

END TERM EXAMINATION

FIRST SEMESTER (MCA) JANUARY-2024

Paper Code: MCA-101 Subject: Discrete Structures
Time: 3 Hours Maximum Marks :60

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

- Q1 Answer all the following questions briefly:- (2x10=20)
- Show that $(A-B) - C = A - (B \cup C)$
 - Show that if any five integers from 1 to 8 are chosen, then atleast two of them will have a sum 9.
 - Solve by mathematical induction $1(1!) + 2(2!) + 3(3!) + \dots + n(n!) = (n+1)! - 1$
 - In a group of students, there are 7 boys and 8 girls. Out of 15 students, 6 students have to be selected. Find out how many different ways the students can be selected such that at least one boy should be selected?
 - Show that the 4 fourth roots of unity form a group with respect to multiplication
 - Show that $2^{340} \equiv 1 \pmod{11}$ by fermett little theorem
 - Justify by giving example of relation R_1, R_2, R_3 and R_4 on $A = \{4, 5, 6, 7, 8\}$ having property
 - R_1 is reflexive and symmetric but not transitive
 - R_2 is symmetric and antisymmetric
 - Consider the Boolean algebra D30. Determine all the Boolean sub-algebra of D30 having atleast four element.
 - Show that inverse of an element a in the group is unique.
 - Prove that complete planar graph K_4 is planar

UNIT - I

- Q2(a) Among the first 500 positive integers: (5)
- Determine the integers which are not divisible by 2, nor by 3, nor by 5.
 - Determine the integers which are exactly divisible by one of them.
- (b) Assuming repetitions are not allowed, how many 4 digit numbers can be formed from digits 1, 2, 3, 5, 7, 8 (5)
- How many of these are less than 4000?
 - How many in part i) are odd?
 - How many in part i) contain both 2 and 5?
- Q3(a) Let $A = \{1, 2, 3, 4\}$ and $R = \{(2, 1), (2, 3), (3, 2), (4, 3)\}$. Find the (5)
- Reflexive closure of R
 - Symmetric closure of R
 - Transitive closure of R using warshal's algo.
- (b) Find the particular solution of the difference equation $a_{r+2} + a_{r+1} + a_r = r \cdot 2^r$ (5)

UNIT - II

- Q4(a) Prove the following without truth table (5)
- $(p \vee q) \rightarrow \neg r, r \vee t, p \mid \neg t$
 - $p \rightarrow q, \neg q \vee r, \neg(r \wedge \sim s), p \mid \neg s$
 - $(q \rightarrow r) \wedge (s \rightarrow t), (u \rightarrow v) \wedge (w \rightarrow x), q \vee u \mid \neg r \vee v$
- (b) Draw Hasse diagram for D100. Find GLB and LUB for $B = \{10, 20\}$ and $C = \{5, 10, 20, 25\}$. Is D100 is Finite Boolean algebra. Justify. (5)

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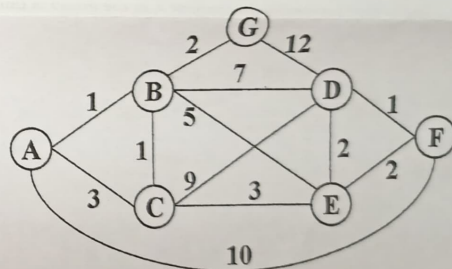
- Q5(a) If L is a distributive lattice, for any $a, b, c \in L$, then show that (5)
- $a \vee b = a \vee c$ and $a \wedge b = a \wedge c \Rightarrow b = c$
 - $(a \wedge b) \vee (b \wedge c) \vee (c \wedge a) = (a \vee b) \wedge (b \vee c) \wedge (c \vee a)$
- (b) Draw K map and simplify the following Boolean expression (5)
- $ABC'D' + AB'CD' + ABC'D + AB'CD$
 - $F(A, B, C, D) = \sum(0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 11)$

UNIT - III

- Q6(a) Prove that the order of each subgroup of a finite group G is a divisor of the order of the group G. (5)
- (b) Determine $\gcd(a, b)$. Find s and t such that $\gcd(a, b) = sa + tb$, where $a=45$ and $b = 126$ (5)
- Q7(a) Prove that the necessary and sufficient condition that a non-empty subset H of a Group G be a subgroup is $a \in H, b \in H \Rightarrow ab^{-1} \in H$ (5)
- (b) Consider two distinct prime numbers $p = 17$ and $q = 19$. Apply the RSA algorithm to find the public key and private key. (5)

UNIT - IV

- Q8 (a) An undirected tree has a 1 vertex with degree 1, 2 vertices with degree 2 each, 3 vertices with degree 3 each, and n vertices with degree n each. Prove that no such tree exists. (5)
- (b) Use Dijkstra's algorithm to find the shortest path between a and f in the given graph. (5)



- Q9 (a) State and Prove 5 color theorem. (5)
- (b) Give an example of a graph which contains (5)
- an Eulerian circuit that is also a Hamiltonian circuit.
 - an Eulerian circuit and a Hamiltonian circuit that are distinct.
 - an Eulerian circuit, but not a Hamiltonian circuit
 - a Hamiltonian circuit, but not an Eulerian circuit
 - Neither an Eulerian circuit, nor a Hamiltonian circuit

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FIRST SEMESTER (MCA) JANUARY 2024

Paper Code: MCA-103

Subject: Computer Networks

Time: 3 Hours

Maximum Marks: 60

Note: Attempt five questions in all including Q.No.1 which is compulsory.

Select one question from each unit.

[3x4=12]

- Q1 Attempt questions (**any four**): -
- a) What do you understand with digital signal encoding (digital to digital encoding) techniques? Why these techniques are needed? convert the following bit stream into a digital signal using Manchester encoding technique.
101000010
 - b) Compare wired and wireless transmission mediums in terms of speed, security and scale. Explain the hidden station and exposed station problems with proper diagrams.
 - c) Differentiate between CSMA and CSMA/CD.
 - d) What is CIDR? How does it solve the problem of shortage of IPv4 addresses?
 - e) Explain the technique of Checksum calculation with proper example.

UNIT-I

- Q2
- a) What is analog to digital encoding? What is its use in data communication? Explain the PCM technique in detail. (7)
 - b) What is MODEM? How does it make the communication possible between two remote machines? (5)
- Q3 Explain the layered architecture? Why Network models have been designed using layered architecture? Explain layers of TCP/IP model in detail. (12)

UNIT-II

- Q4
- a) Differentiate between error detection and retransmission technique and error detection and correction techniques. Explain the scenarios in which these techniques are preferred. Encode following data word using Hamming code with even parity. (7)
 - b) 1001001000011101
Explain Stop and Wait ARQ with an example and required diagrams. (5)
- Q5
- a) Explain Ethernet frame format in detail. What is the need of padding in it? (7)
 - b) Explain DCF Medium Access Control (MAC) method of wireless LAN networks in detail. (5)

UNIT-III

- Q6
- a) Explain the IPv4 address classes with their features. How address distribution was done in classful addressing method? Explain. (5)
 - b) What is link state routing algorithm? Explain the method of routing table population in Link State routing. (7)

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- Q7
- a) Explain IPv6 address auto configuration process. What happens, when the autoconfiguration process gets fail. (5)
 - b) Explain the Multicast routing protocols based on source-based tree and group shared tree methods. (7)

UNIT-IV

- Q8
- a) Explain TCP protocol header in detail. (7)
 - b) Mention the applications where UDP protocol is used with proper reason. (5)
- Q9
- a) Explain the process of mail transfer including all the necessary components of the process. Include proper diagrams if needed. (6)
 - b) Explain Private and public key cryptography with their Pros and Cons. For large amount of data transfer which one would be preferred? (6)

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(Please write your Exam Roll No.)

Exam Roll No. 0721460423

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FIRST SEMESTER (MCA) DECEMBER-2023 - JANUARY 2024

Paper Code: MCA-105

Subject: Operating System with Linux

Maximum Marks: 60

Time: 3 Hours

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

Q1. Answer the following briefly:

(2x10 = 20)

- (a) Compare monolithic kernel and microkernel. Which type of kernel is used in Microsoft Windows 10?
- ✓(b) Differentiate between internal and external command in Linux.
- (c) Illustrate the bootstrap process of an operating system.
- (d) Differentiate between busy waiting and blocked waiting in an operating system.
- ✓(e) Write the Peterson's algorithm (pseudo code) to solve critical-section problem.
- ✓(f) Compare internal fragmentation with external fragmentation of memory.
- ✓(g) Explain the necessary and sufficient conditions for a deadlock situation in the computer system.
- ✓(h) Differentiate between physical and logical formatting of a disk.
- (i) Explain blocking and non-blocking I/O.
- (j) Describe the concept of data mirroring in RAID.

UNIT - I

- Q2. (a) What is distributed operating system? Compare client-server computing and peer-to-peer computing. (5)
- (b) Explain the multi-programmed batch systems and time-sharing systems with their advantages and disadvantages. (5)

OR

- Q3. (a) Why inter-process communication is important? Compare shared memory and message passing models of inter-process communication. (5)
- (b) What is interrupt? Explain various services offered by an operating system. (5)

UNIT - II

- Q4. (a) Describe the functions of a dispatcher. Illustrate multilevel queue scheduling approach. (5)
- ✓(b) Explain the readers-writers problem. Write algorithm (code snippet) to solve the readers-writers problem using Semaphore. (5)

OR

- Q5. (a) What are the conditions to be fulfilled by a solution of critical-section problem? (5)
Explain the TestAndSet() and Swap() approaches to solve the critical section problem.

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- ✓(b) What is the use of medium-term scheduler? Three processes P1, P2 and P3 arrive at time zero. Their total execution time is 10ms, 15ms, and 20ms, respectively. They spent first 20% of their execution time in doing I/O, next 60% in CPU processing and the last 20% again doing I/O. Using round robin algorithm, determine the utilization of CPU in percentage. (5)

UNIT - III

- Q6. (a) Differentiate between deadlock and starvation. By considering an appropriate example, describe the process initiation denial approach of deadlock avoidance. (5)
- (b) Explain demand paging with its advantages and disadvantages. Illustrate the page fault handling process with a suitable diagram. (5)

OR

- Q7. (a) Describe resource allocation graph approach for deadlock detection. With a suitable example, justify that a cycle in the graph is a necessary but not a sufficient condition for the existence of deadlock. (5)
- ✓(b) Explain the Belady's anomaly in page-replacement algorithms? Consider the page reference string: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2 with 4 page frames, determine the number of page faults using LRU and FIFO page replacement algorithm. (5)

UNIT - IV

- Q8. ✓(a) Differentiate between the Scan and C-Scan disk-scheduling algorithms. A disk queue requests for I/O to blocks on cylinders 98, 183, 37, 122, 14, 124, 65, and 67, determine the total head movement (in cylinders) if the disk head is initially at cylinder 53 and the disk arm is moving toward 0. (5)
- ✓(b) Explain the linked-allocation and indexed-allocation methods of allocating disk space, with their advantages and disadvantages. (5)

OR

- Q9. (a) Explain the use (with syntax in 'C' programming) of following file management system calls of Linux: (a) access, (b) chmod, (c) umask, (d) open, and (e) creat. (5)
- (b) Explain various approaches of free disk-space management in operating systems. (5)

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FIRST SEMESTER [MCA] JANUARY 2024

Paper Code: MCA-107

Subject: Database Management Systems

Time: 3 Hours

Maximum Marks: 60

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

(2x10=20)

- Q1 Answer all the following questions briefly:-
- (a) State the difference between DBMS and RDBMS.
 - (b) What are trivial and non-trivial functional dependencies.
 - (c) What do you mean by minimal cover of a FD set?
 - (d) What are primary keys and foreign keys in a database table.
 - (e) Write a short note on two-phase locking protocol.
 - (f) In concurrency control, how deadlock is handled.
 - (g) Discuss ACID properties.
 - (h) State the difference between 3 NF and BCNF.
 - (i) Does a relation with two or more columns always have an MVD? Show with an example.
 - (j) Distinguish outer and inner joins.

UNIT-I

- Q2 (a) Discuss the concept of generalization and specialization with examples. (5)
 (b) State the differences between instances and schemas. (5)
- Q3 (a) Draw and elaborate the architecture of DBMS while providing suitable example. (5)
 (b) Differentiate between Network & Relational Data Base Management Systems. (5)

UNIT-II

- Q4 (a) Discuss tuple relational calculus and domain relational calculus. (5)
 (b) Differentiate between DML, DDL, DCL, and TCL. (5)
- Q5 (a) Write Syntax and examples of following SQL commands: (5)
 (i) Alter table with different clauses
 (ii) Like operator
 (iii) Check constraint
 Also discuss the difference between HAVING and WHERE clause.
 (b) With a single example, discuss Unions, intersection and minus operators. (5)

UNIT-III

- Q6 (a) Consider a relation $R = \{A, B, C, D, E, F, G, H\}$ with the following FDs = $\{A \rightarrow BCD, AE \rightarrow F, E \rightarrow G, D \rightarrow H\}$. Decompose the relation till 3NF. (5)
 (b) Discuss the structure of PL/SQL Block. What is the use of cursors and triggers. (5)
- Q7 (a) List the roles of different types of keys in DBMS. And, find candidate keys and Primary Key for $R = \{A, B, C, D, E\}$ and $F = \{CD \rightarrow E, DE \rightarrow B, AB \rightarrow C\}$ (5)
 (b) Given a relation $R (P, Q, R, S, T)$ and Functional Dependency set $FD = \{QR \rightarrow PST, S \rightarrow Q\}$, determine given R is in which normal form? (5)

UNIT-IV

- Q8 (a) Differentiate between Conflict and View serializability. (5)
 (b) Explain lossy and lossless decomposition. (5)
- Q9 (a) Explain dependency preserving decomposition in detail. Elaborate differences between RDBMS and OODBMS. (5)
 (b) Discuss the concept of database security. How database administrator ensures the security of the database. (5)

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FIRST SEMESTER [MCA] JANUARY 2024

Paper Code: MCA-109

Subject: Object Oriented Programming and Java

Time: 3 Hours

Maximum Marks: 60

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. (2×10=20)
- (a) Draw difference between object based and object-oriented programming with example
 - (b) Draw difference between JDK and JRE
 - (c) Explain abstraction and encapsulation with suitable code example
 - (d) Explain auto boxing and unboxing with suitable code example
 - (e) Draw difference between throw and throws
 - (f) Describe the use of Thread class and Runnable interface
 - (g) Describe the use and importance of "static" keyword in java.
 - (h) Explain the working of Layout Manager in Event Handling.
 - (i) Describe the use and importance of "final" keyword in java.
 - (j) Describe the marshalling and un-marshalling in RMI

UNIT - I

- Q2
- (a) Elaborate with proper diagram the JVM architecture. Explain the garbage collection model as well. (5)
 - (b) Elaborate what are Interfaces? Write a program in java to explain the concept of multiple inheritances by using interfaces (5)
- Q3
- (a) Write object-oriented code in java to implement ATM machine operations. (5)
 - (c) Discuss the need class nesting? Draw the Inner Classes Hierarchy. Give short code snippets to illustrate. (5)
 - (i) Static Inner Class
 - (ii) Method Local Inner Class

UNIT - II

- Q4
- (a) Justify the use of Exception Handling Framework in Java Programming. Elaborate the different exception handling constructs available (5)
 - (b) Differentiate between process and threads. What are the different stages in a thread life cycle that a thread goes through? (5)
- Q5
- (a) What you mean by collection framework? Elaborate in detail - How collection framework play an important role to implement data structure in java. Draw a complete hierarchy of collection framework (5)
 - (b) Determine the use of Datagram Packet. Draw the client/server socket interaction flow in UDP and explain the socket working in detail (5)

UNIT - III

- Q6
- What is event handling? How Layout Manager play an important role in GUI application in java and elaborate in detail the concept of event - listener model in java with a suitable code example. (10)
- Q7
- Elaborate in detail the concept of Anonymous classes and inner class and its types with code examples (10)

- Q8
- (a) What is JDBC? Elaborate JDBC Architecture in detail. Discuss the significance java.sql package in java database connectivity. (5)
 - (b) What is file handling, how streams are useful for file handling in java. Elaborate the difference between byte stream and character stream with suitable code example. (5)
- Q9
- (a) What is RMI? Elaborate RMI Architecture in detail. Discuss the significance of "stub" and "skeleton" in Remote Method Invocation (5)
 - (b) Explain the following (Any two) (5)
 - (i) default function
 - (ii) lambda expression
 - (iii) try with resources.

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