B.TECH / EE /5TH SEM/ ELEC 3104/2017
DATA STRUCTURE AND DATABASE CONCEPT
(ELEC 3104)

Time Allotted : 3 hrs   Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: $10 × 1 = 10$

(i)   Which of the following data structures may give overflow error, even though the current n elements in it are less than its size?
(a) Simple queue   (b) Circular queue (c) Stack   (d)Priority queue.

(ii)   In quick sort, what would be a good choice as the partitioning element?
(a) first element of the list   (b) last element of the list
(c) median of the list   (d) none of these.

(iii)   Best case time complexity of insertion sort is
(a) O(1)   (b) O(n)   (c) O(n log n)   (d) O(n²).

(iv)   If T be a nonempty, full binary tree with I internal nodes, the number of leaves L is represented by
(a) 2* I + 1   (b) I + 1   (c) I + 2   (d) 2* I + 2.

(v)   Postfix expression of 3 + 4 * 5 / 6 is
(a) 3 4 5 6 * / +   (b) 3 4 5 * 6 + /   (c) 3 4 * 5 6 / +   (d) 3 4 5 * 6 / +.

(vi)   In the relational modes, cardinality is termed as:
(a) Number of tuples   (b) Number of attributes.
(c) Number of constraints   (d) Number of tables.

(vii)   In the architecture of a database system external level is the
(a) physical level   (b) logical level
(c) conceptual level   (d) view level.

(viii)   In a RDBMS, which of the following statements about Weak Entities and Total Participation is True?
(a) Total Participation guarantees Weak Entity
(b) Weak Entity has to have Total Participation
(c) Weak Entity may never have Total Participation
(d) Total Participation will never be applicable for Weak Entities.

(ix)   Relational Algebraic query that finds customers, who have a balance of over 1000 is
(a) $\sigma_{Cust\_name}(\Pi_{balance >1000}(Deposit))$
(b) $\sigma_{Cust\_name \wedge balance >1000}(Deposit)$
(c) $\Pi_{Cust\_name}(\sigma_{balance >1000}(Deposit))$
(d) $\Pi_{Cust\_name \wedge balance >1000}(Deposit)$.

(x)   R is a relation with m tuples and S is a relation with n tuples, then maximum number of tuples in R $\bowtie$ S is
(a) m^n (b) m × n   (c) n^m (d) m + n.

Group - B

2. (a)   Write the algorithms for the followings:
(i) Delete a node with specified value from a single linked list.
(ii) Reverse the nodes of a single linked list, i.e., the first node becomes last node and vice versa.

(b)   (i) Convert the following infix expression to postfix expression using stack (show all the steps):
(A+ B) $*$ C – (D – E)
(ii) State the advantages and disadvantages of linear queue and circular queue.

$(3 + 3) + (3 + 3) = 12$

3. (a)   You have been given the *push( )* and *pop( )* operations that are valid on a stack. Using these operations (and without using *enqueue ( )* and *dequeue( )* functions), how can you design a Queue? Write the algorithm and explain considering 5 elements in an example.

(b)   (i) Discuss the advantages and disadvantages of linked list over array as linear data structure.
(ii) Write a function to insert an element into an array which is sorted in descending order.

$6 + (3 + 3) = 12$

Group - C

4. (a) What is a Binary Search Tree (BST)? Make a BST for the following sequence of numbers:
45, 36, 76, 23, 89, 115, 98, 39, 41, 56, 69, 48
Traverse the tree in Preorder, Inorder and postorder.

   (b) Write the binary search algorithm. Why binary search is considered to be better than linear search?

$$(1 + 4 + 3) + (2 + 2) = 12$$

5. (a) (i) What is recursion?
   (ii) Distinguish between primitive and non-primitive recursions.
   (iii) What is tail recursion?

   (b) (i) Explain with a suitable example the principle of operation of QuickSort Algorithm.
   (ii) In which cases, QuickSort becomes a 'SlowSort' ?

$$(2 + 2 + 2) + (5 + 1) = 12$$

Group – D

6. (a) Define super key, candidate key and primary key. Give one example for each.

   (b) Draw the entity-relationship diagram of a hospital management system taking at least four entities.

$$6 + 6 = 12$$

7. (a) Given below are two tables T1 and T2:

T1

V	W	X	Y	Z
1	a	x	15	e
2	a	x	10	f
2	b	x	15	g
2	b	y	15	h

T2

C	D	X	W
4	p	x	b
5	t	x	b
6	p	y	a
7	r	y	a

Find the result of the following relational algebra expression step by step:

$$\sigma_{D = p}(\Pi_{X, Y}(T1) \bowtie \Pi_{X, D}(T2))$$

   (b) Given the following tables:
DEPT(deptno, dname, loc)
EMP(empno, ename, job, mgr, hiredate, sal, comm, deptno)

Give an expression in SQL for each of queries below:
   (i) List the details of the employees who earn more than employee BLAKE.
   (ii) List the names and department names of all employees. Order the list in the ascending order of department names.
   (iii) List the maximum and minimum salaries of departments 10 and 20.

$$6 + (3 \times 2) = 12$$

Group – E

8. (a) Briefly describe ACID properties in relation to RDBMS.

   (b) Reorder the following schedule into an equivalent serial schedule:
r1(A)w1(A)r2(A)w2(A)r1(B)w1(B)r2(B)w2(B)

   (c) Let F be the following set of functional dependencies: {AB→CD, B→DE, C→F, E→G, A→B}. Use Armstrong's axioms to show that {A→FG} is logically implied by F.

In which cases, QuickSort becomes a 'SlowSort' $4 + 2 + 6 = 12$

9. Given the following Un-normalized relation:

ORDER NUMBER			1023
SUPPLIER NUMBER			500028
ORDER DATE			09/05/88
DELIVERY DATE			25/07/88

PART NO.	PART-DESC	QTY-ORD	PRICE
O463	Hook	150	15.00
1492	Bolt	1000	10.00
3164	Spanner	10	5.00

Whose fields may be given as follows:

PURCHASE-ORDER(Orderno, Supplierno, Order-Date, Delivery-Date, (Partno, Part-Description, Quantity-Ordered, Price), Total-Price)

Normalize this un-normalized relation upto 2NF with justification.

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