

**MCA (INTEGRATED)**  
**(SEM VI) THEORY EXAMINATION 2022-23**  
**DATABASE MANAGEMENT SYSTEMS**

Time: 3 Hours

Total Marks: 70

**Note:** Attempt all Sections. If require any missing data; then choose suitably.

**SECTION A**

**1. Attempt all questions in brief.** **2 x 7 = 14**

- a. Discuss about the statement “Redundancy leads to data inconsistency” with a suitable example.
- b. Differentiate between the char & varchar data types.
- c. How database triggers are useful? How are they executed?
- d. Summarize the advantages of normalization.
- e. Differentiate between partial and full functional dependencies.
- f. Summarize the functionality of buffer manager.
- g. Differentiate between Deferred and Immediate database modification.

**SECTION B**

**2. Attempt any three of the following:** **7 x 3 = 21**

- a. Express the advantages, disadvantages and applications of DBMS.
- b. Show the importance of Relational Integrity Constraints with proper example of each.
- c. Discuss about BCNF? Summarize how BCNF is different from Third Normal form?
- d. Explain the concepts of one pass and two pass algorithms.
- e. Define and explain the various types of transaction failures.

**SECTION C**

**3. Attempt any one part of the following:** **7 x 1 = 7**

- a. With a neat diagram discuss the three-level architecture of DBMS. Discuss also the mapping between various levels.
- b. Analyze the different needs for designing an ERD for Library Management System and design the ERD for that.

**4. Attempt any one part of the following:** **7 x 1 = 7**

- a. SAILORS (Sid, Sname, Rating, Age)  
 BOATS (Bid, Boat Name, Color)  
 RESERVES (Sid, Bid, Day)  
 Based on above relations, expose the Relational Algebra expressions for following-
  1. Find the colors of boats reserved by 'Ramesh'.
  2. Find sailors details who have reserved all boats.

- b. For following relation, determine the Super Key, Candidate Key, Primary Key and Alternate Key -  
First\_Sem\_Students( Name, Father\_name, Mother\_name, DOB, Address, Branch, Batch, Sem, Section, Class\_roll\_number, Aadhar\_no )

**5. Attempt any one part of the following:**

**7 x 1 = 7**

- a. For a relation Client Master[Client\_No, Name, Address, City, Pincode], express the SQL queries for following-  
1. Find a list of such clients whose name starts with 'R' and ends with 'Kumar'.  
2. Find a list of clients who belongs from Ghaziabad/ Loni/ Noida.
- b. Design a trigger for maintaining the backup of deleted employees detail in Deleted Employees (EmpId,EmpName,deleted\_date) if any employee is being deleted from EmpMaster (EmpId,Name, Father, DOB, Department).

**6. Attempt any one part of the following:**

**7 x 1 = 7**

- a. Show the concept of Query Processing. Determine the use of a parser.
- b. By using the concept of Bitmap Indexing, find the employees with an age in the range 45-55 and a salary in the range 100-200 for following data-

No	Age	Salary
1	25	60
2	45	60
3	50	75
4	50	100
5	50	120
6	70	110
7	85	140
8	30	260
9	25	400
10	45	350
11	50	275
12	60	260

**7. Attempt any one part of the following:**

**7 x 1 = 7**

- a. Draw and explain the state diagram of transaction.
- b. What do you mean by Locking techniques of concurrency control? Discuss any one locking technique in detail.

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**MCA-INT**  
**(SEM VI) THEORY EXAMINATION 2022-23**  
**GRAPH THEORY**

Time: 3 Hours

Total Marks: 70

**Note:** Attempt all Sections. If require any missing data; then choose suitably.

**SECTION A****1. Attempt all questions in brief.****2 x 7 = 14**

- (a) Define Regular Graph.
- (b) Define Isolated and Pendent vertex.
- (c) What are the applications of a Planer graph?
- (d) It is possible to construct a graph with 12 vertices such that 2 of the vertices have degree 3 and the remaining vertices have degree 4.
- (e) Show that the sequence 6, 6, 6, 6, 4, 3, 3, 0 is not graphical.
- (f) What is an Edge Covering?
- (g) Define minimum vertex degree of  $G$  ( $\delta(G)$ ) and maximum vertex degree of  $G$  ( $\Delta(G)$ ).

**SECTION B****2. Attempt any three of the following:****7 x 3 = 21**

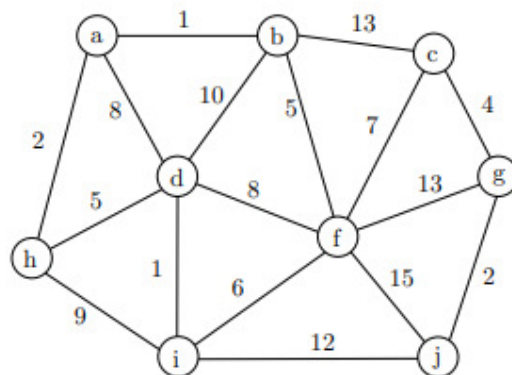
- (a) What does it mean by Degree of a Vertex? Can a simple graph exist with 15 vertices each of degree five? Explain your answer.
- (b) Define the terms Distance, Centre and Eccentricity in a tree. Show that the distance between two spanning trees is a metric.
- (c) Define the Vector and Vector Space with example.
- (d) What are Chromatic Polynomials? Explain the concept of Chromatic Partition.
- (e) Explain the Digraph and Binary Relations.

**SECTION C****3. Attempt any one part of the following:****7 x 1 = 7**

- (a) Explain the Combinatorial and Geometric with the help of example.
- (b) Prove the given statement, "A tree with  $n$  vertices has  $n-1$  edges".

**4. Attempt any one part of the following:****7 x 1 = 7**

- (a) Find a minimal spanning tree for the given graph by Kruskal's algorithm and Prim's algorithm.

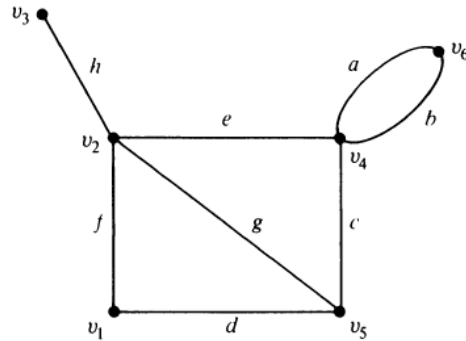


- (b) Prove that There is one and only one path between every pair of vertices in a tree  $T$ .

5. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Define the cut set matrix and draw the cut set matrix give graph.



- (b) Explain the Fundamental Circuit Matrix.

6. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Define the Matching. What is the Complete Matching? Are all bipartite graphs having complete matching?
- (b) Prove that A graph with at least one edge is 2-chromatic if and only if it has no circuits of odd length.

7. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Prove that in any digraph the sum of the in-degrees of all vertices is equal to the sum of their out-degrees.
- (b) Explain Euler digraphs in detail.

**MCA-INT**  
**(SEM VI) THEORY EXAMINATION 2022-23**  
**ARTIFICIAL INTELLIGENCE**

**Time: 3 Hours****Total Marks: 70**

**Note:** Attempt all Sections. If require any missing data; then choose suitably.

**SECTION A**

**1. Attempt all questions in brief. 2 x 7 = 14**

- (a) Name the elements of an agent.
- (b) What do you mean by term weak AI and strong AI
- (c) What do you infer from hill-climbing search algorithm?
- (d) Justify the usage of universal and existential quantifier with an example
- (e) Derive the process of conditional probability in Bayes' Theorem
- (f) Explain the brief in concept of reinforcement learning
- (g) Write short notes on support vector machine

**SECTION B**

**2. Attempt any three of the following: 7 x 3 = 21**

- (a) Discuss agents and its structure. Also discuss the types of agents.
- (b) Illustrate Classical "Water jug Problem". Prepare the production rules for this problem and also give the solution with appropriate rules applied on to it.
- (c) Illustrate the different design issues to be solved to use hidden markov model for real world application.
- (d) Write the steps for converting FOPL into CNF.
- (e) Illustrate machine learning concept. Differentiate between supervised, unsupervised and reinforcement learning.

**SECTION C**

**3. Attempt any one part of the following: 7 x 1 = 7**

- (a) For each of the following agent develop the PEAS description of task environment
  - (i) Online food delivery
  - (ii) Online shopping agent
  - (iii) Weather forecasting system
  - (iv) For Tic-Tac-Toe Game
- (b) Trace the constraint satisfaction procedure to solve the following cryptarithmic problem: BASE+ BALL = GAMES

**4. Attempt any one part of the following: 7 x 1 = 7**

- (a) Describe A\* and AO\* search technique. Prove that A\* is complete and optimal.
- (b) Explain the concept of alpha-Beta pruning. Write Alpha-Beta search algorithm

5. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Use forward and backward chaining algorithm for the Given the knowledge base as:  $P, P \rightarrow Q, Q \rightarrow R$ . Derive R by using forward and backward chaining?
- (b) Modify the following sentences to FOPL-
  - a) If it is not raining and I have time, then I will go to movie.
  - b) If it is raining and I will not go to movie.
  - c) It is not raining.
  - d) I will not go to movie.
  - e) I will not go to movie only if it is not raining.

6. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Discuss Expectation-Maximization algorithm by choosing a suitable example also discuss its advantages and disadvantages.
- (b) Apply the principles of pattern recognition system for dimension reduction using Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA).

7. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Illustrate classification is done by k-nearest neighbors. Perform KNN classification algorithms on the following dataset and predict the class for X ( $p_1=3, p_2=7$ ). Given  $k=3$ .

Sl. No.	P1	P2	Class
1	6	5	False
2	7	7	False
3	3	5	True
4	2	4	True

- (b) Describe the decision tree-learning model by choosing a suitable example. Also discuss the issues related to the applications of decision tree

**MCA-INT**  
**(SEM VI) THEORY EXAMINATION 2022-23**  
**INTRODUCTION TO AUTOMATA THEORY & LANGUAGES**

**Time: 3 Hours****Total Marks: 70****Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 7 = 14**

- (a) List out applications of automata.
- (b) Differentiate between dead state and not reachable states.
- (c) Design a regular expression that accepts all strings containing at least two 1's over the input {0,1}.
- (d) What is unit production?
- (e) What do you mean by ambiguous grammar?
- (f) Explain recursive theory function.
- (g) What do you understand by the Halting Problem?

**SECTION B****2. Attempt any three of the following:****7 x 3 = 21**

- (a) Explain each step in designing of NFA with  $\epsilon$ -moves for the regular expression  $(a+b)^*abb$ .
- (b) Construct a Moore machine that will count occurrence of substring aab in the given string over the input {a,b}.
- (c) Discuss the various closure properties of CFLs.
- (d) Write short notes on:
  1. Turing Machine as Computer of Integer functions
  2. Universal Turing Machine
- (e) Define Post's Correspondence Problem (PCP) and Modified PCP with its applications. Find any three PCP solutions of the lists  $x=(b,bab^3,ba)$  and  $y=(b^3,ba,a)$ .

**SECTION C****3. Attempt any one part of the following:****7 x 1 = 7**

- (a) Design a DFA that will accept set of strings over {a, b} in which every 'a' is followed by a 'b'.
- (b) Construct a DFA for  $L(G) = \{w | w \in (a+b)^*, n_a(w) \geq 2, n_b(w) \leq 1\}$

**4. Attempt any one part of the following:****7 x 1 = 7**

- (a) Discuss Chomsky Hierarchy in detail.
- (b) Discuss the grammar? Write a grammar for language  $L(G) = \{w \in \{a, b\}^* | w \text{ is a palindrome of odd length}\}$ .

**5. Attempt any one part of the following:****7 x 1 = 7**

- (a) Convert the grammar  $S \rightarrow aAA, A \rightarrow a|a|bS$  to a PDA that accepts the same language by empty stack.
- (b) Discuss the Push Down Automata (PDA). Discuss with suitable example.

6. Attempt any *one* part of the following: 7 x 1 = 7

- (a) Design a Turing Machine for the language L, where  $L = \{ a^n b^n b^n : n \geq 1 \}$ .
- (b) Design a Turing Machine for equal number of a's and b's.

7. Attempt any *one* part of the following: 7 x 1 = 7

- (a) Discuss the complexity classes? Write the short note on
  - (i) P Class
  - (ii) NP Class, and
  - (iii) NP-Complete.
- (b) Write the short note on:
  - (i) Multi-Tape and Multi-Head Turing Machine
  - (ii) Church-Turing Thesis

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**MCA - INT**  
**(SEM VI) THEORY EXAMINATION 2022-23**  
**UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS**

**Time: 3 Hours****Total Marks: 70****Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief. 2 x 7 = 14**

- (a) Differentiate between prosperity and wealth.
- (b) Define existence?
- (c) Difference between respect and gratitude.
- (d) What is utility value?
- (e) What do you understand by trust?
- (f) Differentiate between units and space.
- (g) What do you mean by professional ethics?

**SECTION B****2. Attempt any three of the following: 7 x 3 = 21**

- (a) What do you mean by values (human values)?
- (b) What is pre-conditioning? What is their source?
- (c) How can you say that love is the complete value?
- (d) Explain the differences and similarities between animal order and human order. What is the relation between these two orders?
- (e) What is utility value and artistic value? How are both important in human life? Explain with example

**SECTION C****3. Attempt any one part of the following: 7 x 1 = 7**

- (a) What are the basic guidelines for value education?
- (b) Explain with examples the various activities in the self 'I'.

**4. Attempt any one part of the following: 7 x 1 = 7**

- (a) What is 'justice'? What are its four elements? Is it a continuous or a temporary need?
- (b) Distinguish between the activities of different orders of nature giving an example of each.

**5. Attempt any one part of the following: 7 x 1 = 7**

- (a) What do you understand by competence in professional ethics? Give two examples of its implications in industry.
- (b) Write a short note on the need for value education in today's scenario.

**6. Attempt any *one* part of the following:**

**7 x 1 = 7**

- (a) Define Sanyam and Swasthya. How are they helpful in keeping harmony between self and body.
- (b) How do we differentiate in relationships on the basis of body, physical facilities, or beliefs? What problems do we face because of such differentiation?

**7. Attempt any *one* part of the following:**

**7 x 1 = 7**

- (a) Explain how there is recyclability and self-regulation in nature.
- (b) What would be the pragmatic implications of value-based living at the four levels? Briefly explain.

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