MEAD-601 Advanced Data Structures and Algorithms L T/P C

4 0 4

Marking Scheme:
Teachers Continuous Evaluation and End Term Theory Examiantion: As per per university examination norms from time to time
Instruction to Paper Setters: **Maximum Marks**: As per University norms

Question No. 1 should be compulsory and cover the entire syllabus. This question may have objective or short answer type questions. Apart from Question No. 1, rest of the paper shall consist of four sections as per the units given in the syllabus. Every section should have two questions. However, student may be asked to attempt only 1 question from each section.

Course Objectives:

1. The course aims to teach students advanced data structures and algorithms like red-black trees, B-trees, AVL trees, graph algorithms, greedy, divide & conquer etc.
2. Students should be able to analyze the running time of algorithms and understand how to design efficient algorithms for a given problem.
3. Students should be able to apply advanced data structures and algorithms to solve complex problems in computer science and related fields.
4. The course aims to improve the student's programming skills.

Course Outcomes:

1. Ability to apply data structure in different problem scenarios
2. Ability to analyse the time complexity of algorithms
3. Ability to understand and apply different problems solving approaches using algorithms
4. Ability to implement different algorithms and data structures.

Mapping of Course Outcome to Programme Outcome ((scale 1: low, 2: Medium, 3: High)					
CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	2	1	1
CO2	2	3	3	3	1
CO3	3	3	3	3	2
CO4	1	1	2	1	3

UNIT - I

Elementary Data Structure: Arrays, Expressions, Linked list, Polynomials; Representation and Operations binary search Trees and operations, AVL trees, augmented data structure, Red Black Trees and properties

UNIT - II

Overview of Divide-and-Conquer, Dynamic Programming and Greedy Algorithms, Comparison of dynamic programming and Greedy algorithm with Knapsack as case study Theoretical foundation of greedy algorithm, Matroids and Greedy methods, A Task Scheduling problem as a Matroid.

UNIT-III

Graph representation and implementation, searching of a graph, application of BFS and DFS Data structure for Sets, Disjoint Set and Union – find problem and implementation, Basic Hash function and collision resolution Hash Tables (Universal Hashing, Perfect Hashing) implementation and Applications, Sorting and Searching techniques.

UNIT - IV

Traversal algorithms, Tree, Spanning tree generation Algorithms,

Computational Geometry: Line segments properties, determining whether any pair of segment intersects, Finding a convex hull, finding the closest pair of points

Textbooks:

1. T. H. Cormen, C. E. Leiserson, R.L. Rivest, C. Stein. Introduction to Algorithms, 3rd Edition, PHI, 2009
2. Ellis Horowitz, Sartaj Sahni & Anderson-Freed. Fundamentals of Data Structures, 2nd Edition, Universities Press,2008

Reference books:

1. Weiss, Mark Allen. Data structures and algorithm analysis. 2nd Edition, Pearson Education India,1996.
2. Robert L. Kruse, Bruce P. Leung. Data Structures and Program Design in C. 2nd Edition, Pearson Education, 2006.
3. M. Goodrich, R. Tamassia, and D. Mount, Data Structures and Algorithms in C++. 2nd Edition, Wiley, 2014.

MEAD-603 Mathematics for AI

L	T/P	C
4	0	4

Marking Scheme:
Teachers Continuous Evaluation and End Term Theory Examiantion: As per per university examination norms from time to time
Instruction to Paper Setters: **Maximum Marks**: As per University norms

Question No. 1 should be compulsory and cover the entire syllabus. This question may have objective or short answer type questions. Apart from Question No. 1, rest of the paper shall consist of four sections as per the units given in the syllabus. Every section should have two questions. However, student may be asked to attempt only 1 question from each section.

Course Objectives:

1. To understand the mathematical concepts and techniques necessary for working with AI algorithms and models.
2. To make students learn to apply linear algebra, calculus, probability theory, and graph theory to solve AI problems.
3. To learn about calculus and its application in AI, including optimization, derivatives, and gradients.
4. To develop critical thinking skills and the ability to evaluate and analyze mathematical concepts and techniques in the context of AI.

Course Outcomes:

1. Ability to use techniques necessary for working with AI algorithms and models.
2. Ability to apply linear algebra, calculus, probability theory, and graph theory to solve AI problems.
3. Ability to use mathematical tools and software for solving AI problems.
4. Students will be prepared to take advanced courses in AI, machine learning, and related fields.

Mapping of Course Outcome to Programme Outcome ((scale 1: low, 2: Medium, 3: High)					
CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	3	3	1
CO2	3	3	3	3	1
CO3	2	3	2	2	2
CO4	3	2	3	2	1

UNIT - I

Linear Algebra: Matrices and Determinants, Gauss Elimination, Linear Independence. Rank of a Matrix. Vector Space. Solutions of Linear Systems and concept of Existence, Uniqueness, Determinants. Cramer's Rule, Gauss–Jordan Elimination. The Matrix Eigenvalue Problem, Determining Eigenvalues and Eigenvectors, Eigenbases. Diagonalization. Quadratic Forms.Cayley – Hamilton Theorem

UNIT - II

Calculus: Continuity and differentiability, derivative of composite functions, chain rule, derivative of some common functions- logarithmic, exponential, trigonometric and inverse trigonometric**.** Applications of derivatives. Vector and matrix calculus, derivatives of scalar and vector valued functions, Gradient algorithms and convex functions

UNIT - III

Vector Calculus: Vector and Scalar Functions and Their Fields. Derivatives, Curves. Arc Length. Curvature. Torsion, Gradient of a Scalar Field. Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field, Line Integrals, Path Independence of Line Integrals, Double Integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Stokes Theorem. Divergence Theorem of Gauss.

UNIT - IV

Vector spaces: The n dimensional vectors, vector spaces, subspaces, spanning sets, linear dependence of vectors, basis and dimensions, linear transformation, null space and range space of a linear transformation, rank and nullity, rank and nullity theorem, inverse of a linear transformation, composition of linear map, matrices of a linear transformation and its transpose, the minimal polynomial

Textbooks:

1. Strang G. Linear algebra and its applications. Belmont, CA: Thomson, Brooks/Cole; 2006.
2. Deisenroth MP, Faisal AA, Ong CS. Mathematics for machine learning. Cambridge University Press; 2020.

Reference books:

1. Aggarwal CC, Aggarwal LF, Lagerstrom-Fife. Linear algebra and optimization for machine learning. Springer International Publishing; 2020.
2. Boyd S, Boyd SP, Vandenberghe L. Convex optimization. Cambridge university press; 2004.

MEAD-605 Principles of AI

L	T/P	C
4	0	4

Marking Scheme:
Teachers Continuous Evaluation and End Term Theory Examiantion: As per per university examination norms from time to time
Instruction to Paper Setters: **Maximum Marks**: As per University norms Question No. 1 should be compulsory and cover the entire syllabus. This question may have objective or short answer type questions. Apart from Question No. 1, rest of the paper shall consist of four sections as per the units given in the syllabus. Every section should have two questions. However, student may be asked to attempt only 1 question from each section.

Course Objectives:

1. The course aims to teach students the basics principles of Artificial Intelligence and how AI Evolve over the decades
2. The course aims to teach heuristics and uninformed searching techniques
3. Students would be exposed to different ways of knowledge representations and reasoning approaches
4. The course aims to teach the students Ethics in AI

Course Outcomes:

1. Ability to understand the AI principles applicable in different AI enabled applications
2. Ability to apply heuristic search techniques for problem solving
3. Ability to represent different type of knowledge effectively and to reason out in the presence of uncertain knowledge.
4. Students will understand the ethical application of AI techniques.

Mapping of Course Outcome to Programme Outcome ((scale 1: low, 2: Medium, 3: High)					
CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	3	1	1
CO2	2	3	3	3	2
CO3	3	3	3	3	2
CO4	1	1	2	2	3

UNIT - I

Overview: foundations, scope, problems, and approaches of AI. AI Evolution: Turing's Work, Turing Test, Alternative test
Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents, Artificial Intelligence programming techniques

UNIT-II

Problem-solving through Search: forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, Beyond Classical Search, Parallel Search, Search Engines, sample applications.

UNIT-III

Knowledge Representation and Reasoning: Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; Logic Concepts & Logic Programming, Prolog, Understanding of clauses and predicated, Recursion, backtracking and cut. Creating knowledge base using prolog.
Planning: planning as search, partial order planning, construction and use of planning graphs

UNIT-IV

Representing and Reasoning with Uncertain Knowledge: probability, connection to logic, independence, Bayes rule, bayesian networks, probabilistic inference.
Decision-Making: basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications.
Machine Learning and Knowledge Acquisition: learning from memorization, examples, explanation, and exploration. Ethics in AI

Textbooks:

1. Stuart Russel, and Peter Norvig, "Artificial intelligence: A Modern Approach", Pearson Education Limited, 4th Edition, 2010.
2. E. Rich, K. Knight. S. B. Nair, "Artificial lntelligence", McGraw-Hill Publishing Company Limited, New Delhi, 3'd Edition ,2017.

Reference books:

1. Mark Watson, "Practical Artificial lntelligence Programming with Java", Leanpub, 5th Edition, 2020.
2. lvan Bratko, "Prolog Programming for Artificial Intelligence", Pearson Education, 5th Edition, 2011.

MEAD-609 Statistical Methods for Data Science L 4 T/P 0 C 4

Marking Scheme:
Teachers Continuous Evaluation and End Term Theory Examiantion: As per per university examination norms from time to time
Instruction to Paper Setters: **Maximum Marks**: As per University norms

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Course Objectives:

1. To understand the fundamental concepts of statistics, including probability theory, random variables, probability distributions, and statistical inference.
2. To learn about the different types of data and how to describe and summarize data using graphical and numerical methods.
3. To understand the principles of statistical hypothesis testing and how to test hypotheses using appropriate tests and procedures.
4. To develop critical thinking skills and the ability to evaluate statistical claims and arguments in data science.

Course Outcomes:

1. Ability to describe and summarize data using appropriate statistical methods.
2. Ability to design experiments and test hypotheses using appropriate statistical methods.
3. Ability to analyze data using regression models and other statistical techniques.
4. Students will develop solid foundation in statistical methods and be prepared to take more advanced courses in data science or related fields.

Mapping of Course Outcome to Programme Outcome ((scale 1: low, 2: Medium, 3: High)					
CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	3	3	1
CO2	2	3	3	3	1
CO3	3	3	2	2	2
CO4	3	2	3	2	2

UNIT - I

Introduction and types of Data - Basic definitions, Introduction and types of Data: Understanding data, Classification of data, Scales of measurement, Describing Categorical Data - Frequency distributions, Charts of categorical data, Mode and Median
Describing Numerical Data - Frequency Tables for numerical data, Mean, Median and Mode, Measures of dispersion- Range, variance and standard deviation, Percentiles, Quartiles, and Interquartile range
Association between two categorical variables, Relative frequencies, Association between two numerical variables - Scatterplot, Describing association, Covariance, Correlation, Fitting a line, Association between categorical and numerical variables

UNIT - II

Permutation and Combination, Basic Principles of Counting, Probability: Basic Definition, Properties of Probability, Independent exhaustive events, Conditional and Joint Probability, Random Variables, Probability Distribution: discrete and Continuous, Probability Mass Function, Discrete random variables - Cumulative distribution function

UNIT - III

Multiple random variables: Two random variables, Multiple random variables and distributions, Independence, Functions of random variables - Visualization, functions of multiple random variables, Expected value of a random variable, Scatter plots and spread, Variance and standard deviation, Covariance and correlation, Inequalities, Multiple continuous random variables, Jointly Gaussian random variables Probability models for data

UNIT - IV

Estimation and Inference, Bayesian estimation, Hypothesis testing, Time series based Forecasting: Introduction to Time Series, Time Series Analysis, Time Series Forecasting Methods

Textbooks:

1. James G, Witten D, Hastie T, Tibshirani R. An introduction to statistical learning. New York: springer; 2013.
2. Casella G, Berger RL. Statistical inference. Cengage Learning; 2021.

Reference books:

1. Gelman A, Carlin JB, Stern HS, Dunson DB, Vehtari A, Rubin DB. Bayesian data analysis. CRC press; 2013.
2. Levin RI. Statistics for management. Pearson Education India; 2011.