

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

MCA (Sem.-1)  
**ADVANCED DATA STRUCTURES**  
Subject Code : PGCA-1952  
M. Code : 79037  
Date of Examination : 21-12-2023

Time : 3 Hrs.

Max. Marks : 70

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying TEN marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1) Write short notes on :

- a. What do you mean by amortized analysis?
- b. What is the worst case time complexity of merge sort?
- c. What are the characteristics of a good hash function?
- d. What is the worst case time complexity of counting sort algorithm?
- e. What are the four rotations of AVL tree?
- f. What is minimum spanning tree?
- g. What is maximum flow?
- h. What is string copy?
- i. How to concatenate two strings? Explain.
- j. What is the time complexity of Rabin Karp algorithm?

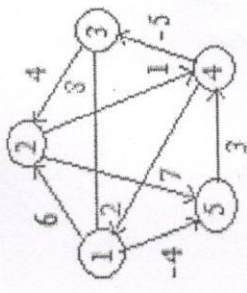
**SECTION-B**

2) Answer the following :

- a. Consider a hash table with 10 slots and the collisions are resolved by linear probing. The following keys are inserted in the order: 15, 2, 1, 5, 20, 31, 12, 21, 17 and 34. The hash function is  $h(k)=k \bmod 10$ . What is the resultant hash table?
  - b. What is perfect hashing? Explain.
- 3) a. Show the red-black trees that result after successively inserting the keys 41,38,31,12,19,8 into an initially empty red-black tree.  
b. Explain disjoint-set data structures using an example.
  - 4) What is the difference between counting sort and bucket sort? Explain with the help of an example.
  - 5) What are the methods of amortized analysis? Explain in detail.

**SECTION-C**

- 6) How graphs are represented in memory? Explain in detail.
- 7) Apply all pairs shortest algorithm for constructing the shortest path for the following graph.



- 8) What is the good suffix rule in Boyer-Moore algorithm? Explain in detail with the help of an example.
- 9) What is prefix function in Knuth-Morris-Pratt algorithm? Explain in detail.

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MCA (Sem.-1)  
**TECHNICAL COMMUNICATION**  
Subject Code : PGCA-1905  
M.Code. : 79039  
Date Examination : 29-12-2023

Time : 3 Hrs.

Max. Marks : 70

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying TEN marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1. Write short notes on :

- a) Communication
- b) Advantages of listening skills
- c) 7C's of effective communication(only names)
- d) Coherence in writing
- e) Precis Writing
- f) Purpose of Indexing
- g) Body Language
- h) Types of Verbal Communication
- i) Newsletter
- j) Symposium.

**SECTION-B**

2. Communication- an Art or a Science. Discuss.
3. What are the barriers to communication? How to have an effective communication?
4. Write a Paragraph on 'Importance of Soft Skills'
5. Write a letter to a dealer asking for a discount on bulk order of computers.

**SECTION-C**

6. Write a memo from the Manager to the employees for their misconduct during an event.
7. Discuss the format of Technical Report.
8. What are the qualities required for an effective presentation?
9. What is an e-mail? Write a sample email explaining various components of e-mail.



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MCA (Sem.-1)  
**ADVANCED DATABASE MANAGEMENT SYSTEM**  
Subject Code : PGCA-1953  
M.Code : 79038

Date of Examination : 11-12-2023

Time : 3 Hrs.

Max. Marks : 70

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying TEN marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1. Write short notes on :

- a) What do you understand by Data Independence? Name its types.
- b) Define Conceptual view and Physical view of DBMS.
- c) What are weak entities? How are they represented in DBMS?
- d) Define Multi-valued Dependency. Give an example.
- e) Define Relational Calculus.
- f) What do you understand by Document Type Definition?
- g) Distributed DBMS Commit Protocols.
- h) What do you understand by Spatial Databases and its types?
- i) Define Distributed Query Processing.
- j) Given the relation  $R(ABCDEFGHIJ)$  with the following functional dependencies.

$F: \{CH \rightarrow G, A \rightarrow BC, B \rightarrow CFH, E \rightarrow A, F \rightarrow EG\}$

List the all-possible candidate keys for the relation R.

**SECTION-B**

2. Explain about Database System Architecture with diagrams. Discuss its types.
3. a) What is meant by ER model? Explain the term relationship in ER model, Connectivity and Cardinality.  
b) Discuss the types of relationship in ER model with suitable examples.
4. a) Find the highest normal form of a relation  $R(V, W, X, Y, Z)$  with functional dependency set as :  
 $\{WX \rightarrow Y, VX \rightarrow WZ, W \rightarrow Z\}$   
b) State the difference between 3NF and BCNF with proper examples.
5. What is Concurrency? Discuss different concurrency control techniques.

**SECTION-C**

6. What is Parallel Database? Compare inter and intra query parallelism.
7. What do you understand by the concept of distributed database? Discuss the various commit protocols in DDBMS.
8. Define the term Big Data and No SQL databases. What are the different types of NoSQL Databases? Discuss open source databases.
9. What is temporality in the context of databases, and why is it important in data management? What is the difference between valid time and transaction time in temporal databases?

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MCA (Sem.-1)  
**DISCRETE STRUCTURES AND OPTIMIZATION**  
Subject Code : PGCA-1917  
M. Code : 79035  
Date of Examination : 14-12-2023

Time : 3 Hrs. Max. Marks : 70

**INSTRUCTIONS TO CANDIDATES :**

- SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
- SECTION - B & C. have FOUR questions each.
- Attempt any FIVE questions from SECTION B & C carrying TEN marks each.
- Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

- Write short notes on the following :
  - What is the basic concept of set theory and how it is used in discrete mathematics?
  - How does the study of combinatorial mathematics contribute in optimizing algorithms in computer science?
  - What distinguishes fields, integral domains and rings in abstract algebra?
  - What is the role of hashing functions in data structures?
  - What are some practical instances where the pigeonhole principle is employed within combinatorial mathematics?
  - Differentiate briefly between semigroups, monoids and groups.
  - What is the significance of cosets and congruence relations in the context of group theory?
  - Define isomorphism and homomorphism in graph theory.
  - List the characteristics of Hamiltonian paths.
  - What is the concept of Euler graphs and list their properties?

**SECTION-B**

- Imagine a scenario where the population of bacteria in a colony multiplies by 4 every hour.
  - How would you establish a recurrence relation for the number of bacteria after  $n$  hours?
  - If a colony begins with 50 bacteria and the population grows by a factor of 5 every hour, how many bacteria will be present in the colony after 8 hours?
- Explain the practical applications of combinations and permutations. What is the minimum number of students needed in a discrete mathematics class to guarantee that at least three students receive the same grade, when there are four possible grades: A, B, C, and D?
- Define Boolean Algebra, sub-algebras and Boolean rings. Given the Boolean function  $F(A, B, C, D) = \sum(0, 2, 5, 7, 11, 13, 14, 15)$ , employ the Karnaugh Map method to simplify the function  $F$  and represent the resulting expression.  
Provide an overview of the key characteristics of rings and offer examples of different types of rings. Also, compare rings to other algebraic structures, such as groups and fields, highlighting their distinctive features.

**SECTION-C**

- Describe the fundamental principles and characteristics of right cosets in the context of group theory. Calculate the number of right cosets of a subgroup  $H$  in a group  $G$ , given  $|G| = 72$  and  $|H| = 8$ .
- Delve into the concept and attributes of symmetric groups and provide concrete examples. Determine the order of a symmetric group  $S_{12}$  and identify any of its non-trivial subgroups.
- Investigate the significance and practical applications of graph isomorphism in graph theory. Provide specific instances where graph isomorphism plays a crucial role in real-world problems.
- Write an extensive explanation of the concept of planar graphs and their coloring properties in graph theory. Discuss the history and significance of the Four-Color Theorem and the current status of its proof, whether it remains a conjecture or has been proven.

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MCA (Sem.-1)  
**PROGRAMMING IN PYTHON**  
Subject Code : PGCA-1951  
M. Code : 79036  
Date of Examination : 16-12-2023

Time : 3 Hrs.

Max. Marks : 70

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
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3. Attempt any FIVE questions from SECTION B & C carrying TEN marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1. Write short notes on :

- a) What is Python's main design philosophy?
- b) How do you declare a variable in Python?
- c) What is the purpose of the print() function in Python?
- d) How can you comment a single line in Python?
- e) What does the len() function do in Python?
- f) How do you create a list in Python?
- g) What does a Python set data structure contain?
- h) How do you define a function in Python?
- i) What is a module in Python?
- j) How do you handle an exception in Python?

**SECTION-B**

2. What is the purpose of an indentation in Python code, and how is it different from other languages?
3. What are data types in Python and can you provide examples of each?
4. Describe the use of list, set and dictionary comprehensions in Python.
5. Write a program that finds the largest element in a list of numbers without using built-in functions like max().

**SECTION C**

Discuss the concept of Object-Oriented Programming (OOP) in Python. How can you create and manipulate classes and objects in Python?

7. Write a Python program to find the factorial of a number using a recursive function.
8. Create a Python class representing a basic calculator with methods for addition, subtraction, multiplication and division.
9. Develop a Python script that calculates the area of various geometric shapes (e.g., circle, rectangle, triangle) based on user input.



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