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Periyanaickenpalayam, Coimbatore – 641020

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

II YEAR

ODD SEMESTER

ACADEMIC YEAR 2024 – 2025

INDEX

HEAD OF THE DEPARTMENT

ACOE **PRINCIPAL** **CHAIRMAN**

CS3301

DATA STRUCTURES

UNIT I

LISTS

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation– Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – PolynomialADT – Radix Sort – Multilists.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is an Abstract Data Type (ADT)?	1	1	2
2.	What is the difference between Array-based and Linked List-based implementations of List ADT?	1	1	2
3.	Define the time complexity of accessing an element in an array-based list.	1	1	2
4.	How is resizing handled in an array-based implementation of List ADT?	1	2	2
5.	Compare singly linked lists and doubly linked lists.	1	2	2
6.	Define tail pointer in a circularly linked list.	1	2	2
7.	List any two real-life applications of linked lists.	1	1	2
8.	What is Radix Sort?	1	1	2
	PART B			
1.	Analyze the differences between Abstract Data Types (ADTs) and Data Structures. Explain how ADTs provide abstraction while dealing with data organization.	1	4	16
2.	Analyze the differences between singly linked lists, circular linked lists, and doubly linked lists in terms of structure, operations, and real-world applications.	1	4	16
3.	Analyze the working of Radix Sort with an example. Compare and contrast its time complexity and efficiency with other sorting algorithms like Merge Sort and Quick Sort.	1	4	16
4.	Analyze the structure and features of multilists. Discuss their advantages over simple linked lists and provide a comparison based on real-world applications.	1	4	16

UNIT II

STACKS AND QUEUES

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue– Applications of Queues.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is a Stack ADT?	2	1	2
2.	Differentiate between static and dynamic stack implementations.	2	2	2
3.	Define the `push` and `pop` operations in a stack.	2	1	2
4.	List any two applications of stack data structure.	2	1	2
5.	What is meant by balancing symbols?	2	1	2
6.	What is the difference between infix and postfix expressions?	2	1	2
7.	Define recursion in the context of function calls.	2	1	2
8.	Explain the difference between stack and queue data structures.	2	2	2
	PART B			
1.	Analyze the operations supported by Stack ADT. Discuss the time complexity and explain how the stack follows the Last-In-First-Out (LIFO) principle with examples.	2	4	16
2.	Analyze the operations supported by Queue ADT. Compare the performance of queue operations like enqueue and dequeue with those of a stack, highlighting the FIFO principle.	2	4	16
3.	Analyze how stacks are used to manage function calls and recursion in programming languages. Explain how the call stack operates and handles local variables, function return values, and recursion depth.	2	4	16
4.	Analyze the applications of queues in CPU scheduling, disk scheduling, and network traffic management. Explain how the queue data structure enhances the efficiency of these processes.	2	4	16

UNIT III

TREES

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define the terms "root," "parent," and "child" in a tree.	3	1	2
2.	What are the different types of tree traversal techniques?	3	2	2
3.	Define preorder, inorder, and postorder traversal.	3	2	2
4.	What is a binary tree?	3	1	2
5.	How many children can a node in a binary tree have?	3	2	2
6.	How does an expression tree help in representing infix, postfix, and prefix expressions?	3	2	2
7.	What is the time complexity of searching in a balanced BST?	3	1	2
8.	How is an AVL tree different from a regular binary search tree?	3	2	2
	PART B			
1.	Explain the Tree Abstract Data Type (ADT) with its properties. Discuss the different types of tree traversals (Inorder, Preorder, and Postorder) with examples.	3	4	16
2.	Define Expression Trees and explain how they are constructed. How are infix, prefix, and postfix expressions evaluated using expression trees?	3	4	16
3.	Explain the Binary Search Tree (BST) ADT. Write algorithms for Insertion, Deletion, and Searching in BSTs and illustrate them with examples.	3	4	16
4.	Write and explain algorithms for Insertion and Deletion in a binary heap. Evaluate their time complexity.	3	5	16

UNIT IV

MULTIWAY SEARCH TREES AND GRAPHS

B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of Graph - Breadth-first traversal – Depth-first traversal — Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is a B-Tree? State its properties.	4	1	2
2.	Define a graph and list its basic components.	4	1	2
3.	What is the difference between weighted and unweighted graphs?	4	2	2
4.	What is Breadth-First Traversal (BFS)? State one of its applications.	4	1	2
5.	What is a bi-connected graph?	4	1	2
6.	State Euler's theorem for Euler circuits in a graph.	4	1	2
7.	Define topological sort. What kind of graphs support topological sorting?	4	1	2
8.	State the main difference between Prim's algorithm and Kruskal's algorithm.	4	2	2
	PART B			
1.	Compare and contrast B-Tree and B+ Tree in terms of their structure, performance, and applications. Analyze the advantages of B+ Tree over B-Tree.	4	5	16
2.	Explain the basic concepts of graphs with definitions of key terms like vertices, edges, degree, and connected components. Illustrate how graphs can be represented using Adjacency List and Adjacency Matrix.	4	4	16
3.	Explain Breadth-First Traversal (BFS) and Depth-First Traversal (DFS) algorithms with step-by-step examples. Analyze their time and space complexity.	4	4	16
4.	Compare Prim's algorithm and Kruskal's algorithm for finding the Minimum Spanning Tree. Analyze their performance based on different graph structures.	4	5	16

UNIT V

SEARCHING, SORTING AND HASHING TECHNIQUES

Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort –. Merge Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing –Rehashing – Extendible Hashing.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is searching in data structures?	5	1	2
2.	Compare linear search and binary search based on time complexity and efficiency.	5	2	2
3.	What is sorting, and why is it important in data structures?	5	1	2
4.	What is hashing in data structures?	5	1	2
5.	What is a hash collision?	5	1	2
6.	What is the difference between Insertion Sort and Bubble Sort in terms of efficiency?	5	2	2
7.	Define linear search. What is its time complexity in the best and worst cases?	5	1	2
8.	What is Shell Sort? How does it improve the efficiency of insertion sort?	5	2	2
	PART B			
1.	Explain the working of Linear Search and Binary Search with their respective algorithms. Analyze the time and space complexities of both techniques in the best, worst, and average cases.	5	4	16
2.	Explain the concept of Hashing and Hash Functions. Discuss the properties of a good hash function and analyze how hashing improves the efficiency of data retrieval.	5	4	16
3.	Explain the working of Bubble Sort, Selection Sort, and Insertion Sort with step-by-step examples. Analyze their time complexity in best, worst, and average cases.	5	4	16
4.	Compare and evaluate Separate Chaining and Open Addressing based on their efficiency, performance, memory usage, and suitability for different hash table scenarios.	5	5	16

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CS3351 - DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION

UNIT I

COMBINATIONAL LOGIC

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Ad Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers multiplexers.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	List the four possible elementary operations simple binary addition consists of.	1	1	2
2.	Simplify the following Boolean function and draw the logic diagram. F = x'y' + xy + x'y	1	3	2
3.	Construct a full adder by using two half adders and OR gate.	1	3	2
4.	Compare the function of decoder and encoder and Convert a two-to-four-line decoder with enable input to 1:4 demultiplexer	1	2	2
5.	Draw 1:8 demultiplexer using two 1:8 demultiplexer.	1	3	2
6.	How would you design the logic diagram of a 2-bit multiplier?What is magnitude comparator?	1	2	2
7.	The output Y of a 2-bit comparator is logic 1 whenever the 2-bit input A is greater than the 2-bit input B. What is the number of combinations for which the output is logic 1?	1	3	2
8.	Evaluate the logic circuit of a 2-bit comparator.	1	3	2
	PART B			
1.	Consider, F1 = xyz′ + wx′y′ + (x′ + z + w) (x′ + z + w′) + xyz + wx′y , F2 = xy + wx′ + x′ + z i) Without using K-Map, show F1 can be simplified to F2 by algebraic means. (8) ii) Implement F2 using NAND gates only. Assume all variables are available in both true and complement form. (8)	1	5	16
2.	Design a combinational circuit with three inputs, x, y and z and three outputs, A, B and C. When the binary input is 0, 1, 2 or 3 the binary output is one greater than the input. When the binary input is 4, 5, 6 or 7, the binary output is one less than the input.	1	5	16
3.	Design a 4 bit adder / subtractor circuit and explain.	1	5	16
4.	Design 4-bit magnitude comparator with three outputs: A>B, A<B and A=B.	1	5	16

UNIT II

SEQUENTIAL LOGIC

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF,Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, stateminimization, state assignment, circuit implementation - Registers – Counters.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Outline the difference between a synchronous sequential circuit and an asynchronous sequential circuit.	2	1	2
2.	How does ripple counter differ from synchronous counter?	2	2	2
3.	How do you eliminate the race around condition in a JK flip-flop?	2	1	2
4.	State the difference between latches and flip-flops.	2	1	2
5.	Define a latch and a FF.	2	1	2
6.	Mention the different types of shift registers.	2	1	2
7.	Define the terms: state table and state assignment.	2	1	2
8.	Differentiate Mealy and Moore state machines.	2	2	2
	PART B			
1.	Design and implementation of SR FF using NOR gate.	2	5	16
2.	Explain in detail about 4 bit Johnson counter.	2	5	16
3.	A sequential circuit with two D FFs A and B, two inputs X and Y, and one output Z is specified by the following input equations: $A(t+1) = x'y + xA$ $B(t+1) = x'B + xA$ $Z = B$	2	5	16
4.	Explain the operation of 4 bit bidirectional shift register.	2	5	16

UNIT III

COMPUTER FUNDAMENTALS

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands ofComputer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Addressand Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding ofMachine Instruction – Interaction between Assembly and High Level Language.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is Von Neumann bottleneck?	3	1	2
2.	Classify the instructions based on the operations they perform and give one example of each category.	3	2	2
3.	Why are the most frequently used variables stored in registers?	3	2	2
4.	List the decision making instructions supported by MIPS assembly language.	3	1	2
5.	What is instruction set architecture?	3	2	2
6.	What do you mean by little endian?	3	2	2
7.	List the types of addressing modes.	3	1	2
8.	What are the various types of operations required for instructions?	3	2	2
	PART B			
1.	Explain the fundamental units of a stored program digital computer, along with a block diagram.	3	4	16
2.	Explain IAS architecture with the help of neat diagram and list the instructions supported by IAS computer.	3	4	16
3.	Discuss about instruction cycle	3	4	16
4.	Define addressing mode. Classify addressing modes and explain in each type with examples.	3	5	16

UNIT IV

PROCESSOR

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control,Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	List the operations involved in instruction cycle.	4	1	2
2.	Draw the data path segment for arithmetic-logic instructions.	4	1	2
3.	What is the ideal speed-up expected in a pipelined architecture with ‘n’ stages? Justify your answer.	4	2	2
4.	What do you mean by pipelining? List its types.	4	1	2
5.	Differentiate between the static and dynamic techniques.	4	2	2
6.	What is branch hazard?	4	1	2
7.	What is meant by speculative execution?	4	1	2
8.	Differentiate data hazards and control hazards.	4	2	2
	PART B			
1.	Outline the difference between hardwired control and micro programmed control	4	4	16
2.	What is hazard? Give hazard free realization for the following Boolean functions F(A, B, C, D) = ∑m (1, 5, 6, 7) using AND-OR gate network.	4	5	16
3.	Why is branch prediction algorithm needed? Differentiate between the static and dynamic techniques.	4	4	16
4.	What are pipeline hazards? Outline the types of pipeline hazards.	4	4	16

UNIT V

MEMORY AND I/O

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is a direct-mapped cache?	5	1	2
2.	What is hit time?	5	1	2
3.	Which signal is used to notify the processor that the transfer is completed? Define.	5	1	2
4.	Mention the modes of DMA transfer.	5	1	2
5.	Outline of interrupt driven I/O.	5	2	2
6.	What is memory mapped I/O?	5	2	2
7.	Define supervisor / kernel / executive state.	5	1	2
8.	State the advantages of virtual memory?	5	2	2
	PART B			
1.	Present an outline of virtual address, physical address, address translation, segmentation, page table, swap space and page fault.	5	4	16
2.	Elucidate interconnection standards.	5	4	16
3.	Outline a direct memory access with a diagram.	5	4	16
4.	Describe the various mechanisms for accessing I/O devices.	5	4	16

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MA3354

DISCRETE MATHEMATICS

UNIT I

LOGIC AND PROOFS

Propositionallogic–Propositionalequivalences-Predicatesandquantifiers–Nestedquantifiers–Rules ofinference - Introduction toproofs–Proofmethods and strategy.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Show that ¬ (P→Q) and P∧¬Q are equivalent.	1	2	2
2.	Construct the truth table for the compound proposition (p →q)→(q→p).	1	1	2
3.	What are the negations of the statements $\forall x(x^2 > x)$ *and* $\exists x(x^2 = 2)$?	1	1	2
4.	Express the following statement using predicators and quantifiers, "All men are mortal".	1	1	2
5.	Verify P∨Q→P is a Tautology.	1	2	2
6.	Construct truth table for$(p \wedge \neg q) \rightarrow q$.	1	2	2
7.	Using truth table, show that $p \vee \neg(p \wedge q)$ is a tautology.	1	1	2
8.	Define PCNF and PDNF .	1	1	2
	PART B			
1.	Show that $P \rightarrow (Q \rightarrow R)$and $(P \wedge Q) \rightarrow R$are logically equivalent using truth table.	1	2	8
2.	Using indirect method of proof, derive $P \rightarrow \neg S$ from $P \rightarrow (Q \vee R)$, $Q \rightarrow \neg P$, $S \rightarrow \neg R$, P.	1	3	8
3.	Show that $\forall x(P(x) \rightarrow Q(x)), \forall x(R(x) \rightarrow \neg Q(x)) \Rightarrow \forall x(R(x) \rightarrow \neg P(x))$.	1	2	8
4.	Show that $\big(\neg P \wedge (\neg Q \wedge R)\big) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$.	1	2	8
5.	Without constructing the truth table find the PDNF and PCNF of P→(Q∧R)∧(¬P→(¬Q∧¬R))	1	3	8
6.	Show that $p \vee (q \wedge r)$ *and* $(p \vee q) \wedge (p \vee r)$ are logically equivalent.	1	2	8
7.	Find the PDNF of the statement, $(q \vee (p \wedge r)) \wedge \neg((p \vee r) \wedge q)$.	1	3	8

UNIT II

COMBINATORICS

Mathematicalinduction–Stronginductionandwellordering– Thebasicsofcounting– The pigeonholeprinciple– Permutationsand combinations–Recurrencerelations–Solvinglinear recurrencerelations– Generatingfunctions–Inclusionand exclusionprinciple and its applications.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Find the first four terms of the sequence defined by the recurrence relation and initial condition $a_n = a_{n-1}^2$, $a_1 = 2$.	2	1	2
2.	State the Pigeonhole principle.	2	2	2
3.	Find the recurrence relation satisfying the equation $y_n = A(3)^n + B(-4)^n$	2	1	2
4.	In how many ways can the letters of the word MISSISSIPPI be arranged?	2	1	2
5.	If 9 colours are used to paint 100 houses, show that at least 12 houses will be of the same colour.	2	1	2
6.	Solve the recurrence relation $y(k) - 8y(k-1) + 16y(k-2) = 0$ for $k \geq 2$,where y(2) = 16 and y(3) = 80 .	2	1	2
7.	If $nc_5 = 20nc_4$, find 'n'.	2	1	2
8.	In how many ways can 5 persons be selected from amongst 10 persons ?	2	2	2
	PART B			
1.	Using mathematical induction to show that $1^2 + 2^2 + 3^2 + \cdots \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$whenever *n* is a positive integer.	2	3	8
2.	Use mathematical induction to show that $1+2+3+....+n = \frac{n(n+1)}{2}$.	2	3	8
3.	Solve the recurrence relation $a_n = 8a_{n-1} - 16a_{n-2}$ for $n \geq 2$, $a_0 = 16$, $a_1 = 80$.	2	2	8
4.	Solve the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}, n \geq 2, a_0 = 2$, $a_1 = 3$.	2	2	8
5.	In a survey of 100 students, it was found that 40 studied Mathematics, 64 studied Physics,5 studied Chemistry, 1 studied all the three subjects, 25 studied Mathematics	2	4	8

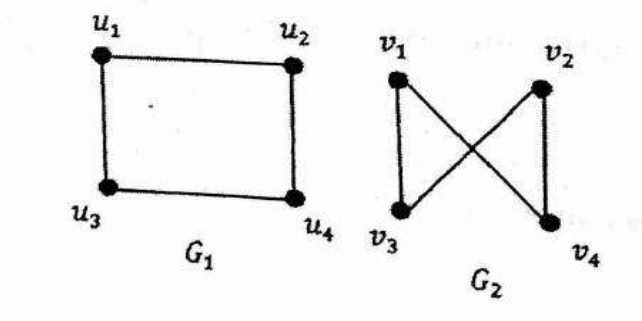
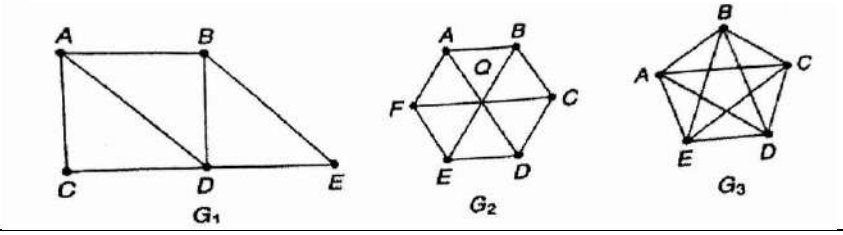
	and Physics, 3 studied Mathematics and Chemistry, 20 studied Physics and Chemistry. Use the principle of inclusion and exclusion, find the number of students who studied Chemistry only and the number who studied none of these subjects?			
6.	From a club consisting of 6 men and 7 women, in how many ways can we select a committee of i) 3 men and 4 women ii) 4 persons which has at least one woman iii) 4 persons that has at most one man.	2	4	8

UNIT III

GRAPHS

Graphsandgraphmodels –Graphterminology andspecialtypesofgraphs– Matrixrepresentation ofgraphs andgraphisomorphism– Connectivity–Eulerand Hamiltonpaths.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define a complete graph with example.	3	1	2
2.	What is meant by simple graph? Give an example.	3	1	2
3.	Define a regular graph with example.	3	2	2
4.	State the handshaking theorem.	3	1	2
5.	Draw the graph represented by the given adjacency matrix $\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$.	3	2	2
6.	Define Pseudo graph.	3	1	2
7.	Give an example of a graph which is Eulerian but not Hamiltonian.	3	1	2
8.	Draw the graph with 5 vertices A,B,C,D,E such that deg(A) = 3 , B is an odd vertex , deg(C) = 2 and D and E are adjacent.	3	2	2

PART B				
1.	In any graph G, prove that the total number of odd-degree vertices is even.	3	2	8
2.	Prove that maximum number of edges in a simple disconnected graph G with 'n' vertices and 'k' Components is $\frac{(n-k)(n-k+1)}{2}$.	3	2	16
3.	Determine whether the following graphs G1 and G2 are isomorphic.  	3	4	8
4.	Find an Euler path or an Euler circuit, if it exists in each of the three graphs below. If it does not exist, explain why?  	3	4	8
5.	Draw thegraph with the adjacency matrix $\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$ with respect to the ordering of A, B, C, D.	3	4	8

UNIT IV

ALGEBRAIC STRUCTURES

Algebraicsystems–Semigroupsandmonoids-Groups–Subgroups–Homomorphism's–Normal subgroup andcosets–Lagrange's theorem– Definitionsand examples of RingsandFields.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define a Ring.	4	1	2
2.	Define monoid.	4	1	2
3.	Prove that if G is abelian group then for all $a,b \in G$ $(a*b)^2 = a^2 * b^2$.	4	2	2
4.	Define a field.	4	1	2
5.	Prove that identity element is unique in a group.	4	1	2
6.	State any two properties of a group.	4	1	2
7.	Define semi groups and monoids.	4	1	2
8.	Define a commutative ring.	4	2	2
	PART B			
1.	State and prove Lagrange's theorem.	4	2	8
2.	Show that the intersection of two normal subgroup of a group (G,*) is a normal subgroup of (G,*).	4	2	8
3.	Let (G, *) be a group, then prove that (i) For each $a \in G, (a^{-1})^{-1} = a$ (ii) For all, $a, b \in G, (a*b)^{-1} = b^{-1} * a^{-1}$ for all $a, b \in G$.	4	4	8
4.	Show that Kernal of a group homomorphism is a normal subgroup of the group.	4	2	16
5.	Show that the set Z_4 = { 0,1,2,3 } is a commutative ring with respect to the binary operations additive modulo ($+_4$) and multiplicative modulo (X_4).	4	4	16

6.	Show that the set of integers Z with the binary operations $\oplus$ and Θ defined by a$\oplus$b = a+b-1 and a Θ b = a+b-ab for $a, b \in Z$ is a commutative ring with identity.	4	4	16
7.	Show that the set of all non-zero real numbers is an abelian group under the operation * defined by $a * b = \frac{ab}{2}$.	4	4	8

UNIT V

LATTICESAND BOOLEANALGEBRA

Partialordering–Posets–Latticesasposets–Propertiesoflattices-Latticesasalgebraicsystems–Sublattices–Directproductandhomomorphism–Somespeciallattices–Booleanalgebra–Sub Boolean Algebra–BooleanHomomorphism

.No	Question	CO	BTL	Marks
	PART A			
1.	State DeMorgan's law in Boolean Algebra.	5	1	2
2.	Draw a Hasse diagram of $D_{20} = \{1,2,4,5,10,20\}$.	5	1	2
3.	Prove that $(a')' = a$ for all $a \in B$ where B is a Boolean Algebra.	5	1	2
4.	Draw a Hasse diagram of $D_{12} = \{1,2,3,4,6,12\}$.	5	2	2
5.	State the distributive inequalities in Lattice.	5	1	2
6.	Define Boolean algebra.	5	2	2
7.	Define a lattice. Give suitable example.	5	1	2
8.	Define Sub lattices.	5	2	2
	PART B			
1.	State and Prove De Morgan's law in Boolean Algebra.	5	4	8
2.	In a Boolean Algebra, prove that the following statements are equivalent. (i) $a + b = b$ (ii) $a.b = a$ (iii) $a' + b = 1$ (iv) $a.b' = 0$.	5	3	8
3.	In a Boolean Algebra show that $ab' + a'b = 0$ if and only if $a = b$.	5	3	8

4.	Prove that every chain is a distributive lattice.	5	4	8
5.	Let $(L, \leq)$ be a lattice. For any $a, b, c \in L$ the following properties called isotonicity hold. If $b \leq c$ then (i) $a * b \leq a * c$ (ii) $a \oplus b \leq a \oplus c$.	5	3	8
6.	Let $(L, \leq)$ be a lattice. For any $a, b, c \in L$ the following inequalities hold. (i) $a \oplus (b * c) \leq (a \oplus b) * (a \oplus c)$ (ii) $a * (b \oplus c) \geq (a * b) \oplus (a * c)$	5	4	8

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CS3391 - OBJECT ORIENTED PROGRAMMING

UNIT I

Introduction To OOP And Java

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors Methods -Access specifiers – Static members- Java Doc comments

Q.No	Question	CO	BTL	Marks
	PART A			
1.	List the core OOP's concepts	1	1	2
2.	List the various access specifiers supported by OOPS	1	1	2
3.	Write down the characteristics of object	1	1	2
4.	Compare class and object.	1	2	2
5.	Define static variable and static method.	1	1	2
6.	List out the types of array.	1	1	2
7.	Describe about Encapsulation,Inheritance,and Polymorphism.	1	2	2
8.	Illustrate constructors in java.	1	1	2
	PART B			
1.	Explain with example passing objects as parameters to methods and returning objects from methods in Java..	1	4	16
2.	i. Explain OOPS and its features. ii.Summarize about the usage of constructor with an example using Java.	1	4	8 8
3.	i.Summarize about access specifier in Java. ii.Describe the term static fields and methods and explain its types with example.	1	2	16
4.	Interpret with an example what is method overloading and method overriding	1	2	16

UNIT II

INHERITANCE, PACKAGES AND INTERFACES

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Examine the importance of inheritance	2	1	2
2.	Identify what are the two ways of using super keyword	2	1	2
3.	Define interface and write the syntax of the interface	2	1	2
4.	What modifiers may be used with top-level class?	2	1	2
5.	Illustrate what is protected visibility	2	2	2
6.	What is a default constructor? Illustrate.	2	2	2
7.	Define Package	2	1	2
8.	Summarize any two string handling methods in Java	2	2	2
	PART B			
1.	Explain in detail about Package with an Example Program	2	4	16
2.	.i. Explain with an example what is meant by object cloning? ii. Summarize in detail about inner class with its usefulness	2	4	8 8
3.	i.Describe in detail about inheritance. ii.Write a program for inheriting a class	2	2	8 8
4.	Illustrate with an example how passing objects as parameters to methods and returning objects from methods in Java	2	2	16

UNIT III

EXCEPTION HANDLING AND MULTITHREADING

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is re-throwing an expression?	3	1	2
2.	List the any five byte stream class	3	1	2
3.	What are streams? What are their advantages?	3	1	2
4.	What are three types of I/O streams	3	2	2
5.	Define: Thread	3	1	2
6.	What are the two methods available in stack trace elements?	3	1	2
7.	Explain how to create custom exception.	3	2	2
8.	Differentiate exception and error.	3	1	2
	PART B			
1.	Explain the following in detail with example program i.Checked Exception ii.Unchecked exception	3	4	16
2.	Explain the following with example i. Reading console input ii. Writing console output.	3	4	8 8
3.	Discuss in detail about exception handling constructs and write a program to illustrate Divide by zero exception .	3	2	16
4.	Explain in detail about Thread and its types.	3	2	16

UNIT IV

I/O, GENERICS, STRING HANDLING

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Why is synchronization required in thread?	4	1	2
2.	What is the need for thread?	4	1	2
3.	Define multithreading	4	1	2
4.	Give the properties of thread.	4	2	2
5.	Write down the need for generic programming	4	1	2
6.	List the importance of thread constructor	4	1	2
7.	Give the methods used for inter thread communication.	4	2	2
8.	summarize the advantages of generic programming	4	1	2
	PART B			
1.	Assess an example program in Java on how to implement bounded types (extend superclass) with generics	4	3	16
2.	Explain in detail about multithread programming with example.	4	4	16
3.	I.Differentiate multithreading and multitasking ii.Describe the properties of thread in detail.	4	3	8 8
4.	Illustrate a program to perform string operations using ArrayList. Write functions for the following Append - add at end Insert – add at particular index Search List all string starts with given letter “a”.	4	2	16

UNIT V

JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	List the features of Swing	5	1	2
2.	List out some system colors available in Java and their purpose	5	1	2
3.	Name any four event of a button component.	5	1	2
4.	Differentiate between a Choice and a List.	5	2	2
5.	List the difference between scrollbar and scroll pane.	5	1	2
6.	Give the steps needed to show a Frame.	5	2	2
7.	Show what method can be used for changing font of characters?	5	2	2
8.	Quote how can you create your own GUI components?	5	1	2
	PART B			
1.	Illustrate a Java program to implement the following Create four check boxes. The initial state of the first box should be in checked state. The status of each check boxshould be displayed. When we change the state of a check box, the status should be displayed and updated	5	2	16
2.	i..Describe in detail about swing Components. ii.Describe the types of layout management. 3. Summarize in detail about graphics programming.	5	4	8 8

3.	I.Explain how an application can respond to events in Java? Write the steps and the example.	5	2	16
4.	Recommend a Java swing with one button and adding it on the JFrame object inside the main() method.	5	3	16

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CS3352

FOUNDATIONS OF DATA SCIENCE

UNIT I

INTRODUCTION

Introduction: Data Science: Benefits and uses – facets of data – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – build the model– presenting findings and building applications – Data Mining – Data Warehousing – Basic Statistical descriptions of Data.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Differencebetween datawarehouse and data mining.	1	2	2
2.	List the facets,application and uses of data science.	1	2	2
3.	What is differences between Data science and BigData.	1	1	2
4.	Define Data Science and KDD.	1	1	2
5.	List the three sub phases in data preparation.	1	2	2
6.	What are external and internal data?	1	2	2
7.	List the steps involved in building a model.	1	2	2
8.	Define a Datawarehouse and list the characteristics.	1	1	2
	PART B			
1.	Explain the data science process in detail with a neat sketch.	1	4	16
2.	Explain the components of datawarehouse and its functions in detail.	1	4	16
3.	Explain about data preparation process in detail	1	4	16
4.	Explain about data exploratory analysis.	1	4	16

UNIT II

DESCRIBING DATA

Types of Data – Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages – Describing Variability – Normal Distributions and Standard (z) Scores

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What are the types of data.	2	1	2
2.	List out the types of variables.	2	2	2
3.	Define variability.	2	1	2
4.	What is meant by normal distribution.	2	1	2
5.	Define standard (z) scores.	2	1	2
6.	What is standard errors.	2	1	2
7.	Difference between bar chart and histogram.	2	2	2
8.	Write the application of the normal distribution.	2	1	2
	PART B			
1.	Explain mean ,median and mode with proper example.Shorts notes on range and variance.	2	4	16
2.	How to find the standard deviation of a given data 3,5,7 with a sample mean is 5.	2	4	16
3.	Write short notes on Normal distribution.To find a Z-score for which the area to the right is 5%:Since the table is cumulative from the left, you must use the complement of 5%.	2	4	16
4.	Explain about Describing Data with Tables and Graphs with neat example.	2	4	16

UNIT III

DISTRIBUTED RELATIONSHIPS

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations – regression towards the mean.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is Correlation and Regression?	3	1	2
2.	Define Least Square Regression Line.	3	1	2
3.	Define Standard Error of Estimate.	3	1	2
4.	What is Multiple regression?Benefits of Multiple Regression Equations?	3	1	2
5.	What does a correlation coefficient tell you?Significance of correlation coefficient?	3	1	2
6.	List the types of Correlation coefficient.	3	2	2
7.	What are the assumptions our data has to meet for pearson's?	3	1	2
8.	Give Pearson's r formula with explanation.Give Pearmans's rho formula.	3	2	2
	PART B			
1.	Explain about types of Correlation coefficients with examples and summarize data and help you compare results between studies.	3	4	16
2.	Find the least squares regression line for the five-point data set and verify that it fits the data better than the line y2=12x−1consideredin"Goodnessof Fit of a Straight Line to Data".	3	4	16
3.	Explain Types of regression, regression line,least square regression line, standard error of estimates in detail with example.	3	4	16
4.	Explain scatter plots with example and How to interpret scatterplots.	3	4	16

UNIT IV

PYTHON LIBRARIES FOR DATA WRANGLING

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is Comparisons, Masks, and Boolean Logic.	4	1	2
2.	Write about the Pandas Data Frame Object.	4	2	2
3.	What is Hierarchical Indexing.	4	1	2
4.	Define Pivot Tables.	4	2	2
5.	HowtoCreateStructuredArrays.	4	2	2
6.	WriteaboutSimpleAggregationinPandas.	4	1	2
7.	Define Data manipulation.	4	1	2
8.	Define aggregation and grouping.	4	1	2
	PART B			
1.	Explain in detail about Combining Datasets: Merge and Join Relational Algebra with example.	1	4	16
2.	Explain Computation on NumPy Array in detail with example programs.	1	4	16
3.	Explain about comparisons,masks,boolean logic – fancy indexing – structured arrays.	1	3	16
4.	Explain about Data manipulation with Pandas.	1	5	16

UNIT V

DATA VISUALIZATION

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting – Geographic Data with Basemap – Visualization with Seaborn.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is Python Matplotlib and its uses?	5	2	2
2.	Is Matplotlib Included in Python?	5	1	2
3.	Write matplotlib function to draw a simple histogram.	5	1	2
4.	Creating a simple Graph and Adding Some error in y value.	5	1	2
5.	Define Visualizing Errors.	5	2	2
6.	What is seaborn?	5	1	2
7.	Define Three-DimensionalPlotting.	5	2	2
8.	What is map projections?	5	1	2
	PART B			
1.	Explain about Geographic Data with Basemap with example program	5	4	16
2.	Explain about Seaborn Versus Matplotlib Exploring Seaborn Plots with example programs.	5	4	16
3.	Explain about Text and Annotation with example programs.	5	4	16
4.	Explain Three-Dimensional Plotting in Matplotlib with example programs.Explain about Describe Visualizing Errors in detail.	5	4	16

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