

- (vii) If  $h$  is any hashing function and is used to hash  $n$  keys into a table of size  $m$ , where  $n < m$ , the expected number of collisions involving a particular key  $x$  is
  - (a) more than 1
  - (b) less than 1
  - (c) exactly 1
  - (d) more than  $n$  but less than  $m$ .
- (viii) Which of the following is CORRECT with respect to a stack?
  - (a) push(pop())
  - (b) pop(pop())
  - (c) push(push(x))
  - (d) pop(push(x)).
- (ix) Which of the following operation is used if we want only specific columns of a table?
  - (a) Projection
  - (b) Selection
  - (c) Join
  - (d) Union.
- (x) The postfix expression for the infix expression  $a * (b + c) / e - f$  is
  - (a)  $/* a + b c - e f$
  - (b)  $a b c + * e / f -$
  - (c)  $a b c + e / * f -$
  - (d) none of these.

**Group - B**

- 2. (a) Write a function to calculate  $\exp(x, y) = x^y$  using recursion.
- (b) Write an algorithm using stack to check whether a given expression contains balanced parenthesis or not.
- (c) Write a function to delete a node from any given position of a doubly linked list.

**4 + 4 + 4 = 12**

- 3. (a) What is tail recursion? Write a recursive function to find the sum of first  $n$  natural numbers.
- (b) Convert the following infix expression into its equivalent postfix expression (show all intermediate steps):

$$P * (Q + R) / S - T * (U + V / W)$$

- (c) What is self-referential structure?

**(1 + 4) + 5 + 2 = 12**

**Group - C**

- 4. (a) Form a binary min-heap from the following sequence of data (show the intermediate steps):

**50, 40, 35, 25, 20, 27, 33**

Now delete the smallest element from the heap, and show the resulting heap (show the steps).

- (b) How AVL tree differs from BST? Insert the following keys in the order given below to build an AVL tree:

**8, 12, 9, 11, 7, 6**

(Clearly mention all the rotations used and balance factor of each node).

**(3 + 3) + 6 = 12**

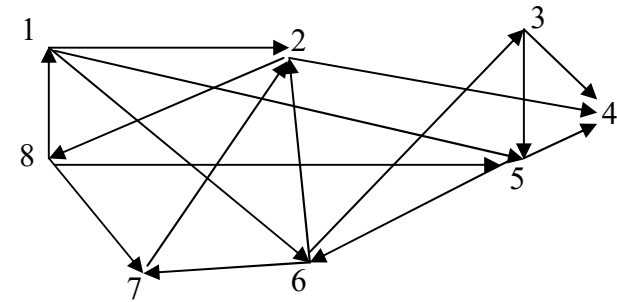
- 5. (a) Write an algorithm to find the smallest number in a binary search tree.
- (b) The in-order and pre-order traversal sequence of a binary tree is given below:

**In-order: 23 17 32 15 35 25 40 19 28**

**Pre-order: 15 17 23 32 19 25 35 40 28**

Draw the binary tree and explain the logic used to construct the tree.

- (c) Write the result of running BFS and DFS on the directed graph given below using vertex 1 as the source.



**3 + 5 + 4 = 12**

**Group - D**

- 6. (a) Define weak entity and discriminator with suitable examples.
- (b) What do you understand by entity integrity constraint and referential integrity constraint?
- (c) What are the disadvantages of file-processing system compared to database management system?

**4 + 4 + 4 = 12**

- 7. (a) Consider a relational database as given below:  
 Train ( train-no, train\_name, start\_station)  
 Coach( coach-no, train-no, type, price)  
 Schedule( train no, day\_of\_week, type)  
 where the underlined attributes are the primary keys.

Write the relational algebraic expressions for the following queries:

- (i) Find all the train names starting from station XYZ.
  - (ii) List the price and type of all coaches of "Satabdi Express" train.
  - (iii) List the train number and price of all "2 A/C" (type) coaches with price below Rs.3475/-
  - (iv) Find all those train names which are scheduled to run on Mondays and Wednesdays (i.e. day\_of\_week)
- (b) Describe the three-level architecture of DBMS.
- (2 × 4) + 4 = 12**

### Group – E

8. (a) What is partial and transitive functional dependency?
  - (b) What is Normalisation? Describe the different anomalies that may be present in relations that are not normalised.
  - (c) Given FD sets:  $F = \{ A \rightarrow BC, A \rightarrow D, CD \rightarrow E \}$  and  $G = \{ A \rightarrow BCE, A \rightarrow ABD, CD \rightarrow E \}$ . Determine whether F is equivalent to G?  
**(1 + 1) + (2 + 3) + 5 = 12**
9. (a) Describe the different states of a transaction life cycle.
  - (b) What do you understand by blind write?  
Let T1 and T2 be transactions that operate on same data items A and B. Let r1(A) mean that T1 reads A, w1(A) mean that T1 writes A, same for T2. Consider the following schedule S and determine if S is conflict serializable or not?  
 $S : r1(A); w1(A); r2(A); w2(A); r1(B); w1(B); r2(B); w2(B)$
  - (c) What is two-phase locking protocol? How does it guarantee serializability?  
**4 + 4 + (1 + 3) = 12**

## DATA STRUCTURE AND DATABASE CONCEPT (CSEN 2206)

**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) A transaction that completes its execution is said to be
 

(a) aborted	(b) committed
(c) rolled back	(d) partially committed.
  - (ii) In case of entity integrity, the primary key may be
 

(a) not null	(b) null
(c) duplicate	(d) both null and not null.
  - (iii) A key that represents relationship between different tables is called a
 

(a) Primary Key	(b) Candidate Key
(c) Foreign Key	(d) Secondary Key.
  - (iv) DML language is used to
 

(a) define schema	(b) access data
(c) ensure security	(d) all of these.
  - (v) Maximum number of edges in an n-node undirected graph without any self loop is
 

(a) $n^2$	(b) $n-2$	(c) $n(n-1)/2$	(d) $n(n+1)/2$ .
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  - (vi) A dynamic data structure where we can search for desired records in  $O(\log n)$  time is
 

(a) heap	(b) height balanced binary search tree	(c) circularly linked list	(d) array.
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