

Nomenclature: **Mathematics**

Semester: 1st

Code: DAI-11-T

Total Marks: 30

Credits: 3+0+0

Important Instructions:

- 1) Attempt all Questions each assignment given below
- 2) Each assignment carries 15 marks
- 3) All questions are to be attempted in legible handwriting on plane white A-4 size paper and upload the scanned copy of the assignments on student's portal

Assignment – I

Q1. Using elementary row transformations reduce the following matrix into echelon form and hence determine its rank. Also check whether the corresponding system of linear equations is consistent or inconsistent:

$$\begin{matrix} 1 & 2 & 3 \\ 2 & 5 & 8 \\ 3 & 8 & 13 \end{matrix}$$

Q2. Find the eigen values and the corresponding Eigen vectors of the matrix

$$A = \begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$$

Also verify the Cayley–Hamilton theorem for the given matrix and hence find the inverse of the matrix using the theorem.

Q3. Reduce the quadratic form $Q = x^2 + 2y^2 + 3z^2 + 2xy + 2yz + 2xz$, into canonical form by using suitable linear transformations. Hence determine the rank, index, and signature of the quadratic form.

Assignment - II

Q1. Find the stationary points of the function $f(x, y) = x^2 + y^2 - 4x - 8y + 20$ and determine whether the points correspond to maxima, minima, or saddle points using the second derivative test.

Q2. State and verify Rolle's Theorem for the function $f(x) = x^2 - 6x + 8$ in the interval $[2, 4]$. Also find the value of c that satisfies the theorem.

Q3. Evaluate the following double integral by changing the order of integration:

$$\int_0^1 \int_y^1 (x + y) dx dy$$

Also sketch the region of integration and express the integral in reversed order.

Nomenclature: **Probability and Statistics**

Semester: 1st

Code: DAI-12-T

Total Marks: 30

Credits: 3+0+0

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Assignment – I

Q1. Define a sample space and explain the concept of events in probability theory with suitable examples. State and explain the axioms of probability. Using these axioms, prove that

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) \text{ for any two events A and B.}$$

Q2. A bag contains 5 red balls, 4 blue balls, and 3 green balls. Two balls are drawn randomly one after another without replacement. Find the probability that:

1. Both balls are red,
 2. One ball is red and the other is blue,
 3. At least one ball is green.
- Also explain whether the events are dependent or independent.

Q3. Explain the concepts of discrete and continuous random variables with suitable examples. A random variable XXX has the following probability mass function:

$$P(X = x) = \begin{cases} k(x + 1), & x = 0, 1, 2, 3 \\ 0, & \text{otherwise} \end{cases}$$

Find:

1. The value of kkk,
2. The probability distribution of X,
3. $P(X \geq 2)$,
4. The mean of the distribution.

Assignment - II

Q1. Explain the characteristics and properties of Binomial, Poisson, and Normal distributions. A machine produces defective items with probability 0.02. In a sample of 100 items, find the probability that exactly 3 items are defective using the Poisson approximation to the Binomial distribution.

Q2. A random sample of 64 observations is taken from a normal population with known standard deviation $\sigma=8$. The sample mean is found to be 52. Test the hypothesis that the population mean is 50 at the 5% level of significance using an appropriate test procedure. Clearly state the null and alternative hypotheses.

Q3. Explain the concepts of Type I and Type II errors in hypothesis testing. A researcher wants to compare the mean marks obtained by two groups of students in Statistics. The marks obtained by the students are given below:

Group A: 45, 50, 48, 52, 49

Group B: 40, 42, 38, 45, 41

Using Student's t-test, determine whether there is a significant difference between the means of the two groups at the 5% level of significance.

Nomenclature: **Data Structure**
Code: DAI-13-T
Credits: 3+0+0

Semester: 1st
Total Marks: 30

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Assignment – I

Q1. Explain the concept of Data Structures and Abstract Data Types (ADT) with suitable examples. Differentiate between linear and non-linear data structures. Also discuss the memory representation of arrays and linked lists along with their advantages and disadvantages.

Q2. Describe the operations performed on arrays and linked lists such as traversal, searching, insertion, and deletion. Write an algorithm to insert an element in a singly linked list at a specified position and explain its working with a suitable example.

Q3. Explain the implementation of stacks and queues using arrays and linked lists. Discuss the applications of stacks in converting infix expressions into postfix expressions. Convert the following infix expression into postfix form and evaluate it:

$$(A+B)*(C-D)/E$$

Assignment - II

Q1. Define a Binary Tree and explain its terminology with suitable diagrams. Describe pre-order, in-order, and post-order traversals of binary trees. Construct a Binary Search Tree (BST) using the following elements and perform in-order traversal:

45, 20, 60, 10, 30, 50, 70

Q2. Explain the representation of graphs using adjacency matrix and adjacency list methods. Discuss the Breadth First Search (BFS) and Depth First Search (DFS) traversal algorithms with suitable examples. Compare BFS and DFS based on their applications and efficiency.

Q3. Explain the working of Bubble Sort, Selection Sort, and Quick Sort algorithms. Sort the following list of numbers using the Quick Sort technique and show all intermediate steps:

45, 12, 78, 34, 23, 90, 11

Also discuss the time complexity of the Quick Sort algorithm in best and worst cases.

Nomenclature: **Introduction to Artificial Intelligence**

Semester: 1st

Code: DAI-14-T

Total Marks: 30

Credits: 3+0+0

Important Instructions:

- 1) Attempt all Questions each assignment given below
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Assignment – I

Q1. Define Artificial Intelligence and discuss its importance in modern applications. Explain the goals and characteristics of AI. Also describe the Turing Test and explain how it is used to determine machine intelligence with suitable examples.

Q2. Explain the concept of problem solving in Artificial Intelligence using state space representation. Describe production systems and their characteristics in detail. Differentiate between informed and uninformed search techniques with suitable examples.

Q3. Discuss the working of Depth First Search (DFS) and Breadth First Search (BFS) algorithms with suitable examples. Compare both algorithms based on memory usage, completeness, optimality, and applications. Also explain the A* algorithm and its advantages in heuristic search.

Assignment - II

Q1. Explain Propositional Logic and Predicate Logic with suitable examples. Discuss the syntax and semantics of propositional logic. Convert the following proposition into conjunctive normal form (CNF):

$$(P \rightarrow Q) \wedge (Q \rightarrow R)$$

Q2. What is Knowledge Representation in Artificial Intelligence? Explain the significance of knowledge representation and discuss Semantic Networks and Frames with suitable examples. Also explain how facts are represented in logic systems.

Q3. Explain the need for probabilistic reasoning in Artificial Intelligence. State and explain Bayes' theorem with suitable examples. A medical test detects a disease correctly in 95% of infected cases and gives a false positive result in 5% of healthy cases. If 2% of the population is infected, find the probability that a person actually has the disease when the test result is positive.

Nomenclature: **Python Programming**

Semester: 2nd

Code: DAI-15-T

Total Marks: 30

Credits: 3+0+0

Important Instructions:

- 1) Attempt all Questions each assignment given below
- 2) Each assignment carries 15 marks
- 3) All questions are to be attempted in legible handwriting on plane white A-4 size paper and upload the scanned copy of the assignments on student's portal

Assignment – I

Q1. Explain the history and features of Python programming language. Discuss Python identifiers, keywords, indentation, comments, operators, and expressions with suitable examples. Also explain the difference between mutable and immutable data types in Python.

Q2. Describe different decision-making statements available in Python with suitable syntax and examples. Write a Python program to check whether a given number is positive, negative, or zero using nested conditional statements and multi-way decision statements.

Q3. Explain the working of loops in Python. Discuss the use of while loop, for loop, nested loops, break, continue, and pass statements with suitable examples. Also write a Python program to print the multiplication table of a number using loops.

Assignment - II

Q1. Explain Python functions and their types with suitable examples. Discuss parameter passing, default arguments, recursion, lambda functions, and modules in Python. Write a recursive Python function to find the factorial of a given number.

Q2. Describe different file handling operations in Python. Explain the use of file modes, read(), readline(), write(), writelines(), and append() functions with examples. Write a Python program to create a text file, write data into it, and display the contents of the file.

Q3. Explain the concept of Object-Oriented Programming in Python. Discuss classes, objects, constructors, inheritance, method overriding, and exception handling with suitable examples. Write a Python program to demonstrate single inheritance and exception handling using try-except blocks.