Hall Ticket Number:

Code No. : 13667 N/O

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

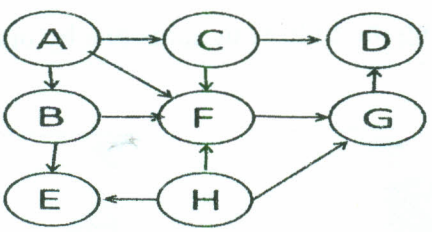
B.E. (I.T.) III-Semester Main & Backlog Examinations, Jan./Feb.-2024

Data Structures

Time: **3 hours** Max. Marks: **60**

*Note: Answer all questions from **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	What is the time complexity of insertion into an array? Compare the time complexity with insertion into linked list.	2	1	1	1
2.	List the applications of stacks and evaluate the given post fix evaluation: 6 2 3 + - 3 8 2 / + * 2 3 / +	2	2	1	1
3.	Suppose a queue is represented by a circular array of size N. F and R are front and rear positions. If F points a location before front element of queue and R points to last element of queue, how many elements are there in the queue?	2	2	2	1,2
4.	Write the computational advantages of using Sparse Matrix implementation over normal matrices.	2	1	2	1
5.	Define Red-Black Tree. Describe the properties of Red-Black Tree with an example.	2	1	3	1
6.	Construct a binary tree from the following traversal In order: 4 2 5 1 6 7 3 8 Post order: 4 5 2 6 7 8 3 1	2	3	3	2
7.	Define m-way search tree. What is the minimum and maximum number of elements in an m-way search tree of height h?	2	1	4	1
8.	A poor village is facing difficulties at night due to unavailability of street-lights. Assume that the village contains 9 blocks, 'block a', 'block b', 'block c', 'block d', 'block e', 'block f', 'block g', 'block h', 'block i'. There are 12 roads, r1(a, b), r2(b, c), r3(a, c), r4(c, e), r5(e, d), r6(e, f), r7(e, i), r8(i, f), r9(f, g), r10(i, g), r11(g, h), r12(i, h), where the entries inside the bracket show the blocks which they connects via direct paths. Based on the aforementioned information, suggest the minimum number of street-lights with their installation sites (i.e. block) required to lighten-up the roads connecting these blocks.	2	3	4	2
9.	Consider an array of 100 sorted numbers. Atmost how many searches are needed to search an element using Binary Search. Justify your answer.	2	2	5	2
10.	Define topological sort and write the topological sort of the following graph. 	2	3	5	1

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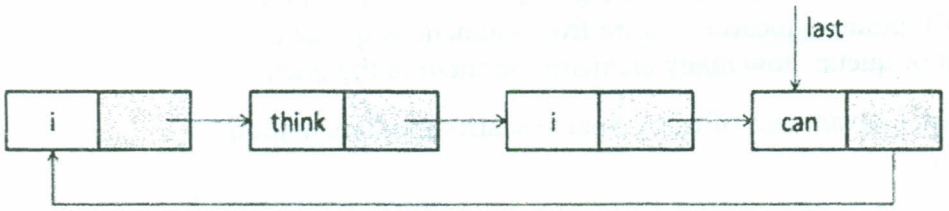
	Part-B (5 × 8 = 40 Marks)				
11. a)	Explain Asymptotic Notations used to describe the running time of an algorithm. Justify the following statement. $6n^3/(\log+1)=O(n^3)$	4	1	1	1
b)	Convert the given infix expression into post fix expression and explain the representation of stacks used for conversion. A ↑ B *C – D + E /(F + (G + H))	4	3	1	2
12. a)	Define Queue ADT? Write a menu driven program to implement the following Queue operations using array: i) enqueue(element) ii) dequeue() iii) Peek() iv) Display() v) isEmpty() vi) isFull()	4	1	2	1
b)	Consider the circular list given below with string data:  Write a function which will display the output in following fashion: i think i can think i can i can can At each line, the function should display data from all the nodes present. After printing each line, an appropriate node has to be deleted. After printing the last line, "last" pointer should be holding the NULL value	4	3	2	2
13. a)	Write a function to delete an element from the binary search tree. Explain with example for each case.	4	2	3	2
b)	What are Splay Trees? Discuss Splay operation. Start with a Splay tree that is a 15-node full binary tree. The keys are 1-15. Remove the keys in order 11, 14, 13 and 15. Draw your tree immediately after each rotation. Also label rotation with rotation type.	4	3	3	2
14. a)	Construct a B-tree of order 5 by inserting the following items one by one. C N G A H E K O M F W L T Z D P R	4	2	4	2

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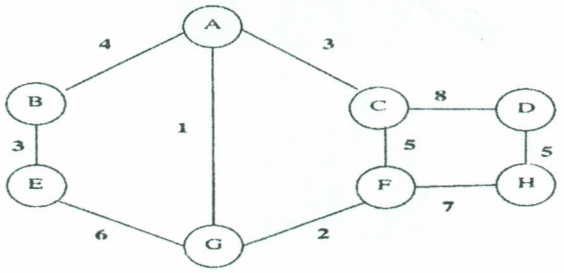
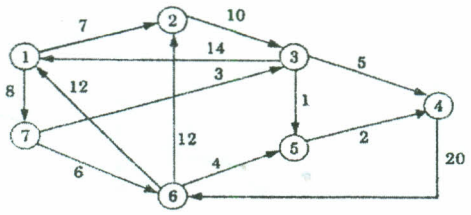
b)	What is a minimum spanning tree? Give Kruskal's algorithm to find a minimum spanning tree. Determine the minimum cost spanning tree of the following graph:- 	4	3	4	2
15. a)	Show the result of inserting 14, 12,9,8,7 10 and 18 one at a time into an initially empty binary heap. Also sort the above elements in the ascending order by applying heap sort algorithm.	4	2	5	2
b)	Given the hash function h=key mod 10, where 10 is the size of the hash table. Insert the following data into hash table. Use linear probing and quadratic probing to address the collisions. 12,45,67,88,27,78,20,62,36,55.	4	2	5	2
16. a)	What is polynomial ADT? How do you implement a polynomial ADT using an array? Explain.	4	2	1	1
b)	Write a function that takes a list sorted in non-decreasing order and deletes any duplicate nodes from the list. The list should only be traversed once. For example if the linked list is 11→11→11→21→43→43→60 then removeDuplicates() should convert the list to 11→21→43→60.	4	4	2	3
17.	Answer any ***two*** of the following:				
a)	Show the AVL tree that results after each of the integer keys 9, 27, 50, 15, 2, 21, and 36 are inserted, in that order, into an initially empty AVL tree. Clearly show the tree that results after each insertion, and make clear any rotations that must be performed.	4	3	3	2
b)	Write the pseudo code for BFS and DFS and apply the same in the below graph. 	4	3	4	2
c)	Write the function in C for insertion sort and show the passes of insertion sort with an example.	4	2	5	1

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	37.5%
iii)	Blooms Taxonomy Level – 3 & 4	42.5%

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