2022

Data Structures and Algorithms

Full Marks : 100
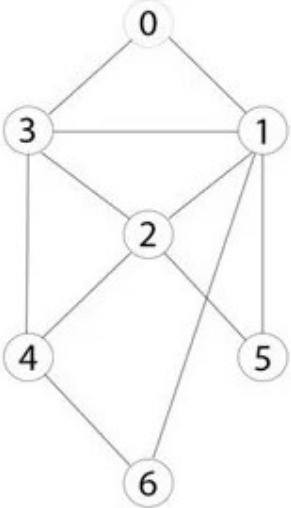
Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer **any five** *questions.*

1.	a)	Write an algorithm to delete the last node from a single linked list.			5
	b)	Apply quick sort and arrange the following list of numbers in ascending order. 44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88, 66			8
	c)	Compare linear search and binary search technique.			4
	d)	Derive the time complexity of insertion sort algorithm.			3
2.	a)	Consider the following stack of characters, where STACK is allocated N=8 memory cells: STACK:A,C,D,F,K,__,__,__ [Note:__ denotes an empty memory cell] Describe the stack as the following operations take place:			8
		i)	POP(STACK,ITEM)	v)	POP(STACK,ITEM)
		ii)	POP(STACK,ITEM)	vi)	PUSH(STACK,R)
		iii)	PUSH(STACK,L)	vii)	PUSH(STACK,S)
		iv)	PUSH(STACK,P)	viii)	POP(STACK,ITEM)
	b)	Write a procedure to push an element into a stack implemented using linked list.			6
	c)	Translate the following infix expressions into their equivalent prefix and postfix expressions:			3x2=6
		i)	(A-B)/((D+E)*F)		
		ii)	((A+B)/D)^((E-F)*G)		
	3.	a)	Consider the following infix expression Q: ((A+B)*D)^(E-F) Use stack to translate Q into its equivalent postfix expression P		6

	b)	Evaluate the following arithmetic expression using stack: 5+3^2-8/4*3+6	8
	c)	Write an algorithm/procedure to delete an element from a queue implemented using circular array.	6
4	a)	Consider the following queue of characters, where QUEUE is a circular array which is allocated six memory cells: FRONT=2, REAR=5, QUEUE:__,A,C,D,F,__ [Note:__ denotes an empty memory cell] Describe the queue as the following operations take place:	8

i)	Two letters are deleted	v)	Two letters are deleted
ii)	K,L,M are added to the queue	vi)	S is added to the queue
iii)	Two letters are deleted	vii)	Two letters are deleted
iv)	R is added to the queue	viii)	One letter is deleted

	b)	Consider the algebraic expression E=(a-b)/((c*d)+e)	3+4=7
		i) Draw the tree T which corresponds to the expression E.	
		ii) Find the pre-order and the post-order of T.	
	c)	What is 2D array? Consider a 2D array A=3x3, represent it in memory using row major order.	2+3=5
5.	a)	Differentiate between complete and full binary tree. If there are total of 3 levels in a binary tree then how much maximum elements can be present in the tree?	3+2=5
	b)	Suppose the following list of letters is inserted in order into an empty binary search tree: J, R, D, G, T, E, M, H, P, A, F, Q	3+4=7
		i) Find the final tree T.	
		ii) Describe the tree after node M is deleted followed by deletion of node D.	
	c)	Construct an AVL search tree by inserting the following elements in the order of their occurrence. 64, 1, 44, 26, 13, 110, 98, 85	6
	d)	Define a B-tree.	2
6.	a)	Write a brief note on memory allocation and garbage collection.	4
	b)	Define a graph. How is it different from a tree?	2+2=4

	c)	Describe how a graph can be represented sequentially in memory with an adjacency matrix. Give an example.	4
	d)	Find DFS and BFS traversal order of the following graph using the auxiliary data structures: 	4+4=8
7.	a)	What do you mean by hashing?	2
	b)	Consider a company with 68 employees that assigns a unique 4 digit employee number to each employee. Suppose L is the set of memory addresses used to store the employee file. L consists of 100 two digit addresses:00,01,02,….,99.Apply any two popular hash functions and calculate the addresses of the following employee numbers: 3205, 7148	4x2=8
	c)	When does collision occur?	2
	d)	What are the different techniques used to resolve collision? Explain any two in brief.	2+6=8