END TERM EXAMINATION

FIRST SEMESTER [MCA] FEBRUARY 2023

Paper Code: MCA-101   Subject: Discrete Structures

Time: 3 Hours   Maximum Marks: 75

Note: Attempt five questions in all including Q. No.1 which is compulsory. Select one question from each unit.

Q1   Answer the following questions:-   (2.5x10=25)
(a) Prove that an irreflexive relation with a suitable example.
(b) Prove that every positive integer can be written as sum of integral powers of 2.
(c) Test the validity of the following statement:-
If the cup is white then it is my cup.
The cup is not white.
Therefore, the cup is not mine.
(d) Prove that the mathematical structure $(Z, \leq)$ is a Poset, where Z is set of integers.
(e) What is a Boolean Expression?
(f) Write five negative integers that are congruent to 3 (modulo 7).
(g) Define the term Left Coset and right Coset in a group.
(h) Write the main components of an Encryption System.
(i) Define a regular graph. Is it possible for a 3-regular graph to contain 5 nodes?
(j) State Four Colour theorem.

UNIT-I

Q2   (a) Convert the following expression in CNF.   (6)
$(p \lor \sim q \leftrightarrow q \to p) \land (p \to r)$
(b) In an examination, if you have to answer 6 questions for 50 marks, then there is at least one question of minimum 9 marks. Prove this statement.   (6.5)

Q3   (a) Nine persons volunteer for a four-person committee. Every possible committee of four persons that can be formed from these 9 names is written on a slip of paper, one slip for each possible committee, and the slips are put in 15 hats. Show that one of the hat contains at least 9 slips of paper.   (6.5)
(b) Let f: A→B be a function and $|A| = |B| = n$. Prove that the following two statements are equivalent.   (6)
(i) f is one to one,
(ii) f is onto.

UNIT-II

Q4   (a) Prove that $(A, <)$ is a lattice where A = {1, 2, 3, 5, 6, 10, 15, 30} and < is the relation of divisibility defined on A such that x < y if x divides y. (6.5)
(b) Explain the term Tautologies, Contradiction and Contingency with a suitable example for each.   (6)

Q5   (a) Explain the concept of isomorphic lattice with a suitable example.   (6)
(b) Consider the multiplication of bacteria in a controlled environment. Let a_r denote the number of bacteria there are on r^{th} day. If $a_r - 2a_{r-1}$ be the rate of growth of rth day and that the rate of growth doubles every day, determine a_r given that $a_0 = 1$.   (6.5)

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UNIT-III

Q6 (a) Solve the equation $19x + 17y = 5$ for integers x and y. **(6)**

(b) Define permutation group and show that product of two even permutations in a group is again an even permutation. **(6.5)**

Q7 (a) State Chinese Remainder Theorem. Explain its application with an example. **(6.5)**

(b) What is Euler phi function? Compute $\phi(19)$. **(6)**

UNIT-IV

Q8 (a) What is chromatic number and chromatic polynomial? Determine the chromatic number and chromatic polynomial for a complete bipartite $K_{10,10}$. **(6)**

(b) Distinguish between Hamiltonian and Euler Graph. Give an example of a graph that is Hamiltonian but not an Euler Graph. **(6.5)**

Q9 (a) With a suitable graph, explain the meaning of cut vertex, cut edge and articulation point. **(6)**

(b) Define isomorphism of graphs with a suitable example. What is degree spectrum? Can we use degree spectrum to determine isomorphism of two graphs? **(6.5)**

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END TERM EXAMINATION

FIRST SEMESTER [MCA] JANUARY-FEBRUARY 2023

Paper Code: MCA 103	**Subject: Computer Networks**
Time: 3 Hours	**Maximum Marks: 75**

Note: Attempt all questions as directed. Internal choice is indicated.

Q1. Answer the following briefly: (2.5x10=25)
   (a) What are the different types of transmission media?
   (b) Explain the difference between node-to-node delivery and source-to-destination delivery?
   (c) What are the advantages of Piggy Backing?
   (d) Difference between Bandwidth and Throughput.
   (e) Describe the count-to-infinity problem.
   (f) What is the purpose of cladding in optical fiber?
   (g) Differentiate RST and FIN flag in TCP header.
   (h) Differentiate Connectionless and Connection Oriented services.
   (i) Differentiate between Static Routing and Dynamic Routing algorithm with examples?
   (j) Distinguish between bit rate and baud rate.

UNIT-I

Q2. (a) Explain Pulse Code Modulation Techniques.   **(6.5)**
   (b) What are the different techniques to convert Analog-to-digital? Explain the process.   **(6)**

OR

Q3. (a) Give the NRZ-I, NRZ-I, Manchester, Differential Manchester, and Bipolar encoding of the digital data: 00110101000111.   **(6.5)**
   (b) Explain Soft handoff and Hard handoff.   **(6)**

UNIT-II

Q4. (a) What are the different types for Error Detection Techniques? Explain.   **(6.5)**
   (b) Difference between CSMA, CSMA/CD and CSMA/CA.   **(6)**

OR

Q5. (a) Explain Stop-and-Wait ARQ protocol to the Go-Back-N ARQ Protocol.   **(6.5)**
   (b) Given a 10 bits sequence 11011011100 and a divisor is 1101, find the CRC. Also check your result at receiver side.   **(6)**

UNIT-III

Q6. (a) Explain the architecture of Bluetooth. Compare PICONET and SCATTERNET.   **(6.5)**

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(b) What are the different UNICAST routing algorithms and explain the difference between distance vector and link state routing algorithms.

(6)

OR

Q7. (a) Explain IP MULTIICAST routing protocols?

(6.5)

(b) Explain IPv6 Extension Header. What are the various techniques for transition from IPv4 to IPv6?

(6)

UNIT-IV

Q8. (a) Explain TCP header.

(6.5)

(b) Explain Domain Name Server (DNS)? Explain the address resolution techniques in DNS.

(6)

OR

Q9. (a) Explain the Silly Window Syndrome. Also, explain the cause of Silly Window Syndrome form Sender and Receiver Side.

(6.5)

(b) Explain POP and IMAP in email system.

(6)

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END TERM EXAMINATION

FIRST SEMESTER [MCA] FEBRUARY 2023

Paper Code: MCA-105	Subject: Operating Systems with Linux
Time: 3 Hours	Maximum Marks: 75

Note: Attempt five questions in all including Q. No.1 which is compulsory. Select one question from each unit.

Q1   Attempt **all** questions:-   (10x2.5=25)
  (a) List the differences between Internal Fragmentation and external Fragmentation.
  (b) Explain the function of the ready queue?
  (c) What is multi-threading?
  (d) What are basic requirements of any solution to the critical sections problem?
  (e) Differentiate between multiprogramming and multiprocessing.
  (f) Differentiate between kernel level and user level threads.
  (g) What is meant by context switch?
  (h) What is the use of fork and exec system calls?
  (i) Differentiate between pre-emptive and non-preventive scheduling.
  (j) Differentiate between long-term and short-term scheduling.

UNIT-I

Q2   (a) List five services provided by an operating system. Explain how each provides convenience to the users. Explain also in which cases it would be impossible for user-level programs to provide these services.   (6)
  (b) What is directory? What are the different ways to implement a directory?   (6.5)

Q3   (a) Differentiate how Distributed operating systems differ from Multi-programmed and Time-shared Operating systems? Give key features of each.   (6)
  (b) Explain the following: (i) Multitasking System (ii) Real-time System. (6.5)

UNIT-II

Q4   (a) What is a semaphore? Explain busy waiting semaphores.   (6)
  (b) Explain the differences with diagram between multilevel queue and multilevel feedback queue scheduling.   (6.5)

Q5   (a) How semaphores help in process synchronization? What is the difference between binary and counting semaphores?   (6)
  (b) Process P1, P2 and P3 arrive for execution at times indicated. Using non-pre-emptive scheduling, answer the questions below: (6.5)

Process	Arrival Time	Burst Time
P1	0.0	8
P2	0.4	4
P3	0.8	1

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(i) What is the average turnaround time for these processes with FCFS scheduling?

(ii) What is the average turnaround time for these processes with SJF scheduling?

(iii) What is the average turnaround time if the CPU is left idle for first 1 unit and then SJF scheduling is used?

UNIT-III

Q6 (a) What is the cause of thrashing? How does the system detect thrashing? Once it detects thrashing, what can the system do to eliminate this problem? **(6)**

(b) Consider the following page reference string: **(6.5)**

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.

How many page faults would occur for the following replacement algorithms, assuming three frames? Remember all frames are initially empty, so your first unique pages will all cost one fault each.

(i) LRU replacement
(ii) FIFO replacement
(iii) Optimal replacement

Q7 (a) Write Banker's algorithm for deadlock avoidance. **(6)**

(b) What is virtual memory? How demand paging supports the virtual memory? Explain in detail. **(6.5)**

UNIT-IV

Q8 (a) Explain about file directories and its attributes in detail. **(6)**

(b) What is RAID? Explain various RAID levels. **(6.5)**

Q9 (a) What are the three methods for allocating disk space? Explain. **(6)**

(b) Describe various file access methods. **(6.5)**

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END TERM EXAMINATION

FIRST SEMESTER [MCA] FEBRUARY 2023

Paper Code: MCA107	Subject: *Database Management Systems*
Time: 3 Hours	Maximum Marks: 75

**Note: Attempt five questions in all including Q.No.1 which is compulsory.
Select one question from each Unit.**

Q1 Write short notes on the following **(Any Five)**   **[5x5=25]**
  a) Define database. What are the characteristics of a modern DBMS?
  b) Differentiate between physical and logical database schema.
  c) Differentiate between Generalization and Specialization
  d) Explain about various constraints used in ER-model.
  e) Briefly describe various architectures of database systems
  f) Why the concurrency control is needed? Explain it.
  g) Define transaction and explain desirable properties of transactions

UNIT-I

Q2 a) Write a short notes on i) Foreign Key ii) Relation state iii) Database schema **[7.5]**
   b) Discuss the activities of different database users. **[5]**

OR

Q3 a) Briefly describe hierarchical and network DBMS **[6.5]**
   b) A company database needs to store information about employees (identified by ssn, with salary and phone as attributes), departments (identified by dno, with dname and budget as attributes), and children of employees (with name and age as attributes). Employees work in departments; each department is managed by an employee; a child must be identified uniquely by name when the parent (who is an employee; assume that only one parent works for the company) is known. We are not interested in information about a child once the parent leaves the company.
    Draw an ER diagram that captures this information. **[6]**

UNIT-II

Q4 a) Consider the database: **[7.5]**
    Employee (e-name,street,city)
    Company (c-name,city,c-loan)
    Works (e-name,c-name,salary)
    Manages(e-name,manager-name)
    Using SQL answer following queries:
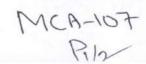   (i) Find employee names who live in same city & on same street as do their managers.
    ii) Find count of employees staying in Delhi.
    iii) Give all mangers working in company "ABC", 10% increase in salary.
    iv) Find all those company names, in which all Delhi employees work.
    v) Find those companies in which at least one employee of Delhi based companies works.

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P.1

b) What do you mean by relational algebra? Explain all the operations of relational algebra. **[5]**

OR

Q5 a) How is stored procedure created? Explain with example the three ways of passing parameters with the stored procedure. **[6.5]**

b) Consider the following relational schema **[6]**

Account (account-number, branch-name, balance)
Loan(Loan-number, branch-name, balance)
Depositor(Customer-name, Account-number)
Borrower(Customer-name, Loan-number)

Formulate the relational algebra statements for the following (Assume keys and additional information (as per requirement):

a) Find all loan numbers for loan made at Bombay branch.
b) Find all customers who have both a loan and an account at the bank.
c) Find the average account balance at each branch.
d) Find the number of depositors at each branch.

UNIT-III

Q6 a) Why normalization is needed? Explain the process of normalization **[7.5]**

b) Write short note on **(any two)** **[5]**
i) Cursors and Triggers
ii) Closure of functional dependencies
iii) List and explain aggregate functions used in SQL with examples

OR

Q7 a) State 1NF, 2NF & 3NF and explain with examples. **[7.5]**

b) List and explain the inference rules of functional dependencies **[5]**

UNIT-IV

Q8 a) What is 2-phase locking protocol? Compare 2PL with Strict 2PL protocol. **[7.5]**

b) List and explain various issues while transactions are running concurrently in DBMS. **[5]**

OR

Q9 a) Briefly discuss about various lock based mechanisms used in concurrency control. **[7.5]**

b) How to perform rollback, commit, check pointing operations on transactions? Explain **[5]**

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END TERM EXAMINATION

FIRST SEMESTER [MCA] FEBRUARY 2023

Paper Code: MCA-109	Subject: Object Oriented Programming and Java
Time: 3 Hours	Maximum Marks: 75

Note: Attempt five questions in all including Q. No. 1 which is compulsory. Select one question from each unit.

Q1 Answer **all** the following questions briefly:- **(2.5x10=25)**

(a) *Class Test { short a; int l; l=a; }*
Interpret the compiler output of the above code in terms of why it is permitted in Java?

(b) Determine the significance of Magic Number in a .class file. What is the valid magic number for bytecode files in java?

(c) Compare (in tabular format) process based and thread based multitasking.

(d) Identify 4 scenarios when an object becomes eligible for Garbage Collection. How can we suggest the garbage collector for running (function calls)?

(e) Enlist the different jdbc drivers?

(f) Elaborate the different layers of RMI architecture?

(g) List the advantages of swings over AWT?

(h) Describe object serialization and when is it required?

(i) Analyze nested and inner classes in Java?

(j) Contrast TreeSet and TreeMap in Java?

UNIT-I

Q2 (a) Your application displays the number of days in a month which is input by the user as an integer value. Elaborate the Java class for the same through a multiway branch statement? **(6.5)**

(b) What do you understand by runtime polymorphism. How is it achieved in Java? **(6)**

OR

Q3 (a) Create a stack to maintain plates in a birthday party. Ask the organizer how many plates they want initially. Maintain track of each plate used and number of plates added. Finally print the number of total number of plates in the stack, plates used and number of plates left in the stack. **(6.5)**

(b) Illustrate dynamic method dispatch through a suitable solution? **(6)**

UNIT-II

Q4 (a) Design an appropriate solution to change the name and priority of main thread of a program and display the same? **(6.5)**

(b) Differentiate between Socket and ServerSocket? **(6)**

OR

Q5 (a) Model a Person with name and age. Manage instances of Person by ensuring that no two instances are duplicated? **(6.5)**

(b) Create a Calculator class. Raise a Custom Exception code that raises an 'Invalid Numeral' exception each time the user tries to enter any character except a number for calculation. **(6)**

P.T.O.

UNIT-III

Q6 (a) Create a class called fruits that has a method mango() that tells if the mango is sweet or sour. Suppose we need a sour mango in taste for only 1 time. Realize this temporary requirement through an anonymous inner class? **(6.5)**

(b) Illustrate the need of Layout Managers in a Java application? **(6)**

OR

Q7 (a) Create a class AWT Counter that starts a counter from 0 and increments its value on every button click? **(6.5)**

(b) Compare nested and inner classes in Java? **(6)**

UNIT-IV

Q8 (a) Through suitable example elaborate the necessary steps to create a JDBC application? **(6.5)**

(b) Discuss the Stream Hierarchy for Byte Stream IO classes. Illustrate each class with small code snippets to instantiate file pointer and read/write from file. **(6)**

OR

Q9 (a) Elaborate in detail the concept of Remote Method Invocation (RMI). Discuss the significance of marshalling and un-marshalling in the RMI concept. **(6.5)**

(b) Demonstrate functional interfaces through appropriate example?. **(6)**

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