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Periyanaickenpalayam, Coimbatore – 641020

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

II YEAR

EVEN SEMESTER

ACADEMIC YEAR 2024 – 2025

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INDEX

HEAD OF THE DEPARTMENT

ACOE **PRINCIPAL** **CHAIRMAN**

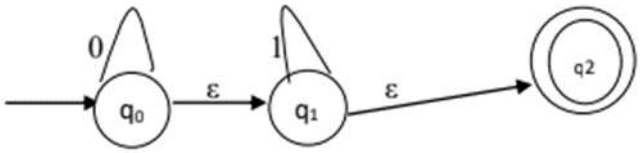
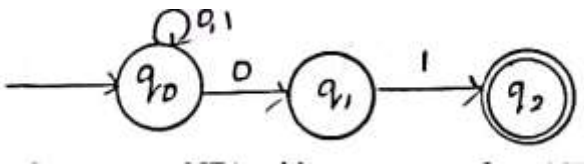
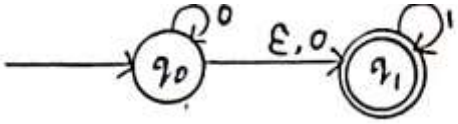
CS3452

THEORY OF COMPUTATION

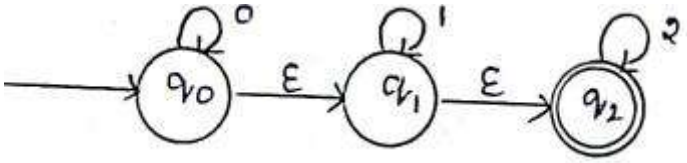
UNIT I

AUTOMATA AND REGULAR EXPRESSIONS

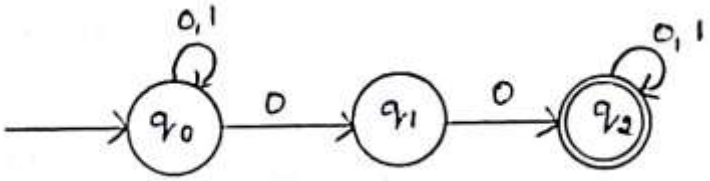
Need for automata theory - Introduction to formal proof – Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Equivalence between NFA and DFA Finite Automata with Epsilon transitions – Equivalence of NFA and DFA- Equivalence of NFAs with and without ε-moves- Conversion of NFA into DFA – Minimization of DFA'S

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define Finite Automata?	1	1	2
2.	Distinguish between DFA and NFA.	1	2	2
3.	List any four types of proofs	1	2	2
4.	Outline a DFA to accept strings over = {a,b} containing a substring aabb. 	1	2	2
5.	What is the regular expression to represent exponential constants of 'C' language.	1	1	2
6.	Define extended transition diagram.	1	1	2
7.	How to identify NFA -E to represent a*b|c?	1	1	2
8.	Define Epsilon transitions. .	1	1	2
	PART B			
1.	Construct DFA equivalent to the NFA given 	1	6	16
2.	Construct a NFA without **ε** moves from NFA with **ε** moves 	1	6	16

3.	Construct a NFA given below and find the **δ**(q0,01).	1	6	16



4.	Consider the NFA to check whether ω=01001 is valid or not.	1	4	16



5.	If L is accepted by NFA with **ε** transitions that L is accepted by an NFA without **ε** transitions.	1		

UNIT II

REGULAR EXPRESSIONS AND LANGUAGES

Regular expression – Regular Languages- Equivalence of Finite Automata and regular expressions Proving languages to be not regular (Pumping Lemma) – Closure properties of regular languages

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Illustrate regular expression to recognize the set of strings over {a,b} having odd number of a's and b's and that starts with 'a'.	2	2	2
2.	When two states are said to be distinguished? Give an example.	2	2	2
3.	Demonstrate a regular expression that recognize the set of all stringds (0+1)* that do not contain the substring 00 and 11 over the alphabet ∑={0,1}.	2	2	2
4.	Explain that reversal of any regular language is also regular .	2	2	2
5.	Recall the term Regular expression .Give a regular expression for any language containing symbols (0,1) and strictky ends with '1'. Illusttrate the following two languages : $L_1 = \{a^n b a^n \mid n > 0\}$ $L_2 = \{a^n b a^n b^{n+1} \mid n > 0\}$ Check whether the above languages are context free or not .	2	2	2
6.	Define Pumping Lemma for regular languages.	2	1	2
7.	Outline an NFA equivalent to (0+1)* (00+11).	2	2	2
8.	What are the various methods for conversion of DFA to RE?	2	1	2
	PART B			
1.	Prove that the set of regular languages is closed under complementation .(i.e., if L is a regular language then L' is also a regular language).Give an example.	2	5	16
2.	Prove that any language accepted by a DFA can be represented by a regular expression and also construct a finite automata for the regular expression 10+(0+11)0*1.	2	5	16

i)Prove that regular expressions are closed under union, intersection
and Kleene closure. (8)

(ii)Identify a language L, such that L* = L+.

3.	Find a minimum State Deterministic Finite Automata recognizing the language corresponding to the regular expression (0*10 + 1 * 0) (01)*.	2	6	16
4.	i)Show that the set $L=\{a^{i^2} \mid i \geq 1\}$ is not regular. ii) Prove that $L = \{ ww \mid w \in \{a,b\}^* \}$ is not regular.	2	6	16

UNIT III

CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA

Types of Grammar - Chomsky‘s hierarchy of languages -Context-Free Grammar (CFG) and Languages – Derivations and Parse trees –Ambiguity in grammars and languages – Push Down Automata (PDA): Definition – Moves - Instantaneous descriptions -Languages of pushdown automata – Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG – Deterministic Pushdown Automata.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Outline CFG to accept the language defined by, L={a(i)b(j)c(k)|i,j,k>=0 and i=j+k}.	3	2	2
2.	List out the steps for performing LL parsing .	3	1	2
3.	Illustrate a regular expression that recognize the set of all strings (0+1)* that do not contain the substrings 00 and 11 over the alphabet ∑={0,}.	3	2	2
4.	Define Pumping lemma for context free language	3	1	2
5.	Mention a few points regarding the Chomsky hierarchy with illustration.	3	2	2
6.	Explain the context free grammar representing the set of palindromes over(0+1)*.	3	2	2
7.	Define Chomsky‘s hierarchy .	3	1	2
8.	What is Deterministic pushdown automata?	3	2	2
	PART B			
1.	For the grammer given below give the parse tree for leftmost and rightmost derivation of the string 1001 .	3	6	16
2.	Let L = { a b c d | n,m ≥ 1} find a PDA for L?	3	6	16
3.	Let L = { a b c | i, j, k ≥ 0 i + j = k} Prove the transition function. i) . Accepted by final state. ii). Accepted by empty state (LN).	3	6	16
4.	Construct PDA to CFG	3	6	16

M= ({p, q}, {0, 1}, {x, z}, δ, q, z, φ }.

5. Construct CFG to PDA .

M = ({ q0, q1 } , {0, 1} , { z0 x x } , δ , q0 z0, φ })

δ (q0, 1, z0) = { q0, x z0 }

δ (q0, 1, x) = (q0, x x }

δ (q0, 0, x) = (q1, x)

δ (q0, ϵ, z0) = (q0, ϵ)

δ (q1, 1), x) = (q1, ϵ)

δ (q1, 0), z0) = (q0, z0)

UNIT IV

NORMAL FORMS AND TURING MACHINE

Normal forms for CFG – Simplification of CFG- Chomsky Normal Form (CNF) and Grei bach Normal Form (GNF) – Pumping lemma for CFL – Closure properties of Context Free Languages – Turing Machine : Basic model – definition and representation –Instantaneous Description – Language acceptance by TM – TM as Computer of Integer functions – Programming techniques for Turing machines (subroutines).

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Tabulate the difference between CNF and GNF.	4	2	2
2.	Illustrate the philosophy behind Pumping lemma for CFLs.	4	2	2
3.	List the different types of mouse events.	4	2	2
4.	What is the role of checking off symbols in a Turing Machine?	4	1	2
5.	Define a Turing Machine	4	1	2
6.	What is meant by a Turing Machine with two way infinite tape?	4	1	2
7.	Explain the multi tape Turing Machine mode. Is it more power than the basic turing machine ? justify your answer	4	1	2
8.	Define instantaneous description of a Turing Machine?	4	2	2
	PART B			
1.	Construct CFG generating CFL for the set of all palindromes over {a,b}.	4	6	16
2.	Discuss the following Turing machine and their working. Are they more powerful than the Basic Turing Machine? i) Multi-tape Turing Machine ii)Multi dimensional Turing machine	4	6	16
3.	Elaborate the working model of a Turing Machine to perform proper subtraction	4	6	16

4.	Explain the Construction of an equivalent grammar in CNF for thegrammar G=({S,A,B}{a,b},P,S) where P={S->bA|aB,A->bAA|aS|a, B->aBB|bS|b}	4	6	16

UNIT V

UNDECIDABILITY

Unsolvable Problems and Computable Functions –PCP-MPCP-Recursive and recursively enumerable languages – Properties -Universal Turing machine -Tractable and Intractable problems – P and NP completeness – Kruskal's algorithm – Travelling Salesman Problem-3-CNFSAT problems.

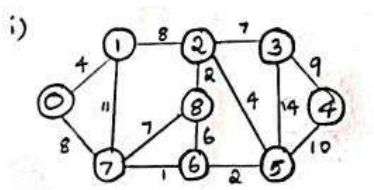
Q.No	Question	CO	BTL	Marks

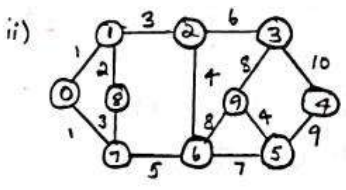
PART A

1.	What are tractable problems?	5	1	2
2.	Define class P and NP problems.	5	1	2
3.	When is a language L recursively enumerable?	5	1	2
4.	Explain that the union of recursive language is recursive language.	5	2	2
5.	What is un decidability problem? Give an example for an undecidable problem .	5	1	2
6.	Differentiate between recursive and recursively enumerable languages.	5	2	2
7.	Define Diagonal languages.	5	1	2
8.	Mention any two un decidability properties for recursively enumerable language.	5	1	2

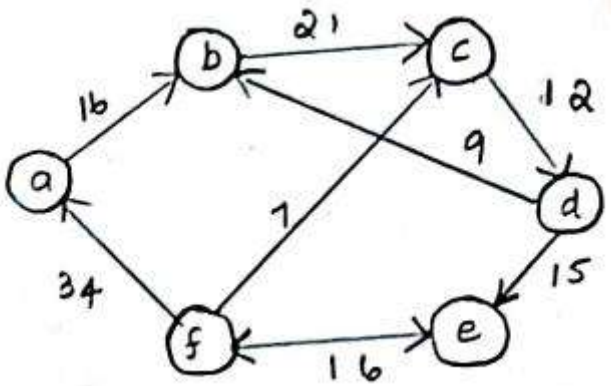
PART B

1.	Solve the given problem using kruskals algorithm?	5	6	16





2.	State recursive and non recursive enumerable languages and Explain it.	5	6	16
	11			
3.	State rice theorem ?.	5	6	16
4	State halting problem is undecidable?	5	6	16
5.	Discuss travelling salesman problem in terms of P and NP completeness?			



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CS3491

ARTIFICIAL INTELLIGENCE AND MACHINE LEARINING

UNIT I

PROBLEM SOLVING

Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is Artificial Intelligence?	1	1	2
2.	What are various applications of AI? or What can AI do today?	1	1	2
3.	What are the advantages of heuristic function?	1	1	2
4.	Is AI a science, or is it engineering? Or neither or both? Explain.	1	2	2
5.	How will you measure the problem-solving performance?	1	1	2
6.	State on which basis search algorithms are chosen?	1	1	2
7.	List some of the uninformed search techniques.	1	2	2
8.	What do you mean by local maxima with respect to search technique?	1	1	2
	PART B			
1.	Define the following problems. What types of control strategy is used in the following problem. i. The Tower of Hanoi ii. Crypto-arithmetic iii. The Missionaries and cannibals problems iv. 8-puzzle problem	1	4	16
2.	Explain the A* search and give the proof of optimality of A* Explain AO* algorithm with a suitable example. State the limitations in the algorithm?	1	4	8 8
3.	Explain the nature of heuristics with example. What is the effect of heuristics accuracy?	1	2	16
4.	Discuss about constraint satisfaction problem with a algorithm for solving a crypt arithmetic Problem. CROSS +ROADS ---------- DANGER ----------	1	2	16

UNIT II

PROBABILISTIC REASONING

Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define principle of maximum expected utility (MEU)	2	1	2
2.	Mention the needs of probabilistic reasoning in AI.	2	1	2
3.	State Bayes' Theorem in Artificial Intelligence.	2	1	2
4.	What is Bayesian Belief Network?	2	1	2
5.	Given that P(A)=0.3,P(A|B)=0.4 and P(B)=0.5, Compute P(B|A).	2	2	2
6.	Differentiate uncertainty with ignorance	2	2	2
7.	What is the need for utility theory in uncertainty?	2	1	2
8.	Why does uncertainty arise?	2	2	2
	PART B			
1.	Explain variable elimination algorithm for answering queries on Bayesian networks?	2	4	16
2.	Construct a Bayesian Network and define the necessary CPTs for the given scenario. We have a bag of three biased coins a,b and c with probabilities of coming up heads of 20%, 60% and 80% respectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each of the three coins) and then the coin is flipped three times to generate the outcomes X1, X2 and X3. a. Draw a Bayesian network corresponding to this setup and define the relevant CPTs. b. Calculate which coin is most likely to have been drawn if the flips come up HHT	2	4	8 8
3.	Discuss about Bayesian Theory and Bayesian network.	2	2	16
4.	Explain how does Bayesian statistics provide reasoning under various kinds of uncertainty?	2	2	16

UNIT III

SUPERVISED LEARNING

Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear ClassificationModels: Discriminant function – Probabilistic discriminative model - Logistic regression,Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vectormachine, Decision Tree, Random forests.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is Machine Learning?	3	1	2
2.	What is 'Over fitting' in Machine learning?	3	1	2
3.	What are the different Algorithm techniques in Machine Learning?	3	1	2
4.	What is the main key difference between supervised and unsupervised machine learning?	3	2	2
5.	What is 'Training set' and 'Test set'?	3	1	2
6.	What is a Linear Regression?	3	1	2
7.	Why is random forest better than SVM?	3	2	2
8.	What is the difference between stochastic gradient descent (SGD) and gradient descent (GD)?	3	1	2
	PART B			
1.	Explain Naïve Bayes Classifier with an Example.	3	4	16
2.	Explain the following a) Linear regression b) Logistic Regression	3	4	8 8
3.	Explain SVM Algorithm in Detail. Explain Decision Tree Classification.	3	2	8 8
4.	Explain the principle of the gradient descent algorithm. Accompany your explanation with a diagram. Explain the use of all the terms and constants that you introduce and comment on the range of values that they can take.	3	2	16

UNIT IV

ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is bagging and boosting in ensemble learning?	4	1	2
2.	What type of classifiers are used in weighted voting method?	4	1	2
3.	What are examples of unsupervised learning?	4	1	2
4.	What are Gaussian mixture models How is expectation maximization used in it?	4	2	2
5.	What is the principle of maximum likelihood?	4	1	2
6.	What is expectation maximization algorithm used for?	4	1	2
7.	How do you implement expectation maximization algorithm?	4	2	2
8.	What is the advantage of Gaussian process?	4	1	2
	PART B			
1.	List the applications of clustering and identify advantages and disadvantages of clustering algorithm.	4	4	16
2.	Explain various learning techniques involved in unsupervised learning?	4	4	16
3.	What is Gaussian process? And explain in detail of Gaussian parameter estimates with suitable examples.	4	2	16
4.	List non-parametric techniques and Explain K-nearest neighbour estimation.	4	2	16

UNIT V

NEURAL NETWORKS

Perceptron - Multilayer perceptron, activation functions, network training – gradientdescent optimization – stochastic gradient descent, error backpropagation, from shallownetworks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU,hyperparameter tuning, batch normalization, regularization, dropout.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is perceptron and its types?	5	1	2
2.	What are the advantages of Multilayer Perceptron?	5	1	2
3.	What are the three main types gradient descent algorithm?	5	1	2
4.	Does stochastic gradient descent lead to faster training?	5	2	2
5.	What are the types of activation function?	5	1	2
6.	Why is ReLU used in deep learning?	5	2	2
7.	Is stochastic gradient descent same as gradient descent?	5	2	2
8.	What are the activation functions of MLP?	5	1	2
	PART B			
1.	List the factors that affect the performance of multilayer feed-forward neural network. Difference between a Shallow Net & Deep Learning Net.	5	4	8 8
2.	Develop a Back propagation algorithm for Multilayer Feed forward neural network consisting of one input layer, one hidden layer and output layer from first principles.	5	4	16
3.	Draw the architecture of a Multilayer perceptron (MLP) and explain its operation. Mention its advantages and disadvantages.	5	5	16
4.	Write the flowchart of error back-propagation training algorithm.	5	5	16

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CS3492

DATABASE MANAGEMENT SYSTEMS

UNIT 1

RELATIONAL DATABASES

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is a Database Management System? Why do we need a DBMS?	1	1	2
2.	List out some applications of Database Management System	1	2	2
3.	What is physical data independence?	1	2	2
4.	What are the three levels of data abstraction?	1	1	2
5.	Differentiate between primary key and foreign key	1	2	2
6.	What are the different types of integrity constraints used in designing relational databases?	1	1	2
7.	Justify the need of embedded SQL	1	2	2
8.	Differentiate between Static SQL and Dynamic SQL.	1	2	2
	PART B			
1.	Explain the database management system architecture with a neat diagram..	1	5	16
2.	Define relational algebra. Explain various relational algebraic operations with examples.	1	5	16
3.	Create an EMPLOYEE table and write the SQL to create, insert, update, delete, save and join the various attributes of an EMPLOYEE Table.	1	5	16
4.	What is a data model? Explain various data models for describing the design ofa database at the logical level.	1	5	16

UNIT 2

DATABASE DESIGN

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define single valued and multi valued attributes.	2	1	2
2.	What is a weak entity? Give an example.	2	1	2
3.	What does the cardinality ratio specify?	2	2	2
4.	Define normalization	2	1	2
5.	List the anomalies of 1NF.	2	1	2
6.	Define Functional Dependency.	2	1	2
7.	'Boyce-Codd normal form is found to be stricter than the third normal form'. Justify the statement	2	2	2
8.	List out the desirable properties of decomposition	2	1	2
	PART B			
1.	What is the notation used in the E-R diagram? Construct an E-R diagram for a banking enterprise with almost all components.	2	3	16
2.	What is the need for Normalization? Outline first normal form, second normal form and third normal form with an example	2	5	16
3.	Discuss briefly about Boyce-Codd normal form, Multi valued dependency andFourth Normal Form.	2	5	16
4.	Explain the concept of Join Dependencies and Fifth Normal Form with examples.	2	5	16

UNIT 3

TRANSACTIONS

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control –Two Phase Locking-Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define transaction.	3	1	2
2.	What is a schedule in transaction management?	3	1	2
3.	What is the need for concurrency control?	3	1	2
4.	What is timestamp-based concurrency control?	3	1	2
5.	What is multiple granularity locking?	3	1	2
6.	Distinguish between deferred and immediate updates in recovery.	3	2	2
7.	What is shadow paging in database recovery?	3	1	2
8.	Name the three phases of the ARIES recovery algorithm.	3	1	2
	PART B			
1.	Explain the states of transactions and discuss the ACID properties in detail.	3	5	16
2.	Discuss about conflict and view serializability	3	5	16
3.	Explain the locking protocols for concurrency control.	3	5	16
4.	Explain Deadlock in detail with an example.	3	5	16

UNIT 4

IMPLEMENTATION TECHNIQUES

RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations – Query optimization using Heuristics - Cost Estimation

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is a data dictionary in a database system?	4	1	2
2.	What is column-oriented storage?	4	1	2
3.	What are ordered indices?	4	1	2
4.	Differentiate BTree and B+Tree Index	4	2	2
5.	Differentiate between static hashing and dynamic hashing	4	2	2
6.	Distinguish between sparse and dense index.	4	2	2
7.	List three components of the query processor.	4	1	2
8.	What is the need for query optimization?	4	1	2
	PART B			
1.	Explain the structure and working of a B+ tree in database indexing. Discuss its advantages over other indexing techniques and provide examples to demonstrate its efficiency	4	5	16
2.	The following key values are organized in an extendable hashing technique. 1, 3, 5, 8, 9, 12, 17, 28. Show the extendable hash structure for this file if the hash function is h(x)=x mod 8 and buckets can hold three records. Assess how the extendable hash structure changes as the result of each of the following steps: INSERT 2. INSERT 24. DELETE 5. DELETE 12.	4	6	16
3.	List the different levels in RAID technology and explain its features.	4	5	16
4.	Give a detailed description about Query processing and Optimization. Explain the cost estimation of Query Optimization	4	5	16

UNIT V

ADVANCED TOPICS

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection – Statistical Database security – Flow control – Encryption and Public Key infrastructures – Challenges

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is a distributed database management system?	5	1	2
2.	Discriminate the meaning of homogeneous and heterogeneous DDBMS	5	2	2
3.	What are the advantages of NO SQL?	5	1	2
4.	State CAP theorem	5	1	2
5.	What is a document-based system in NoSQL databases?	5	1	2
6.	What are the key security issues in databases?	5	1	2
7.	What is encryption in database security?	5	1	2
8.	What are the main challenges in database security?	5	1	2
	PART B			
1.	Explain the architecture of a distributed database system.	5	2	16
2.	Explain in detail about key value stores, Column Based Systems and Graph Databases	5	5	16
3.	Write short notes on Access control based on privileges and role based access control.	5	5	16
4.	Explain SQL Injection attacks and describe techniques to prevent them. provide examples of vulnerable and secure SQL queries.	5	3	16

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CS3401

ALGORITHMS

UNIT I

Introduction

Algorithm analysis: Time and space complexity – Asymptotic Notations and its properties Best case, Worst case and average case analysis – Recurrence relation: substitution method – Lower bounds – searching: linear search, binary search and Interpolation Search, Pattern search: The naïve string-matching algorithm – Rabin-Karp algorithm – Knuth-Morris-Pratt algorithm. Sorting: Insertion sort – heap sort

PART A

Q.No	Question	CO	BTL	Marks
1.	Define time complexity.	1	1	2
2.	Define Omega (Ω) notation.	1	1	2
3.	How does average-case complexity differ from best-case and worst-case complexities?	1	2	2
4.	What is a recurrence relation in the context of algorithms?	1	1	2
5.	Define the term "lower bound" in algorithm analysis.	1	1	2
6.	Define binary search.	1	1	2
7.	Explain the Rabin-Karp algorithm in brief.	1	1	2
8.	What is heap sort?	1	1	2

PART B

Q.No	Question	CO	BTL	Marks
1	Analyze how time complexity and space complexity impact the performance of an algorithm in real-world applications.	1	4	16
2	Evaluate the applicability of asymptotic notations for comparing algorithms with vastly different input sizes.	1	5	16
3	Solve the recurrence relation $T(n)=2T(n/2)+nT(n) = 2T(n/2) + nT(n)=2T(n/2)+n$ using the substitution method and analyze its time complexity.	1	4	16
4	Evaluate the applicability of heap sort in real-time systems compared to insertion sort, justifying the choice with examples.	1	5	16

UNIT 2

Graph Algorithms

Graph algorithms: Representations of graphs – Graph traversal: DFS – BFS – applications Connectivity, strong connectivity, bi-connectivity – Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm – Dijkstra's algorithm – Floyd-Warshall algorithm Network flow: Flow networks – Ford-Fulkerson method – Matching: Maximum bipartite matching

PART A

Q.No	Question	CO	BTL	Marks
1.	Define a graph.	2	1	2
2.	Explain one difference between DFS and BFS.	2	2	2
3.	Explain the key difference between Kruskal's and Prim's algorithms.	2	2	2
4.	What is the Floyd-Warshall algorithm?	2	1	2
5.	Define a flow network.	2	1	2
6.	Define maximum bipartite matching.	2	1	2
7.	What is a biconnected component?	2	1	2
8.	Explain the difference between the Bellman-Ford algorithm and Dijkstra's algorithm.	2	2	2

PART B

Q.No	Question	CO	BTL	Marks
1	Compare and contrast Depth First Search (DFS) and Breadth First Search (BFS) algorithms. Discuss their applications with examples.	2	4	16
2	Analyze the concepts of connectivity, strong connectivity, and bi-connectivity in graphs. Illustrate with examples.	2	4	16
3	Evaluate the effectiveness of the Bellman-Ford algorithm for detecting negative weight cycles in graphs. Provide examples to support your reasoning.	2	5	16
4	Analyze the Ford-Fulkerson method for computing maximum flow in a flow network. Discuss the significance of augmenting paths and residual graphs.	2	4	16

UNIT 3

Algorithm Design Techniques

Divide and Conquer methodology: Finding maximum and minimum – Merge sort – Quick sort Dynamic programming: Elements of dynamic programming — Matrix-chain multiplication – Multi stage graph — Optimal Binary Search Trees. Greedy Technique: Elements of the greedy strategy – Activity-selection problem –- Optimal Merge pattern — Huffman Trees.

PART A

Q.No	Question	CO	BTL	Marks
1.	What is the divide and conquer strategy?	3	1	2
2.	List two examples of algorithms that use the divide and conquer methodology.	3	1	2
3.	Define merge sort.	3	1	2
4.	Explain the difference between merge sort and quick sort.	3	2	2
5.	What is the principle of optimality in dynamic programming?	3	1	2
6.	Define an optimal binary search tree (OBST).	3	1	2
7.	Explain how the greedy strategy solves the activity-selection problem.	3	2	2
8.	What is the time complexity of constructing Huffman Trees?	3	1	2

PART B

Q.No	Question	CO	BTL	Marks
1	Evaluate the efficiency of merge sort and quick sort algorithms. Compare their performances on worst-case, best-case, and average-case scenarios. Provide justification for when one is preferred over the other.	3	5	16
2	Explain construction of Optimal Binary Search Trees (OBST) using dynamic programming. Justify its importance in minimizing search costs with an example.	3	4	16
3	Explain greedy technique by explaining its key elements with examples. Apply the greedy approach to solve the activity-selection problem and discuss its time complexity.	3	4	16
4	Compare the divide and conquer, dynamic programming, and greedy techniques in terms of their problem-solving approaches, advantages, and limitations.	3	4	16

UNIT 4

State Space Search Algorithms

Backtracking: n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem – Assignment problem Knapsack Problem – Travelling Salesman Problem

PART A

Q.No	Question	CO	BTL	Marks
1.	What is backtracking?	4	1	2
2.	What is a Hamiltonian circuit?	4	1	2
3.	Explain how backtracking is used to solve the subset sum problem.	4	2	2
4.	Define the graph coloring problem.	4	1	2
5.	What is branch and bound?	4	1	2
6.	What is the assignment problem?	4	1	2
7.	Define the knapsack problem.	4	1	2
8.	What is the travelling salesman problem (TSP)?	4	1	2

PART B

Q.No	Question	CO	BTL	Marks
1	Explain how backtracking is used to solve the **Subset Sum problem**. Provide a detailed algorithm and discuss its correctness and complexity.	4	4	16
2	Evaluate the effectiveness of backtracking in solving the **n-Queens problem** for large values of nnn. Justify whether backtracking is always the best approach for this problem.	4	5	16
3	Explain the branch and bound technique for solving the **Assignment problem**. Illustrate with an example showing the bounding process.	4	4	16
4	Explain the branch and bound approach for solving the **Travelling Salesman Problem (TSP)**. Discuss the bounding strategy used to limit the search space.	4	4	16

UNIT 5

NP-Complete And Approximation Algorithm

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation NP-algorithms – NP-hardness and NP-completeness – Bin Packing problem – Problem reduction: TSP – 3-CNF problem. Approximation Algorithms: TSP – Randomized Algorithms: concept and application – primality testing – randomized quick sort – Finding kth smallest number

PART A

Q.No	Question	CO	BTL	Marks
1.	Define tractable and intractable problems.	5	1	2
2.	Explain the difference between NP-hard and NP-complete problems.	5	2	2
3.	What is the significance of problem reduction in complexity theory?	5	1	2
4.	What is the 3-CNF problem in Boolean logic?	5	1	2
5.	Explain why the bin packing problem is NP-hard.	5	2	2
6.	What is an approximation algorithm?	5	1	2
7.	Define a randomized algorithm.	5	1	2
8.	What is the purpose of finding the kth smallest number in randomized algorithms?	5	1	2

PART B

Q.No	Question	CO	BTL	Marks
1	Evaluate the role of problem reduction in proving NP-completeness. Discuss with examples, such as the reduction of 3-CNF to other NP-complete problems.	5	5	16
2	Design an efficient approximation algorithm for the Travelling Salesman Problem (TSP). Evaluate its performance on different types of input graphs.	5	6	16
3	Explain the strengths and weaknesses of randomized algorithms in finding the kth smallest number compared to deterministic approaches.	5	4	16
4	Create a problem-solving framework for computationally hard problems, integrating concepts of polynomial-time reduction, approximation, and randomness. Justify its real-world relevance with examples.	5	6	16

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CS3451

INTRODUCTION TO OPERATING SYSTEM

UNIT I

INTRODUCTION

Computer System - Elements and organization; Operating System Overview - Objectives and Functions Evolution of Operating System; Operating System Structures – Operating System Services - User Operating Interface - System Calls – System Programs - Design and Implementation - Structuring methods

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is an operating system?	1	1	2
2.	List the Services of operating system function.	1	1	2
3.	Define system call.	1	1	2
4.	What is System Programs?	1	1	2
5.	What does the CPU do when there are no user programs to run?	1	1	2
6.	List the actions taken by a kernel to context-switch between processes.	1	2	2
7.	Mention the circumstances that would a user be better off using a time-sharing system rather than a PC or a single user workstation?	1	1	2
8.	What are the advantages of peer-to-peer systems over client-server systems?	1	2	2
	PART B			
1.	Explain Operating System Structure and components.	1	5	16
2.	Explain in detail the types of system calls provided by a typical operating system.	1	5	16
3.	Enumerate the different operating system Services and explain with neat sketch	1	4	16
4.	How could a system be designed to allow a choice of operating systems from which to boot? What would the bootstrap program need to do?	1	5	16

UNIT II

PROCESS MANAGEMENT

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithreaded Models – Threading issues; Process Synchronization - The Critical-Section problem Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - MoDeadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock Recovery from deadlock**.**

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is process control block? List out the data field associated with PCB.	2	2	2
2.	Differentiate a Thread from a Process.	2	2	2
3.	What are the difference b/w user level threads and kernel level threads?	2	1	2
4.	Define mutual exclusion.	2	1	2
5.	What is semaphore? Mention its importance in operating system.	2	1	2
6.	What is preemptive and nonpreemptive scheduling?	2	1	2
7.	Define the term ‘dispatch latency’?	2	1	2
8.	Define deadlock	2	1	2
	PART B			
1.	Write in detail about several CPU scheduling algorithms.	2	5	16
2.	Discuss the threading issues which are considered with multithreaded programs.	2	2	16
3.	Discuss how deadlocks could be detected in detail.	2	2	16
4.	Provide two programming examples in which multithreading does not provide better performance than a single-threaded solution.	2	4	16

UNIT III

MEMORY MANAGEMENT

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Replacement - Allocation of Frames –Thrashing.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Difference between internal and external fragmentation	3	4	2
2.	What is virtual memory? Mention its advantages.	3	1	2
3.	What do you mean by thrashing?	3	1	2
4.	Define swapping.	3	1	2
5.	Differentiate between Global and Local page replacement algorithms.	3	4	2
6.	Differentiate a page from a segment.	3	4	2
7.	Define demand paging in memory management. What are the steps required to handle a page fault in demand paging.	3	1	2
8.	Name two differences between logical and physical addresses.	3	2	2
	PART B			
1.	Describe the hierarchical paging technique for structuring page tables.	3	5	16
2.	Explain the segmentation with paging implemented in MULTICS system.	3	5	16
3.	What is thrashing? Explain the working set model in detail.	3	5	16
4.	With a neat sketch, explain how logical address is translated into physical address using paging mechanism?	3	6	16

UNIT IV

STORAGE MANAGEMENT

Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File c- Access methods - Directory Structure - Directory organization - File system mounting - File ShariProtection; File System Implementation - File System Structure - Directory implementation - AllMethods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kern Subsystem

Q.No	Question	CO	BTL	Marks
	PART A			
1.	List the various file attributes	4	1	2
2.	What are the different accessing methods of a file?	4	1	2
3.	What are the most common schemes for defining the logical structure of a directory?	4	1	2
4.	What is garbage collection?	4	2	2
5.	What is meant by polling?	4	2	2
6.	Define rotational latency and disk bandwidth.	4	1	2
7.	Give the importance of Swap space Management.	4	1	2
8.	Draw the diagram for interrupt driven I/O cycle?	4	1	2
	PART B			
1.	Explain the different disk scheduling algorithms with examples.	4	5	16
2.	Explain the services provided by Kernel I/O subsystem	4	5	16
3.	Explain about RAID structure in disk management with various RAID levels of organization in detail	4	5	16

4.	On a disk with 200 cylinders, numbered 0 to 199, compute the number of tracks the disk arm must move to satisfy the entire request in the disk queue. Assume the last request received was at truck 100. The queue in FIFO order contains requests for the following tracks. 55, 58, 39, 18, 90, 160, 150, 38, 184. Perform the computation to find the seek time for the following disk scheduling algorithms. • FCFS • SSTF • SCAN • C-SCAN • LOOK	4	5	16

UNIT V

VIRTUAL MACHINES AND MOBILE OS

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machine their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS Android.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is virtualization?	5	1	2
2.	State the components of a Linux System?	5	1	2
3.	Define the function of Caching-only servers.	5	1	2
4.	What is Linux distribution?	5	1	2
5.	What are the components of kernel mode?	5	1	2
6.	What is paravirtualization?	5	1	2
7.	What is the major design goal for the android platform?	5	1	2
8.	List out any two components that are unique for Mobile OS.	5	1	2
	PART B			
1.	Briefly discuss about the requirements to become a Linux system administrator.	5	5	16

2.	Write about LINUX architecture and LINUX kernel with neat sketch.	5	5	16
3.	Explain Various types of Virtual Machines and their implementations in Detail.	5	5	16
4.	Explain the architecture of Android OS and Compare iOS with Android OS.	5	5	16

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GE3451

ENVIRONMENTAL SCIENCE AND SUSTAINABILITY

UNIT I

ENVIRONMENT, ECO SYSTEM AND BIO-DIVERSITY

Definition, scope and importance of environment – need for public awareness. Eco-system andEnergy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity–values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats tobiodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts– endangered and endemicspecies of India – conservation of biodiversity: In-situ and ex-situ.

PART A

Q.No	Question	CO	BTL	Marks
1.	State the significance of environmental education.	1	1	2
2	What are biotic and abiotic components of an ecosystem?	1	1	2
3.	How does a biome differ from ecosystem?	1	1	2
4.	Identify any two major threats to biodiversity	1	1	2
5.	Define Ecological succession.	1	1	2
6.	Distinguish between endangered and endemic species	1	1	2
7.	Defineprimarysuccessionandsecondarysuccession	1	2	2
8.	Mention the disadvantages of Exsitu Conservation..	1	2	2

PART B

Q.No	Question	CO	BTL	Marks
1.	Analyse the structure and function of an ecosystem with real examples.	1	4	16
2.	Explain the values of the biodiversity(8) “Indiaisamegadiversitynation”–Discuss.(8)	1	1	16
3.	Identify the major threats to biodiversity(10) Write a note on Hot Spot Biodiversity (6)	1	6	16
4	Explain the conservation plan of biodiversity by integrating In-Situ and Ex-Situ.	1	5	16

UNIT 2

ENVIRONMENTAL POLLUTION

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

PART A

Q.No	Question	CO	BTL	Marks
1.	Classify air pollutants into primary and secondary category.	2	2	2
2	State the pollutant responsible for photo chemical smog.	2	1	2
3.	Compare point and non point sources of water pollutants.	2	4	2
4.	Define e-Waste Management	2	1	2
5.	Write the objectives of environmental acts.	2	1	2
6.	Define hazardous waste management	2	1	2
7.	What are the effects of noise pollution	2	2	2
8.	Identify the major cause of soil pollution.	2	1	2

PART B

Q.No	Question	CO	BTL	Marks
1.	Describe the role of individual in the prevention of pollution. Explain the sources, effects and control methods of noise pollution.	2	2	16
2.	Design a flow sheet and explain the steps involved in Solid Waste Management.	2	5	16
3.	Examine the Occupational Health and Safety Management System (OHASMS) with a relevant case study.	2	5	16
4.	Develop a schematic representation of an Industrial Waste Water treatment technique.	2	5	16

UNIT 3

RENEWABLE SOURCES OF ENERGY

Energy management and conservation, New Energy Sources: Need of new sources. Different typesnew energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energyconversion. Concept, origin and power plants of geothermal energy.

PART A

Q.No	Question	CO	BTL	Marks
1.	Mention the objectives of energy management.	3	1	2
2	Assess the significance of OTE.	3	6	2
3.	Investigate the role of Artificial intelligence in energy sector.	3	1	2
4.	What is Bio-mass energy?	3	1	2
5.	Give any five applications of tidal energy conservation.	3	1	2
6.	Specify some important applications of GTE	3	2	2
7.	State the term DESS? Mention its components	3	1	2
8.	Mention the applications of hydrogen energy	3	1	2

PART B

Q.No	Question	CO	BTL	Marks
1.	Explain the applications of Ocean energy and Tidal Energy..	3	5	16
2.	Elaborate the principle and various steps involved in the energy management.	3	5	16
3.	Analyse the role of new energy sources in global energy demands.	3	4	16
4	Develop a detail report on the origin, concept and advantage and disadvantages Geo-Thermal energy.	3	5	16

UNIT 4

SUSTAINABILITY AND MANAGEMENT

Development GDP Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global,Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

PART A

Q.No	Question	CO	BTL	Marks
1.	Define the term GDP.	4	1	2
2	Identify any four millennium development goals.	4	2	2
3.	What is meant by carbon credit?	4	1	2
4.	What are the sources of carbon foot print?	4	2	2
5.	Define environmental management.	4	2	2
6.	Mention any five important needs of sustainability.	4	2	2
7.	Write some advantages of carbon credits.	4	1	2
8.	Mention some effects of climate change.	4	1	2

PART B

Q.No	Question	CO	BTL	Marks
1.	Summarise the Millennium Development Goals and Sustainabilty protocols.	4	4	16
2.	Explain the various steps of environmental management.	4	2	16
3.	Elaborate the goal and aim of sustainable development.	4	4	16
4	Describe the causes, effects and possible solutions of climate change? What is carbon credit? Explain the types and merits	4	5	16

UNIT 5

SUSTAINABILITY PRACTICES

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment,Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energyefficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio economical and technological change.

PART A

Q.No	Question	CO	BTL	Marks
1.	What is zero waste and R concept?	5	1	2
2	Define circular economy.	5	2	2
3.	Identify key elements of ISO14000.	5	2	2
4.	Mention the objectives of EIA	5	1	2
5.	State the term green engineering.	5	1	2
6.	What is meant by energy cycles?	5	1	2
7.	Give an idea about the concept sustainable urbanization.	5	1	2
8.	Define carbon sequestration.	5	1	2

PART B

Q.No	Question	CO	BTL	Marks
1.	Explain the various steps to achieve zero waste? Mention advantages and disadvantages of zero waste	5	2	16
2.	Analyse the 3R concept and suggest improvements for better sustainability	5	4	16
3.	Assess the role of green building materials and sustainable transport in urban planning.	5	6	16
4	Brief the rules to develop sustainable urbane.	5	3	16

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