

B.TECH/CHE/4TH SEM/CSEN 2206/2018
DATA STRUCTURE & 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) Which one is correct with respect to RDBMS?
(a) Primary key \subseteq Super key \subseteq Candidate key
(b) Primary key \subseteq Candidate key \subseteq Super key
(c) Super key \subseteq Primary key \subseteq Candidate key
(d) Candidate key \subseteq Super key \subseteq Primary key
- (ii) A functional dependency $X \rightarrow Y$ is trivial if
(a) X is a subset of Y
(b) Y is a subset of X
(c) X is a subset of Y and Y is a subset of X
(d) none of the above.
- (iii) If an attribute of a relation is a member of some candidate key, then this type of attribute is called
(a) candidate attribute (b) atomic attribute
(c) nonprime attribute (d) prime attribute.
- (iv) Which of the following operations is used if we want only specific columns of a table?
(a) Projection (b) Selection (c) Join (d) Union.
- (v) Degree of a pendant vertex in a graph having n nodes is
(a) 0 (b) 1 (c) n (d) n^2 .

B.TECH/CHE/4TH SEM/CSEN 2206/2018

- (vi) What is not true about insertion sort?
(a) Exhibits the worst case performance when the initial array is sorted in reverse order.
(b) Worst case and average case performance is $O(n^2)$.
(c) Can be compared to the way a card player arranges his card from a card deck.
(d) None of the above.
- (vii) An attribute X of datatype varchar(20) has value 'Pen' and attribute Y of datatype char(20) has value 'Paper' in Oracle. Attribute X has _____ memory spaces and Y has _____ memory spaces.
(a) 20,20 (b) 3,5 (c) 3,20 (d) 20,5.
- (viii) In RDBMS, the constraint that no key attribute may be NULL is referred to as
(a) entity integrity (b) multivalued dependency
(c) referential integrity (d) functional dependency.
- (ix) A binary tree of height h has at least h nodes and at most _____ nodes.
(a) 2^h (b) $2h$ (c) 2^{h-1} (d) 2^{h+1} .
- (x) The circular queue will be full only when
(a) FRONT = MAX - 1 and REAR = MAX - 1
(b) FRONT = 0 and REAR = MAX - 1
(c) FRONT = MAX - 1 and REAR = 0
(d) FRONT = 0 and REAR = 0

Group - B

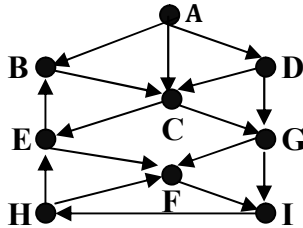
2. (a) What is a tail recursion?
Write a function to compute $F(x, y)$ using recursion, where
 $F(x, y) = F(x-y, y) + 1$ if $y \leq x$
and $F(x, y) = 0$ if $x < y$
- (b) Write a function to delete an element from a circular queue. State the advantages of circular queue over linear queue. **(2+4) + (4+2) = 12**
3. (a) Convert the following infix expression to its equivalent postfix form.
 $(X - 2 * (Y + Z) / W ^ P) + Q$. Show all intermediate steps.
- (b) Write a function to delete the minimum and maximum element of a singly linked list that stores integer values.
- (c) Give the link-list representation for the following polynomial:
 $7x^3y^2 - 8x^2y + 3xy + 11x - 4$

5 + 4 + 3 = 12

Group - C

4. (a) Construct a binary search tree whose nodes in inorder and preorder are given as follows:
 Inorder: D B H E A I F J C G
 Preorder: A B D E H C F I J G
 Show all intermediate steps.

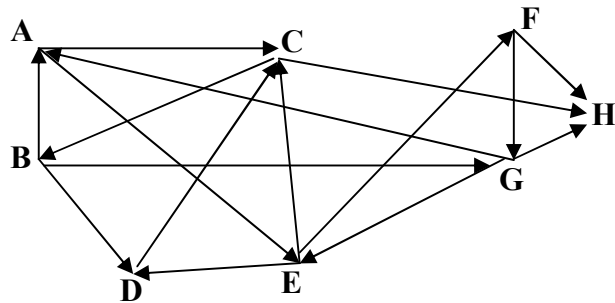
- (b) Consider the graph below that represents the daily flights between different cities. We want to fly from city *A* to *I* with minimum stops, that is find a minimum length path from *A* to *I* given that every edge has a length of 1.



- (c) Define complete binary tree and full binary tree.
 (d) Mention different memory representation of a graph.

$4 + 5 + 2 + 1 = 12$

5. (a) Write the result of running BFS and DFS on the directed graph given below using vertex *A* as the source.



- (b) Form a binary max-heap tree from the following sequence of data: 25, 40, 35, 52, 37, 76, 30, 67, 54. Show the intermediate steps. Now delete 25 and 76 from the tree and show the resultant tree after each deletion.
 (c) What is the time complexity of bubble sort algorithm? Given the numbers 7, 1, 4, 12, 67, 33, and 45, how many swaps will be performed to sort these numbers using bubble sort? Show the steps.

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

Group - D

6. Assume that a "Supplier" table exists with the given structure: Supplier = {S_Id, S_Name, phn} where S_Id is the primary key. Create the "Products" table as per following specifications with appropriate integrity constraints.

Field Name	Data Type	Constraints
PNo	Number(4)	Unique product number for each product
PName	Varchar(30)	Must be in upper case
Supp_ID	Number(4)	A valid supplier id which must exist in 'Supplier' table where S_Id is primary key
Price	Number(7,2)	
Expiry_date	Date	Must provide some value

After creating the table, write the following queries using SQL:

- (i) List the product numbers (PNo), names (PName) and price of those products whose price is more than the average price of all products.
 (ii) List the Product numbers and expiry dates of those products those will expire within 15th May, 2018 and 25th October, 2018, both days inclusive.
 (iii) Count and display the number of products supplied by each Supplier.

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

7. (a) Define the following terms with suitable examples:

- (i) Multi-valued attribute
 (ii) Total Generalisation
 (iii) Cartesian Product

- (b) What do you understand by physical data independence and logical data independence?

- (c) What is a DBA? What are the different functions of a DBA?

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

Group - E

8. (a) What is partial and transitive functional dependency?
(b) Justify the statement "BCNF is stronger than 3NF".
(c) Consider the relation $R = \{ A, B, C, D, E, F, G, H, I, J \}$ and the set of functional dependencies $F = \{ AB \rightarrow C, A \rightarrow DE, B \rightarrow F, F \rightarrow GH, D \rightarrow IJ \}$
What is the candidate key(s) for R? Decompose R into 3NF.
 $(2 + 2) + 3 + 5 = 12$
- 9.(a) What are the ACID properties of a transaction? Explain.
(b) Describe the wait-die and wound-wait protocols for deadlock prevention.
(c) What do you understand by precedence graph?
Let T1 and T2 be transactions that operate on same data items A, B & C.
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: $r1(A); w1(A); r2(A); w2(A); r1(B); w1(B); r2(C); w2(C)$
 $4 + (2 + 2) + (1 + 3) = 12$