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C-51

B.Tech. Computer Science & Engineering - AIDS III Semester Examinations (Jun 2026)

Probability & Statistical Methods for Data Science (ASH-MAT-205A)

Time- 3hrs

Max.Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory, and each Question carries 12 marks.

Q.1		Marks
(a)	Explain statistics and discuss its importance and limitations.	2
(b)	Name and explain any two measures of central tendency.	2
(c)	Differentiate between discrete and continuous probability distributions.	2
(d)	Explain exponential distribution.	2
(e)	What is null hypothesis?	2
(f)	Explain the concept of multiple regression analysis and discuss its importance in data science applications.	2

UNIT-I

- Q.2(a) In a smart grid network, two independent substations experience daily voltage spikes represented by independent random variables X and Y , where $E(X)=1.5$, $E(Y)=2.0$, $\text{Var}(X)=0.4$, and $\text{Var}(Y)=0.6$. If the total penalties incurred by the network is modeled by the linear combination $Z = 3X + 4Y - 2$, compute the expected daily penalty ($E(Z)$) and the variance of the penalty ($\text{Var}(Z)$) by applying the algebraic properties of mathematical expectations for independent variables. 6
- Q.2(b) An autonomous drone delivery system tracks the number of sensor anomalies (X) encountered per flight. The discrete random variable X follows the probability mass function given below: 6

X	1	2	3	4
P(X)	0.1	0.5	0.3	0.1

Compute the expected number of micro-surges $E(X)$, the value of $E(X^2)$, and the variance $\text{Var}(X)$ of the grid system.

- Q.3 A government plans to collect data on income levels. 12
- Define census method and sampling method.
 - Compare both methods.
 - State advantages and disadvantages of each.
 - Suggest which method is suitable for:
 - National census
 - Market research

UNIT-II

- Q.4 Describe exponential distribution. Let a random variable X follows an exponential distribution with $\lambda=0.5$. Find 12

- (i) $P(X > 4)$.
- (ii) $P(2 < X < 6)$.
- (iii) Compute mean and variance.
- (iv) Verify memoryless property with an example for above distribution.

- Q.5** A machine produces items independently, each being defective with probability 0.1. Let X be the trial number of the first defective item. **12**
1. Find the probability that:
 - (a) the first defective occurs on the 4th trial
 - (b) no defective item occurs in first 5 trials.
 2. Find the expected number of trials to get the first defective.
 3. Given no defect in first 3 items, find probability that first defect occurs after 5 trials.

UNIT-III

- Q.6** Write the steps involved in testing of hypothesis for population mean. The melting point of each of 16 samples of a certain brand of hydrogenated vegetable oil was determined, resulting in $\bar{x} = 94.32$. Assume that the distribution of the melting point is normal with $\sigma = 1.20$. **12**
- (i) Test $H_0: \mu = 95$ versus $H_a: \mu \neq 95$ using a two-tailed level 0.01 test.
 - (ii). If a level 0.01 test is used, what is $\beta(94)$, the probability of a type II error when $\mu = 94$?

- Q.7(a)** Analysis of a random sample consisting of $m=20$ specimens of cold-rolled steel to determine yield strengths resulted in a sample average strength of $\bar{x} = 29.8$ ksi. A second random sample of $n=25$ two-sided galvanized steel specimens gave a sample average strength of $\bar{y} = 34.7$ ksi. Assuming that the two yield-strength distributions are normal with $\sigma_1=4.0$ and $\sigma_2=5.0$, does the data indicate that the corresponding true average yield strengths μ_1 and μ_2 are different? Carry out a test at significance level $\alpha=0.01$. (Given $Z_{0.005} = -2.58$). **6**

- Q.7(b)** What is Analysis of Variance (ANOVA)? State the main assumptions of ANOVA and explain the basic idea behind one-way ANOVA. **6**

UNIT-IV

- Q.8** Explain the difference between simple and partial correlation and State conditions when partial correlation is zero. **12**

Let X , Y , and Z denote marks in Mathematics, Physics and English, respectively. The correlation coefficients are: $r_{XY}=0.8$, $r_{XZ}=0.6$, $r_{YZ}=0.5$

- (i) Compute the partial correlation between X and Y controlling for Z .
- (ii) Interpret the result.

- Q.9** Explain why a polynomial regression model may be preferred over a linear model. Write the general form of a polynomial regression model of degree n . Discuss advantages and limitations of higher-degree polynomial models. Further, Let X denote temperature ($^{\circ}\text{C}$) and Y denote yield of a chemical process. A quadratic regression model is fitted as $\hat{y} = 5 + 2x - 0.1x^2$ **12**
- i. Find the predicted yield when temperature is 10°C .
 - ii. Determine the temperature at which the yield is maximum.

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B.Tech. Computer Science & Engineering - AIDS III Semester Examinations (June 2026)
Data Structures (BT-AIDS-201A)

Time- 3hrs
Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

	Marks
Q.1	
(a) What is recursion? Mention one advantage and one limitation of recursion.	2
(b) Define multidimensional array and give one example of its use.	2
(c) What are stack overflow and stack underflow?	2
(d) Write any two differences between linear queue and priority queue.	2
(e) Define circular linked list. State one situation where it is useful.	2
(f) Differentiate between directed graph and undirected graph.	2
UNIT I	
Q.2(a) Analyze the best, average and worst-case complexities of linear search. Explain why binary search requires a sorted array.	6
Q.2(b) Sort the array 64, 25, 12, 22, 11 using insertion sort and show the array after each pass.	6
Q.3 Explain row-major and column-major address calculation for two-dimensional arrays. Find the address of A[3][4] for a 5 x 6 integer array with base address 1000 and element size 4 bytes using row-major order.	12
UNIT II	
Q.4 Explain evaluation of postfix expressions using stack. Evaluate the postfix expression 5 3 2 * + 9 3 / - step by step.	12
Q.5(a) Write and explain the partition procedure used in quick sort. Apply the first partition step on 30, 10, 80, 40, 20, 70 using the first element as pivot.	6
Q.5(b) Describe sequential implementation of a linear queue. Write algorithms for ENQUEUE and DEQUEUE operations and explain the limitation of simple linear queue.	6
UNIT III	
Q.6 Write algorithms to traverse a singly linked list, insert a node after a given key, and delete a node with a given key. Explain each step clearly.	12
Q.7(a) Explain dynamic implementation of stack using linked list. Write algorithms for PUSH and POP operations.	6
Q.7(b) Compare singly linked list, doubly linked list and circular linked list on the basis of memory requirement, traversal facility and insertion/deletion flexibility.	6
UNIT IV	
Q.8 Explain binary tree representation using linked nodes. Construct an expression tree for (A+B)*(C-D) and write its prefix and postfix expressions.	12

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- Q.9(a)** Define AVL tree. Insert the keys 30, 20, 10, 25, 40, 50 into an AVL tree and show rotations wherever required. **6**
- Q.9(b)** Explain DFS traversal algorithm. For a graph of your choice with at least six vertices, write adjacency list representation and perform DFS traversal. **6**

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B.Tech. Computer Science & Engineering - AIDS III Semester Examinations (June 2026)
Database Management System (BT-AIDS-203A)

Time- 3hrs

Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1	Marks
(a) Explain the advantages of DBMS over file processing systems.	2
(b) Explain the term candidate key.	2
(c) What undesirable dependencies are avoided when a relation is in 2NF?	2
(d) Explain the meaning of existential quantifiers.	2
(e) What is serializability? Why is it required?	2
(f) Explain the technique of shadow paging for recovery.	2

UNIT-I

Q.2(a)	Explain data models in DBMS. Compare relational and hierarchical data model.	6
Q.2(b)	Explain specialization and generalization with example diagrams.	6
Q.3(a)	Define the terms: Recursive relationship, foreign key, weak entity type	6
Q.3(b)	Construct an ER diagram for university registrar's office. The office maintains data about each class, including the instructor, the enrollment and the time and place of the class meetings. For each student class pair a grade is recorded. Determine the entities and relationships.	6

UNIT-II

Q.4(a)	Explain different integrity constraints in DBMS	6
Q.4(b)	Explain how SQL triggers work along with their advantages and disadvantages	6
Q.5(a)	Explain the difference between DDL, DML different database languages.	3
Q.5(b)	Consider the following schema: Suppliers (sid, sname, address); Parts (pid, pname, color); Catalog (sid, pid, cost) Write the relational algebraic queries for the following: i) Find the sids of suppliers who supply some red or green part ii) Find the sids of suppliers who supply every red or green part iii) Find the pids of parts supplied by at least two different suppliers	9

UNIT-III

Q.6(a)	Given a relation R with 5 attributes ABCDE and the following FDs: A->B, BC->E, and ED->A. Is R in 3NF? Justify	6
Q.6(b)	What is minimal cover? Explain for a set of functional dependencies {AB->C, C->A, BC->D, ACD->B, BE->C, EC->FA, CF->BD, D->E} Find the	6

- minimal cover.
- Q.7(a) Differentiate between 4NF and 5NF. 6
- Q.7(b) Explain lossless decomposition. Give conditions for lossless join decomposition 6

UNIT-IV

- Q.8(a) What is time stamp? How the system generates the time stamp? Explain the time stamp ordering protocol for concurrency control 8
- Q.8(b) What is immediate update technique? 4
- Q.9(a) Explain Two-Phase Locking (2PL) protocol and strict 2PL with example 6
- Q.9(b) Write detailed note on log-based recovery. 6

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B.Tech. Computer Science & Engineering - AIDS III Semester Examinations (June 2026)
Foundations of Data Science (BT-AIDS-205A)

Time- 3hrs

Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1	Marks
(a) List out the lifecycle of Data Science.	2
(b) Explain Relative and cumulative frequency distribution.	2
(c) Classify the types of relationships in the Scatterplots.	2
(d) Demonstrate a positive and negative correlation.	2
(e) What is data? List the three types of data.	2
(f) How the operations can be performed on null values in pandas data science?	2

UNIT-I

Q.2(a)	Define Data mining and construct the architecture in detail.	6
Q.2(b)	Show the Exploratory data analysis with an example.	6
Q.3	Analyze and explain about data warehousing. Discuss the advantages and disadvantages of data repositories.	12

UNIT-II

Q.4	Discover the Mean and Median for the following retirement ages: 60, 63, 45, 63, 65, 70, 55, 63, 60, 65, 63.	12
Q.5(a)	Classify the types of frequency distribution with examples.	6
Q.5(b)	Discuss in detail about the graph for qualitative (nominal) data.	6

UNIT-III

Q.6	Analyze briefly about Positive, Negative, Little or No Relationship in the scatter plot with an example.	12
Q.7(a)	Assess a detailed sketch of the Least Squares Regression Line.	6
Q.7(b)	Examine the concept of Interpretation of r^2 with an example.	6

UNIT-IV

Q.8	What is an aggregate function? Elaborate about the aggregate functions in NumPy.	12
Q.9(a)	Explain how aggregation, grouping and data pivoting can be performed with Pandas.	6
Q.9(b)	Explain the various techniques that can be used for handling different levels of missing data.	6

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B.Tech. Computer Science & Engineering -AIDS IV Semester Examinations (Jun 2026)
Probabilistic Modelling & Optimization for Data Analytics (ASH-MAT-206A)

Time- 3hrs

Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1	Marks
(a) Define Markov chain simulation.	2
(b) Define Linear programming problems with examples.	2
(c) State Bayes' Law and explain its significance in data analysis.	2
(d) Differentiate between Direct and Gradient search methods.	2
(e) Define convex region. Define slack and surplus variables.	2
(f) Define feasible solution and basic feasible solution.	2

UNIT-I

Q.2(a)	Explain the three steps of Bayesian Data Analysis framework in detail. Illustrate with an example.	6
Q.2(b)	What is Bayesian Interference? How does it work? Discuss.	6
Q.3(a)	Discuss the role of posterior predictive checking in applied Bayesian statistics.	6
Q 3(b)	What is discrete probability? Explain with an example.	6

UNIT-II

Q.4(a)	Explain the Gibbs sampling algorithm in detail. Provide a worked example in R or pseudocode.	6
Q.4(b)	Discuss the Metropolis-Hastings algorithm and its advantages in Bayesian computation.	6
Q.5(a)	Explain hierarchical linear models with varying intercepts and slopes. How do they differ from classical regression?	6
Q.5(b)	Discuss weakly informative priors in logistic regression and their practical importance.	6

UNIT-III

Q.6	Minimize $f = x_1^2 + 2x_2^2 + 3x_3^2$, Subject to: $g_1 = x_1 - x_2 - 2x_3 \leq 12$ $g_2 = x_1 + 2x_2 - 3x_3 \leq 8$, using Kuhn Tucker conditions, find the optimal solution.	12
Q.7(a)	State the significance of search methods. Under what conditions are search methods preferred over classical methods to solve optimization problems?	6
Q.7(b)	Find the extreme values of the function $f(x) = 12x^5 - 45x^4 + 40x^3 + 5$.	6

UNIT-IV

- Q.8** Solve the following Linear Programming Problem using the Simplex Method Maximize $Z = 3x_1 + 2x_2$, Subject to: $2x_1 + x_2 \leq 18$, $x_1 + 2x_2 \leq 12$, $x_1, x_2 \geq 0$ **12**
- Q.9(a)** Define balanced and unbalanced transportation problems. Give the mathematical formulation of the transportation problem. **6**
- Q.9(b)** Find the initial basic feasible solution for the unit cost matrix provided below: **6**

Sources	L ₁	L ₂	L ₃	L ₄	L ₅	Supply
M ₁	5	3	6	8	9	21
M ₂	10	2	8	5	5	30
M ₃	6	11	20	40	3	14
M ₄	1	2	9	14	16	13
Demand	40	6	8	18	6	78

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B.Tech. Computer Science & Engineering – AIDS IV Semester Examinations (Jun 2026)
Data Science with R Programming (BT-AIDS-202A)

Time- 3hrs
Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1		Marks
(a)	Define Data Science and explain the role of a Data Scientist.	2
(b)	Differentiate between structured, semi-structured, and unstructured data with examples.	2
(c)	Explain vectors and data frames in R with suitable examples.	2
(d)	What is data wrangling? Mention any four functions of dplyr package.	2
(e)	Differentiate between supervised and unsupervised learning.	2
(f)	What is Precision and Recall in machine learning?	2

UNIT-I

Q.2(a)	Explain Data Analytics Life Cycle with neat diagram.	6
Q.2(b)	Discuss measures of central tendency and dispersion with examples.	6
Q.3(a)	Explain Bayes' Theorem and Conditional Probability with suitable example.	6
Q.3(b)	Describe different sources of data used in Data Science applications.	6

UNIT-II

Q.4	Explain R data types in detail. Write R programs to demonstrate vectors, lists, factors, and data frames.	12
Q.5(a)	Explain control structures in R with syntax and examples.	6
Q.5(b)	Discuss debugging tools in R such as traceback(), browser(), debug(), and tryCatch().	6

UNIT-III

Q.6	Explain the complete Data Analysis Pipeline. Discuss data wrangling and feature engineering using R packages.	12
Q.7(a)	Explain outlier detection and exploratory data analysis techniques.	6
Q.7(b)	Write short notes on ggplot2 and explain the creation of any three plots in R.	6

UNIT-IV

Q.8	Explain Random Forest and Support Vector Machine algorithms with suitable examples.	12
Q.9(a)	Explain K-Means clustering and Hierarchical clustering with suitable examples.	6
Q.9(b)	Explain Confusion Matrix, Accuracy, Precision, Recall, F1-score, ROC Curve, and AUC.	6

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D-53

B.Tech. Computer Science & Engineering – AI&DS IV Semester Examinations (Jun 2026)
Foundations of Artificial Intelligence & Machine Learning (BT-AIDS-204A)

Time- 3hrs

Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1	Marks
(a) Describe Artificial Intelligence and mention any two applications of AI.	2
(b) Explain the Intelligent Agent? Explain the concept of Agent and Environment.	2
(c) Identify the purpose of scripts in Artificial Intelligence.	2
(d) Explain State Modus Ponens and State Modus Tollens.	2
(e) Describe the Non-Monotonic Reasoning?	2
(f) Describe how Machine Learning works.	2

UNIT-I

Q.2(a)	Write the algorithm of Hill climbing search. Discuss its Pros & Cons?	6
Q.2(b)	Explain the production systems in AI? Discuss their components and differentiate between commutative and noncommutative production systems.	6
Q.3	Analyzing the Heuristic Search Techniques in Artificial Intelligence. Describe the following methods with suitable examples and algorithms: a) A*, b) Best-First Search	12

UNIT-II

Q.4	Applying the alpha-beta pruning and how does it optimize the min-max algorithm for game playing with examples.	12
Q.5(a)	Explain Knowledge Representation in Artificial Intelligence. Compare Propositional Logic and First Order Logic with suitable examples	6
Q.5(b)	Analyze a rule-based system and determine whether forward or backward chaining is more efficient. Justify your answer with reasoning.	6

UNIT-III

Q.6	Explain Semantic Nets in detail. Also differentiate between slots, exceptions, default frames and scripts with suitable examples.	12
Q.7(a)	Draw the respective graphs for Fuzzy Logic based on its type and discuss Fuzzy Logic in detail with suitable examples.	6
Q.7(b)	Briefly explain monotonic reasoning. Discuss Probabilistic reasoning and use of certainty factors with real life examples.	6

UNIT-IV

- Q.8** Analyze the concept of Machine Learning in detail. Discuss its forms (Supervised, Unsupervised, and Reinforcement Learning) with suitable examples. Also explain what is meant by a well-posed machine learning problem. **12**

OR

- Q.9(a)** Explain the concept of clustering in Machine Learning. Discuss different types of clustering techniques. **6**
- Q.9(b)** Describe the Collaborative Filtering? Explain user-based and item-based collaborative filtering techniques with suitable examples. **6**

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B.Tech. Computer Science & Engineering - AIDS IV Semester Examinations (Jun 2026)
Object Oriented Programming using Java (BT-AIDS-206A)

Time- 3hrs

Max. Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1	Marks
(a) What is the role of JVM in Java program execution?	2
(b) What is the use of the static keyword in Java?	2
(c) State any two differences between abstract classes and interfaces.	2
(d) What is synchronization in multithreading?	2
(e) List any four Java buzzwords.	2
(f) What is the purpose of event listeners in Swing event handling?	2

UNIT-I

Q.2(a)	Explain OOP principles with real-world examples and demonstrate the use of arrays in Java.	6
Q.2(b)	Develop a Java program using packages and access specifiers for employee management.	6
Q.3	Evaluate the role of abstract classes and interfaces in achieving abstraction and flexibility in Java applications	12

UNIT-II

Q.4	Create a multithreaded Java application using Thread class and Runnable interface with synchronization.	12
Q.5(a)	Analyze built-in exceptions and their handling mechanisms in Java.	6
Q.5(b)	Evaluate the effectiveness of synchronization techniques in preventing race conditions.	6

UNIT-III

Q.6	Implement a Java program demonstrating polymorphism and collection interfaces List, Set and Map.	12
Q.7(a)	Analyze different types of inheritance with suitable class diagrams and examples.	6
Q.7(b)	Evaluate the significance of Java Collection Framework in enterprise applications.	6

UNIT-IV

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|---------------|--|-----------|
| Q.8 | Develop a Java applet demonstrating event handling and usage of JCheckBox and JRadioButton controls. | 12 |
| Q.9(a) | Analyze the working of applet lifecycle methods with suitable examples. | 6 |
| Q.9(b) | Evaluate Swing GUI programming techniques for modern desktop applications. | 6 |
