

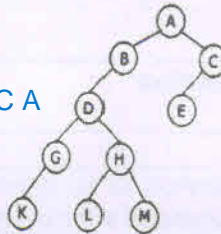


**SOMAIYA**  
VIDYAVIHAR UNIVERSITY

25.05.2024 (E)

Maximum Marks: 100		Semester: JAN 2024 to APRIL 2024	
Programme code: 01/04		Examination: ESE Examination - (KT)	
Programme: B. Tech. in Computer Engineering/IT		Class: SY	Duration: 3 Hrs.
Name of the Constituent College: K. J. Somaiya College of Engineering		Semester: III(SVU 2020)	
Course Code: 116U01C302		Name of the department: COMP/IT	
Name of the Course: Data Structures (116U01C302)/(116U04C302)			
Instructions: 1) Draw neat diagrams 2) All questions are compulsory			
3) Assume suitable data wherever necessary			

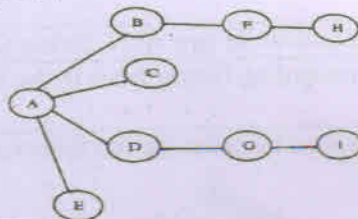
Que. No.	Question	Max. Marks
Q1	Solve any Four	20
i)	Discuss the Primitive Data Structure and non-Primitive Data Structure with examples.	5
ii)	Draw wall of ADT operations and write two ADT String Operator definition	5
iii)	What are the two ways of representing binary trees in the memory? Which one do you prefer and why?	5
iv)	Find the pre-order, post-order, and in-order for the following tree.  Inorder:- K G D L H M B A E C Preorder:- A B D G K H L M C E Postorder:- K G H L M H D B E C A	5
v)	Consider a hash table of size 11. Using linear probing, insert the keys 29, 18, 43, 10, 36, 25, 46 into the table with proper explanation.	5
vi)	Make a comparison between a linked list and a linear array. Which one will you prefer to use and when?	5



Que. No.	Question	Max. Marks
Q2 A	Solve the following	10
i)	Discuss the algorithm/pseudocode to implement Insertion at beginning for a Doubly linked list.	5
i)	Give the linked representation of the following polynomial: $6x^3 + 9x^2 - 7x + 1$ and explain the polynomial representation in detail.	5
OR		
Q2 A	Convert the following infix expression into postfix expression using Stack. Show the contents of Stack with every input element. $A - (B / C + (D \% E * F) / G) * H.$ Also write the algorithm to convert an infix notation to postfix notation	10
Q 2 B	Solve any One	10
i)	Discuss the algorithms/pseudo code to implement following operations on circular Queue. Consider all scenarios:	10
	1. Insert an element	
	2. Delete an element	

ii)	Explain doubly ended queue. Discuss the algorithms/pseudo code to implement following operations on doubly ended queue. Consider all scenarios:	10
	1. Insertion 2. Deletion	

Que. No.	Question	Max. Marks
Q3	Solve any Two	20
i)	What is an AVL tree? Construct an AVL tree by inserting the following elements 63, 9, 19, 27, 18, 108, 99, 81 in the given order with detailed explanation and mention type of rotation wherever required.	10
ii)	Construct a Binary Tree from Traversal results with stepwise explanation In-order Traversal: D B E A F C G Pre-order Traversal: A B D E C F G <span style="color: blue;">Done in book</span>	10
iii)	Consider the graph given below. Perform the depth-first traversal scheme, show the table with contents at each operation and explain detailed procedure along with rules. <i>Start from node A.</i>	10



Que. No.	Question	Max. Marks																																												
Q4	Solve any Two	20																																												
i)	Perform following operations from scratch in an initial empty dictionary and write down the output and dictionary contents after every following operation. <table><tr><th>Sr. No</th><th>Operation</th><th>Output</th><th>Dictionary</th></tr><tr><td>1</td><td>Empty()</td><td></td><td></td></tr><tr><td>2</td><td>Insert(5, A)</td><td></td><td></td></tr><tr><td>3</td><td>Insert(7, B)</td><td></td><td></td></tr><tr><td>4</td><td>Insert(2, C)</td><td></td><td></td></tr><tr><td>5</td><td>Insert(8, D)</td><td></td><td></td></tr><tr><td>6</td><td>Insert(2, E)</td><td></td><td></td></tr><tr><td>7</td><td>Find(7)</td><td></td><td></td></tr><tr><td>8</td><td>FindAll(2)</td><td></td><td></td></tr><tr><td>9</td><td>Size</td><td></td><td></td></tr><tr><td>10</td><td>Erase(5)</td><td></td><td></td></tr></table>	Sr. No	Operation	Output	Dictionary	1	Empty()			2	Insert(5, A)			3	Insert(7, B)			4	Insert(2, C)			5	Insert(8, D)			6	Insert(2, E)			7	Find(7)			8	FindAll(2)			9	Size			10	Erase(5)			10
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7	Find(7)																																													
8	FindAll(2)																																													
9	Size																																													
10	Erase(5)																																													
ii)	With the help of <b>examples</b> explain following functions of MAP <ul style="list-style-type: none"><li>a) begin()</li><li>b) end()</li><li>c) insert()</li><li>d) clear()</li><li>e) erase()</li></ul>	10																																												
iii)	What are sets? With the help of examples explain Set partition using union- find operation.	10																																												



Que. No.	Question	Max. Marks
Q5	(Write notes / Short question type) on any four	20
i)	When to use Abstract data types? Discuss ADT Specification and implementation.	5
ii)	Suggest and justify a suitable data structure for the following problem definition. Illustrate with a suitable example. Consider a multiplayer game: "passing the pillow". When the music stops, the participant with the pillow have to perform an activity and gets eliminated. The game continues with the rest of them. The data structure should maintain the list of the participants, keep track of who's eliminated, remaining list and can announce the final winner. <a href="#">Circular Linked List or Circular Queue</a>	5
iii)	Application of trees	5
iv)	Discuss the Parentheses Matching Algorithm as application of stack	5
v)	Discuss Counting Sort to Sort the array of elements 8, 4, 2, 2, 8, 3, 3, 1	5
vi)	Consider a hash table of size = 10. Using double hashing, insert the keys 72, 27, 36, 24, 63, 81, and 92 into the table.	5

0:

1: 81

2: 72

3: 63

4: 24

5:

6: 36

7: 27

8: 92

9:



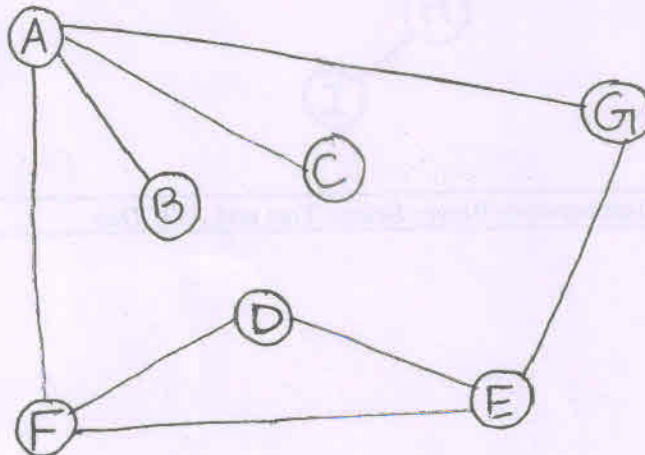
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07.06.2023(E)

Semester: January 2023 –May 2023		Duration:3 Hrs.	
Maximum Marks: 100		Examination: ESE Examination-KT	
Programme code: 04 / 01		Class: SY	Semester: III (SVU 2020)
Programme: B. Tech			
Name of the Constituent College:		Name of the department: IT /COMP	
K. J. Somaiya College of Engineering			
Course Code: 116U04C302	Name of the Course: Data Structures		
Instructions: 1)Draw neat diagrams 2) All questions are compulsory			
3) Assume suitable data wherever necessary			

Que. No.	Question	Max. Marks
Q1	Solve any Four	20
i)	What is Data Structure and list down its types.	5
ii)	Explain Abstract Data Type with example.	5
iii)	Compare Linear and Non- Linear Data Structure.	5
iv)	Explain Singly Linked List. Explain its types with suitable examples.	5
v)	Explain Tree Data Structure. List down its types with suitable diagram	5
vi)	Compare Stack and Queue Data Structure	5

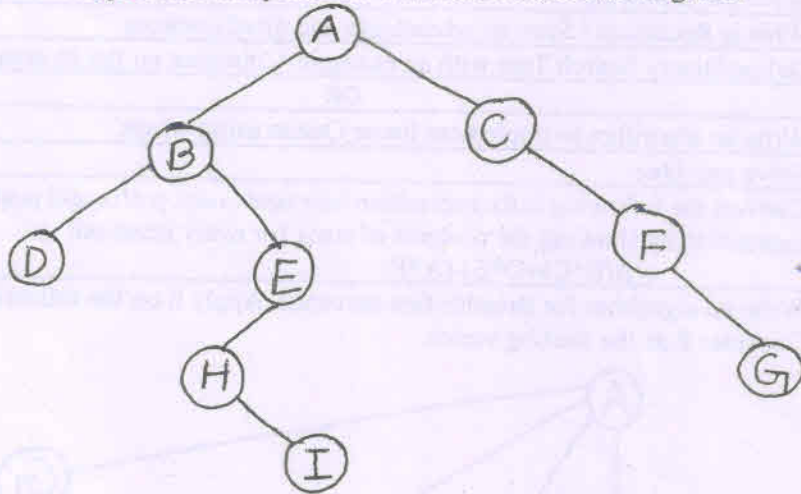
Que. No.	Question	Max. Marks
Q2 A	Solve the following	10
i)	What is Recursion? State its advantages and disadvantages	5
ii)	Define Binary Search Tree with an example. Comment on the its complexity	5
	OR	
Q2 A	Write an algorithm to implement linear Queue using arrays.	10
Q 2 B	Solve any One	10
i)	Convert the following infix expression into equivalent prefix and postfix expression by showing the contents of stack for every iteration: $((A/B^{\wedge}C)+D^{\wedge}E)-(A^{\wedge}F)$	10
ii)	Write an algorithm for Breadth-first-traversal. Apply it on the following graph. Consider E as the starting vertex.	10





Que. No.	Question	Max. Marks
Q3	Solve any Two	20
i)	Explain Dictionary Data Structure and state operations performed on it. State its applications	10
ii)	Define Set Data Structure with suitable example. Write algorithms for its operations: Insertion, Union, Intersection.	10
iii)	Explain how Hash table is used to implement Dictionary Data Structure	10

Que. No.	Question	Max. Marks
Q4	Solve any Two	20
i)	Explain Bubble Sort with example. Write algorithm for bubble sort.	10
ii)	Write an algorithm to search an element in an array using Binary Search Technique	10
iii)	Explain Hash List Search with an example. Comment on its complexity.	10

Que. No.	Question	Max. Marks
Q5	(Write notes / Short question type) on any four	20
i)	Define Graph. Explain different methods to represent the graph with example	5
ii)	Write algorithm for Depth-first-Search Traversal.	5
iii)	What is a Circular Queue? State its advantages over Linear Queue	5
iv)	How Stack can be implemented using Linked List?	5
v)	Give the inorder, preorder and postorder traversal for the following tree:	5
 <pre> graph TD     A((A)) --- B((B))     A --- C((C))     B --- D((D))     B --- E((E))     E --- H((H))     H --- I((I))     C --- F((F))     F --- G((G)) </pre>		
vi)	Differentiate between Binary Search Tree and AVL Tree	5

Inorder: D, B, H, I, E, A, C, F, G

30.11.2023 (E)

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Semester: July 2023 –October 2023		Duration: 3 Hrs.	
Maximum Marks: 100	Examination: ESE Examination		
Programme code: 04	Class: SY	Semester: III (SVU 2020)	
Programme: BTech			
Name of the Constituent College: K. J. Somaiya College of Engineering		Name of the department: IT/Comp	
Course Code: 116U04C302	Name of the Course: Data Structures		
Instructions: 1) Draw neat diagrams 2) All questions are compulsory 3) Assume suitable data wherever necessary			

Que. No.	Question	Max. Marks
Q1	Solve any Four	20
i)	What is ADT (Abstract Data Type)? What are the advantages of ADT?	5
ii)	What is data structure? List the data structures classified based on its type of data structure.	5
iii)	Differentiate between array and linked list (5 valid points)	5
iv)	What is complete binary tree? Explain BFS (Breadth First Search) on complete binary tree with the help of suitable example.	5
v)	Differentiate between map and dictionary data structure (5 valid points)	5
vi)	Sort following numbers using counting sort – 3, 5, 4, 7, 3, 4, 7, 2, 8, 2, 3	5

Que No.	Question	Max. Marks
Q2 A	Solve the following	10
i)	Convert following prefix to infix form using stack (show all steps clearly) /* / ++ a – b c + d e f g h	5
ii)	Write pseudocode to implement linear queue ADT functions.	5
	OR	
Q2 A	Write pseudocode for converting infix expression to postfix form. Also write the pseudocode/algorithm for the data structure used in conversion.	10
Q2 B	Solve any One	10
i)	Explain following circular singly linked list operations with the help of block diagrams 1) Insert_at_end 2) Delete_after 3) Search a given number	10
ii)	Explain following doubly linked list operations with the help of block diagrams 1) Insert_before a node 2) Delete_before 3) Display all numbers	10



Que. No.	Question	Max. Marks
Q3	Solve any Two	20
i)	Write the algorithm to construct a BST from given postorder and inorder traversal. Apply the same and construct BST using following Postorder traversal: 1, 6, 8, 9, 7, 11, 13, 15, 12, 10 Inorder traversal: 1, 6, 7, 8, 9, 10, 11, 12, 13, 15	10
ii)	State the need of height balanced trees. Insert following numbers in the given order on an initially empty AVL tree. Clearly specify the necessary information at each insertion. 20, 10, 30, 40, 50, 60, 25, 21, 55, 58	10
iii)	Explain B-Tree with the help of an example. Show all the cases of insertion operations on the B-Tree.	10

Que. No.	Question	Max. Marks
Q4	Solve any Two	20
i)	State the properties of a good hash function. Hash the following number in a hash table of size 9 using standard modulus hash function. Resolve the collisions using linear probing. 3, 2, 9, 6, 11, 13, 7, 12, 18	10
ii)	Write the pseudocode for binary search. Apply the same on following set of numbers to search for 52. 12, 25, 31, 40, 44, 45, 52, 56, 67, 82	10
iii)	Write the pseudocode for insertion sort. Apply the same on following set of numbers (show all the steps clearly) 40, 25, 12, 52, 44, 82, 31, 67, 45, 56	10

Que. No.	Question	Max. Marks
Q5	Attempt any four	20
i)	Differentiate between static implementation and dynamic implementation.	5
ii)	Explain the use of linked list for polynomial representation.	5
iii)	Differentiate between circular queue and priority queue (5 valid points).	5
iv)	Consider the following graph and represent the same using adjacency matrix and adjacency list.	5
<pre> graph TD     A((A)) --&gt; B((B))     B((B)) --&gt; C((C))     C((C)) --&gt; G((G))     D((D)) --&gt; A((A))     D((D)) --&gt; F((F))     F((F)) --&gt; B((B))     F((F)) --&gt; E((E))     E((E)) --&gt; C((C))     E((E)) --&gt; G((G)) </pre>		
v)	Write dictionary ADT.	5
vi)	Write short note on applications of set data structure.	5





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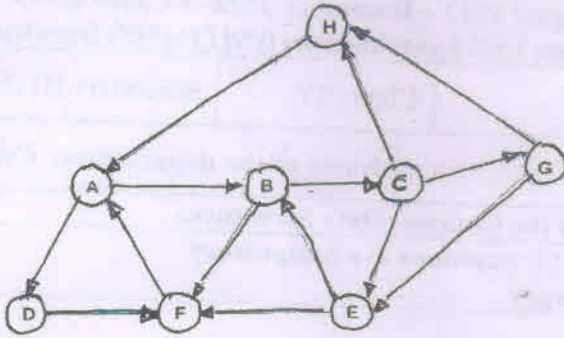
Semester: August 2022 – December 2022 – (Jan-2023)		
Examination: ESE Examination- DSY (Reg+KT) Duration: 3 Hrs.		
Maximum Marks: 100	Class: SY	Semester: III (SVU 2020)
Programme code: 01		
Programme: B Tech		
Name of the Constituent College: K. J. Somaiya College of Engineering	Name of the department: Computer / IT	
Course Code: 116U04C302	Name of the Course: Data Structures	
Instructions: 1) Draw neat diagrams 2) All questions are compulsory		
3) Assume suitable data wherever necessary		

Que. No.	Question	Max. Marks
		20
Q1	Solve any Four	5
i)	What is ADT? Explain with an example	5
ii)	Why dynamic storage allocation is required? Explain.	5
iii)	How Queue data structure is useful in simulation?	5
iv)	What are threaded binary tree applications?	5
v)	Explain partition and union-operations in set.	5
vi)	What is hashed list search?	

Que. No.	Question	Max. Marks
		10
Q2 A	Solve the following	5
i)	Explain linked list implementation of polynomial addition.	5
ii)	Show the steps of infix to postfix conversion for following expression. $A*(B*C+D/E)+F$	
	OR	
Q2 A	Define a priority queue data structure as an ADT. List the operations on a priority queue. Write algorithm for addition and deletion of an element in a priority queue implemented with singly linked list.	10
Q2 B	Solve any One	10
i)	How stack data structure is useful in recursion? Write an algorithm to reverse a stack using recursion. Demonstrate with an example.	10
ii)	For circular singly linked list, design an approach a) for inserting an element at the beginning b) for deleting an element at the end c) searching an element	10

Que. No.	Question	Max. Marks
		20
Q3	Solve any Two	10
i)	Construct AVL Tree for the following sequence of numbers with explanation of each step.  50, 38, 46, 10, 8, 25, 32, 64, 11, 44.	
ii)	Explain the delete a node operation in BST, for all three cases with appropriate example.	10



iii)	<p>Show all the steps of DFS algorithm on the following graph by starting at the vertex 'H'.</p>  <p>If the graph is undirected what are the changes done in DFS algorithm?</p>	10
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Que. No.	Question	Max. Marks
Q4	Solve any Two	20
i)	<p>Suppose you have the following list of numbers to sort: 19, 1, 9, 7, 3, 10, 13, 15, 8, 12.</p> <p>After three complete passes we get;</p> <p>Case 1: We get the output of [1, 3, 7, 9, 10, 8, 12, 13, 15, 19] Case 2: We get the output of [1, 9, 19, 7, 3, 10, 13, 15, 8, 12]</p> <p>Identify the sorting algorithm used in Case 1 and Case 2 with justification of answer.</p>	10
ii)	Compare linear search and binary search on the basis of given points; definition, sorted data, approach, size of array, efficiency	10
iii)	Discuss various ways in which a graph data structure can be represented by giving example of each technique.	10

Que. No.	Question	Max. Marks
Q5	Write notes on any four	20
i)	Type of Data structures	5
ii)	Doubly linked list representation	5
iii)	Postorder traversal of a binary tree	5
iv)	Data Structure used in BFS traversal of graph	5
v)	Dictionary ADT and its applications	5
vi)	Counting Sort	5



Semester: August 2022 – December 2022		
Maximum Marks: 100	Examination: ESE Examination	Duration: 3 Hrs.
Programme code: 04/02	Class: SY	Semester: III(SVU 2020)
Programme: B TECH		
Name of the Constituent College:		Name of the department: Information Technology / Computer Engg
K. J. Somaiya College of Engineering		
Course Code: 116U01C302	Name of the Course: Data Structures	
Instructions: 1) Draw neat diagrams 2) All questions are compulsory		
3) Assume suitable data wherever necessary		

Que. No.	Question	Max. Marks
Q1	Solve any <b>Four</b>	<b>20</b>
i)	Define abstract data type. Give example of abstract data type. What is the difference between in built data type and abstract data type?	5
ii)	What are the advantages and disadvantages of circular linked list?	5
iii)	Write applications of priority queue.	5
iv)	Differentiate between B tree and B+ tree.	5
v)	Explain counting sort. Also state the reason why counting sort is called stable sort?	5
vi)	Convert infix expression $A*B - C/D + E$ into prefix.	5

Que. No.	Question	Max. Marks
Q2 A	Solve the following	<b>10</b>
i)	What is static memory allocation? Give example of memory allocation. What are the advantages of memory allocation?	5
ii)	What is dynamic memory allocation? Give example of dynamic memory allocation. What are the advantages of dynamic memory allocation?	5
OR		
Q2 A	What is data structure? How data structure varies from data type? Explain the classification of data structures? What are different types of data structure?	10
Q 2 B	Solve any <b>One</b>	<b>10</b>
i)	What is Hashing? Explain the different types of hashing. Which hashing method is better? Justify.	10
ii)	Explain SET as ADT with all operations. Also write application for the same.	10

Que. No.	Question	Max. Marks
Q3	Solve any <b>Two</b>	<b>20</b>
i)	What is doubly linked list? Explain working of doubly linked list. Give two real time application of doubly linked list.	10
ii)	Define Stack. Write pseudo code using array or linked list: a. Write a function to check a stack is an underflow b. Write a function to delete an element from stack c. Write a function to display the stack elements	10
iii)	What is Dequeue? Write the pseudo code for insertion at front end and insertion at rear end.	10



Que. No.	Question	Max. Marks
Q4	Solve any <b>Two</b>	<b>20</b>
i)	Explain the bubble Sort in detail with the help of algorithm. Also sort following numbers 10, 9, 11, 6, 15, 2, 4, 13 using bubble sort by illustrating each step.	10
ii)	Explain the insertion Sort in detail with the pseudo code. Also sort following numbers 23, 34, 2, 43, 15, 25, 65, 51, 44, 8, 21 using insertion sort by illustrating each step.	10
iii)	Explain linear search and binary search with example. Show all the steps.	10

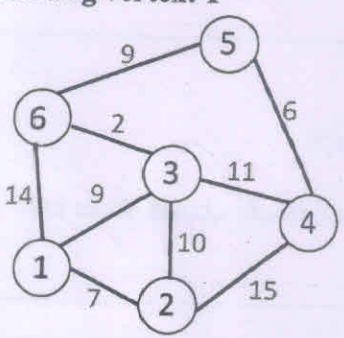
Que. No.	Question	Max. Marks
Q5	Write any <b>four</b>	<b>20</b>
i)	For web page navigation in forward and backward which data structure will be useful? Justify your answer.	5
ii)	Explain the types of binary tree.	5
iii)	Differentiate between DFS and BFS.	5
iv)	Define MAP ADT and its application.	5
v)	State which data structure is used for BFS traversal and show BFS traversal with an small example	5
vi)	Why linked list is better than array? List different types of linked list?	5



Semester: January 2022 – May 2022			Duration: 3:00hrs	
Maximum Marks: 100		Examination: ESE Examination		
Programme code: 75		Class: SY	Semester: III (SVU 2020)	
Programme: Minors in Computer Engg				
Name of the Constituent College: K. J. Somaiya College of Engineering		Name of the department: COMP		
Course Code: 116m75C301	Name of the Course: Data Structures and Algorithms			
Instructions: 1)Draw neat diagrams 2)Assume suitable data if necessary 3) All questions are compulsory.				

Question No.		Max. Marks
Q1	<p>Explain the concept of Abstract Data Type. Write ADT for Complex number <math>(a+ib)</math> as the data type.</p> <p style="text-align: center;">OR</p> <p>Define data structure. Explain practical applications of stack, queue, trees and graphs.</p>	10
Q2 (a)	<p>Define linked list. Explain the following operations with their pre-status, post-effects, sequence of updating the node connections on a doubly linked list. You may support your explanations with the diagrams.</p> <p>a. Insert into Doubly Linked List b. Delete from Doubly Linked List</p> <p style="text-align: center;">OR</p> <p>Define circular linked list. Explain the following operations with their pre-status, post-effects, sequence of updating the node connections on a doubly linked list. You may support your explanations with the diagrams.</p> <p>a. Insert into circular Linked List b. Delete from circular Linked List</p>	10
Q2 (b)	<p>Convert the given infix expression into an equivalent postfix one using stack. Show output after processing every input character. Expression: power <math>((r+t*y+p)/a+b-c), z)</math></p>	10
Q. 2 C	<p>State different types of queues. State and explain applications of each one of them in various domains.</p>	10



Q3 (a)	<p>a. Explain binary search tree and balanced binary search trees with a suitable example.</p> <p>b. Comment on significance of balanced binary search trees? Explain the test of checking if the BST is balanced.</p> <p>c. Create a balanced binary tree for the given input. You need not explain how the balancing was achieved. 30, 10, 5, 25, 75, 34</p>	2+3+5
Q3 (b)	<p>Create a unique binary tree using inorder and postorder traversal sequence given below. Show the output step by step-</p> <p>Inorder- B D C F E G A H Postorder- D F G E C B H A</p> <p>OR</p> <p>Apply depth first approach of graph traversal to the given graph. Show step by step output with contents of all data structures involved in the process. Starting vertex: 1</p> 	10
Q4 (a)	<p>Consider the problem of storing data of ordered pairs of &lt;subject, subject_teacher&gt; for a 25 year old educational institute. The data might be further retrieved to know which faculty members have taught a particular subject over the years, which all different subjects have been taught by a particular faculty member etc.</p> <p>Design a solution for this problem using DICTIONARY data structure.. Support your answer with sample examples of – data elements to be stored, how they are accessed-deleted, how different queries supported by the chosen data structure can be executed on the same, give sample output of those queries etc.</p>	10
Q4 (b)	<p>Hash the following numbers in a table of size 10. Resolve collisions if any, with linear and quadratic probing. State total number of collisions with each technique. 23, 55, 0, 73, 60, 20, 18, 100, 43, 50</p>	10
Q5 (a)	<p>Compare and contrast searching techniques viz Linear Search, Binary Search, Hashed List Search. Support your claims with suitable example.</p>	10
Q5 (b)	<p>Input : 42, 23, 74, 11, 65, 58, 94, 36, 99, 87</p> <p>Sort the given numbers using insertion sort. Show the output after every iteration/pass.</p> <p>OR</p> <p>Sort the given numbers using bubble sort. Show the output after every iteration/pass.</p>	10