

9. (a) Consider the relation R (A, B, C, D, E) with the set of following FDs.  
 $F\{ AB \rightarrow CD, ABC \rightarrow E, C \rightarrow E\}$   
 (i) Find out possible candidate keys.  
 (ii) What is the normal form of R?
- (b) Describe the problems of Lost update and Dirty Read phenomenon which arise as a result of concurrent transactions.

$(4 + 2) + 6 = 12$

**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) Linked lists are not suitable data structures for which one of the following problems  
 (a) insertion sort (b) binary search  
 (c) radix sort (d) polynomial manipulation.
- (ii) The data structure needed to convert a recursion to an iterative procedure is  
 (a) Queue (b) Graph (c) Stack (d) Tree.
- (iii) The number of edges from the node to the deepest leaf is called \_\_\_\_\_ of the tree.  
 (a) height (b) depth  
 (c) length (d) none of the mentioned.
- (iv) In a binary search tree, which of the following traversals would print the numbers in the ascending order?  
 (a) Level-order traversal (b) Pre-order traversal  
 (c) Post-order traversal (d) In-order traversal.
- (v) Which of the following relational algebra operations do not require the participating?  
 Tables to be union-compatible?  
 (a) Union (b) Intersection (c) Difference (d) Join.
- (vi) The descriptive property possessed by each entity set is defined as:  
 (a) Entity (b) Attribute (c) Relation (d) Model.
- (vii) The attribute AGE is calculated from DATE\_OF\_BIRTH. The attribute AGE is  
 (a) single valued (b) multi valued  
 (c) composite (d) derived.

- (viii) Which one of the following is a set of one or more attributes taken collectively to uniquely identify a record?  
 (a) Candidate key (b) Primary key  
 (c) Super key (d) Foreign key.
- (ix) The information about data in a database is called  
 (a) meta data (b) tera data  
 (c) hyper data (d) none of these.
- (x) A normal form in which every determinant is a key, is  
 (a) 2 NF (b) 3 NF (c) BCNF (d) 4 NF.

**Group – B**

2. (a) Consider the array int a[10][10]. The base address of the array is 2000. Calculate the address of the location a[2][3] in the row and column major order.  
 (b) Write the advantages of circular queue over linear queue.  
 (c) Implement stack using a singly linked list.

$$4 + 3 + 5 = 12$$

3. (a) What is stack and why it is called LIFO?  
 (b) Write a C function to insert and delete a node from a singly linked list.  
 (c) Write an algorithm to evaluate postfix expression by using stack data structure.

$$2 + 6 + 4 = 12$$

**Group – C**

4. (a) Show how "Quick sort" algorithm sorts the following sequences of keys: 25, 16, 18, 30, 45, 35, 20, 10.  
 (b) When does the algorithm "Quick sort" exhibit its worst-case behavior?  
 (c) Compare Quick sort and Optimized bubble sort algorithms.

$$6 + 2 + 4 = 12$$

5. (a) Define recursion. Write a C function to calculate factorial of a number n by using tail recursion?  
 (b) Write an algorithm of binary search method. What is the best case, average case and worst case time complexity of a binary search algorithm.

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

**Group – D**

6. (a) What is weak entity type? What will be the schema for representing such entity type in a database table?  
 (b) The IT Training Group (Kolkata) has contacted you to create a conceptual model by using the Entity — Relationship data model for a database that will meet the information needs for its training program. The Company Director has provided the following description of the training group's operating environment. The Company has twelve instructors and can handle up to one hundred trainees per training session. The Company offers five advanced technology courses, each of which is taught by a teaching team of two or more instructors. Each instructor is assigned to a maximum of two teaching teams or may be assigned to do research. Each trainee undertakes one advanced technology course per training session.  
 (i) Draw an ER diagram for IT Training Group (Kolkata) based on the preceding information.  
 (ii) Explain derived attributes with an example.

$$(2 + 2) + (6 + 2) = 12$$

7. Consider the following table:

DEPT(Dcode,Dname);

EMP(Ecode,Ename,Basic,Dcode,Dt\_join);

Write down the relational algebra for the following:

- (i) For each department show the Dname and total basic salary of each department.  
 (ii) Find out the names of the employees who are working in the department named as 'ABC'.  
 (iii) Find out the maximum basic among the employees who has joined after year 2000.

$$(4 \times 3) = 12$$

**Group – E**

8. (a) Explain fully functional dependency with example? Define foreign key with example. Why is it called referential integrity?  
 (b) Discuss "insertion anomalies", "deletion anomalies", "update anomalies" with respect to normal forms with suitable example and suggest a method to overcome it.

$$(2 + 2 + 2) + 6 = 12$$