $(A / (B - C + D)) * (E - A) * C$
- (ii) Devise an algorithm for evaluating the above postfix expression using stacks and analyze the complexity. (10)

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Question Paper Code : 50896

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Third Semester

Computer Science and Engineering

CS 3301 — DATA STRUCTURES

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the advantages of modularity in programming.
2. What are ADT? Give an example.
3. A circular queue has a size of 5 and has 3 elements 11, 30, 41 where $F=1$ and $R=3$. After inserting 50 and 60, what is the value of F and R . Trying to insert 33 at this stage what happens. Delete 2 elements from the queue and insert 71, 98. Show the sequence of steps for the above operations.
4. A letter means push and an asterisk means pop in the following sequence. Give the sequence of values returned by the pop operations, when this sequence of operations is performed on an initially empty LIFO stack.
U S G * O * O L D * * * E V * * * Y * O * *
5. What are the properties of AVL trees?
6. A binary tree T has 9 nodes. The inorder and postorder traversals of T yield the following:
Inorder traversal (I): E A C K F H D B G
Postorder traversal (Po): E C K A H B G D F
Draw the binary tree.
7. Define Euler's circuits.

8. Give the topological order for the DAG in Figure 1.

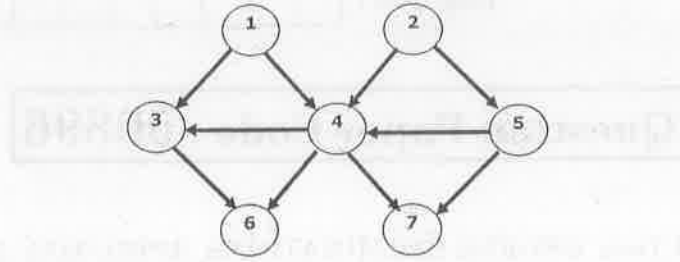


Figure 1

9. What are the different hash functions?
10. The keys 22, 28, 23, 12, 13, 3, 25 and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function $h(k) = k \bmod 10$ and apply linear probing for resolving the collision. What is the resultant hash table?

PART B — (5 × 13 = 65 marks)

11. (a) (i) What are the different ways the list can be implemented? State and explain list ADT. (6)

- (ii) Write the function to add two polynomial given as a linked list. (7)

Input:

$$p_1 = 13x^8 + 7x^5 + 32x^2 + 54$$

$$p_2 = 3x^{12} + 17x^5 + 3x^3 + 98$$

Or

- (b) (i) Distinguish between singly, doubly and circular linked list with an example. (6)

- (ii) Write a C function to insert a node in the middle of the linked list and count the number of nodes in the circular linked list. (7)

12. (a) (i) What is circular queue? Explain with suitable example. (6)

- (ii) State the application of Queue and explain any one application with an example. (7)

Or

- (b) Write a C function for the following conversions. (6+7)

- (i) Infix to postfix expression

- (ii) Evaluate the postfix expression

13. (a) (i) Distinguish between Binary tree, general tree and binary search tree and also give an example. (6)
- (ii) Given the AVL Tree in Figure 2. Draw the resulting balanced tree step by step after 5 is removed. Label each node with balance factor. (7)

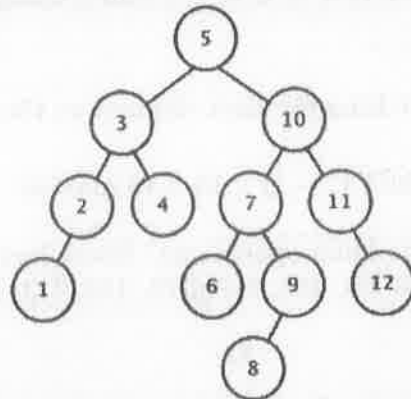


Figure 2

Or

- (b) Write a C function for the following in the Binary search tree: (5+5+3)
- (i) To find the height of a tree.
- (ii) To Find minimum and maximum
- (iii) Pre order traversals.
14. (a) Distinguish between Prim's and Kruskal's? Using Prim's algorithm starting with vertex "A", list the vertices of the graph given in Figure 3. in the order they are added to maximum spanning tree.

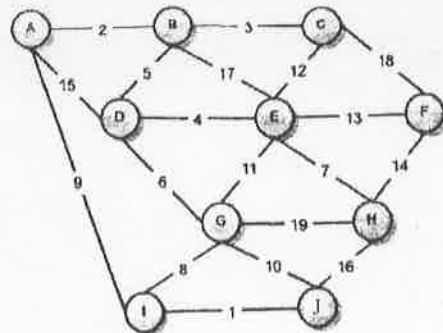


Figure 3

Or

- (b) (i) What is B Tree and B+ Tree? Explain with example. (6)
- (ii) Distinguish between BFS and DFS with the usage of stack and queue. (7)

15. (a) (i) Distinguish between linear search and binary search. (6)
(ii) What is extendible hashing? State and explain with example. (7)

Or

- (b) Sort the sequence 4, 6, 8, 2, 9, 5, 1, 7 and 3 using the following (6+7)
(i) Merge sort
(ii) Quicksort (picking the first element as the pivot).

PART C — (1 × 15 = 15 marks)

16. (a) What are the basic heap operations? Show how heap sort processes the input 142, 543, 123, 65, 453, 879, 572, 434, 111, 242, 811, 102.

Or

- (b) Write the functions for the following operations on doubly linked list.
• Sum up the values stored in the nodes of a list. (5)
• Count the even numbers in the list. (5)
• Delete the node with an element X. (5)

