END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE 2024
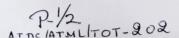
Paper Code: AIDS/AIML/IOT-202   Subject: Object Oriented Programming

Time: 3 Hours   Maximum Marks: 75

Note: Attempt all questions as directed. Internal choice is indicated.

Q1   Attempt **any Five** of the following questions: **(5x5=25)**

a)   What is the role of the ClassLoader in the Java Sandbox model? How does the Sandbox model contribute to overall security and flexibility in Java applications?

b)   Create a Java class that has both static and non-static variables as well as methods. Illustrate how these members can be accessed from the main method.

c)   Analyze the pros and cons of using anonymous inner classes in Java. Elaborate with the help of examples where anonymous inner classes are commonly used.

d)   Describe the lifecycle of a thread in Java. Discuss all the different states of a thread with the help of an example and explain how a thread transitions from one state to another.

e)   What is the difference between final, finally, and finalize keywords in Java? Design a Java program that demonstrates the usage of the final keyword for variable, method, and class.

f)   Differentiate between byte-oriented and character-oriented I/O streams in Java. Provide examples of when byte-oriented streams are more suitable and when character-oriented streams are preferred in different scenarios.

g)   Explain the role of Socket and ServerSocket classes in Java for implementing the Client-Server application. Demonstrate how these classes are used with the help of an example.

h)   Write a program in Java to find the longest word in a given sentence.

i)   Can we access the same name variable which is defined in two different interfaces that are implemented by the same class? Explain how?

Q2   Discuss the main features of object-oriented programming. Explain how each feature contributes to code reusability, maintainability, and scalability. Provide examples in Java to illustrate each feature.   **(12.5)**

OR

Q3   Describe the life cycle of a Java program starting from source code to execution within the JVM. Discuss how each stage ensures the correct and efficient running of Java applications.   **(12.5)**

Q4   Explain the role and significance of the Set, List, and Map interfaces in the Java Collections Framework. Write a Java program that demonstrates the use of Set, List, and Map interfaces. Use *Iterator* to iterate over the elements of a HashSet, an ArrayList, and a HashMap. Add and remove elements, and show how iteration is performed.   **(12.5)**

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END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE 2024

Paper Code: AIDS/AIML/IOT-204   **Subject:** *Database Management Systems*

Time: 3 Hours   *Maximum Marks: 75*

Note: Attempt five questions in all including Q.No.1 which is compulsory.
Select one question from each unit.

Q1 Attempt any Five   [3x5=15]

a) Explain the concept of generalization and aggregation with the help of suitable example.

b) Describe the role of the database administrator (DBA) in managing and maintaining a database system.

c) What is the difference between primary key, candidate key and super key?

d) What is PostgreSQL? List its key features.

e) What are Armstrongs Axioms?

f) Explain the three components of the CAP Theorem: Consistency, Availability, and Partition Tolerance.

UNIT-I

Q2
a) Discuss the main characteristics of the database approach. How it differs from traditional file systems.   [6]

b) Differentiate hierarchical, network, and relational data models in terms of their structure and relationships.   [9]

Q3
a) Explain the architectural components of a DBMS and provide a detailed illustration. How the concept of data independence worked with it. Explain physical and logical data independence.   [6]

b) Draw an ER diagram for a company having following description: [9]
   i) There are several departments in a company and each department play have several locations.
   ii) A manager controls a particular department,
   iii) Each department is associated with number of projects.
   iv) An employee work in only one department but can work on several projects.

UNIT-II

Q4
a) Give expression in relational algebra and SQL to express following queries.
   employee (person-name, street, city)
   works (person-name, company-name, salary)
   company (company-name, city)
   manages (person-name, manager-name)   [6x2.5=15]
   i) Find the names of all employees who work for First Bank Corporation
   ii) Find the names and cities of residence of all employees who work for First Bank Corporation.
   iii) Find the names, street address, and cities of residence of all employees who work for First Bank Corporation and ear more than $10,000 per annum.
   iv) Find the names of all employees in the database who live in the same city as the company for which they work.
   v) Find the names of all employees who live in the same city and on the same street as do their managers.
   vi) Find the names of all employees in this database who do not work for First Bank Corporation.

Q5
a) ... PL/SQL and explain its role in database programming with the help of ... able example.   [5]

b) Discuss DB2. Explain its key features.   [5]

c) Explain architecture of MySQL.   [5]

UNIT-III

Q6
a) What is functional dependencies? What are various types of functional dependencies? Explain with the help of suitable example.   [8]

b) Consider a relation R (A, B, C, D, E, F, G) with the functional dependencies-   [7]
   A → BC
   BC → DE
   D → F
   CF → G
   Find A+, D+, BC+. Is the relation R

Q7
a) What is serializability? Explain two types of serializability.   [7]

b) Describe the two-phase locking protocol. How it ensures serializability?   [8]

UNIT-IV

Q8
a) What are the key features of object-oriented databases?   [5]

b) What is a web database, and how is it used in web applications?   [5]

c) Differentiate between single-level indexes and multi-level indexes with the help of suitable examples.   [5]

Q9
a) What is a data warehouse, and how does it differ from a traditional database?   [7]

b) What is MongoDB? How it is different from NoSQL databases? Explain key features of MongoDB.   [8]

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END TERM EXAMINATION

FOURTH SEMESTER [B.Tech] JUNE 2024

Paper Code: AIDS/AIML/IOT-206   **Subject: Software Engineering**

Time: 3 Hours   **Maximum Marks: 75**

Note: Attempt five questions in all including Q.No.1 which is compulsory. Select one question from each unit. Only scientific calculators are allowed.

Q1   Answer all the following with precise justification: -

   a) Software does not "wear out" but it does deteriorate. **[2.5]**

   b) A review of the SRS (and/or prototype) is conducted by both the software developer and the customer. **[2.5]**

   c) A design should lead to components that exhibit independent functional characteristics. **[2.5]**

   d) Risk identification is a systematic attempt to specify threats to the project plan. **[2.5]**

   e) Context diagram shows the system boundaries, external entities that interact with the system, and major information flows between entities and the system. **[2.5]**

   f) A failure is said to occur if the observable outcome of a program execution is different from the expected outcome. **[2.5]**

UNIT-I

Q2   a) Why do you need a software process model? Discuss SPIRAL life cycle model in detail. **[7.5]**

   b) What do you think are the major issues the software industry is facing today? Briefly discuss the software evolution during the period from 1950 to 1995. **[7.5]**

Q3   a) Write short notes on any three:
(i) Waterfall Model (ii) Incremental Model (iii) Generic Process Model (iv) State Transition Diagrams. **[7.5]**

   b) A project size of 200 KLOC is to be developed. The software development team has average experience on similar types of projects. The project schedule is not very tight. Calculate the Effort, development time, average staff size, and productivity of the project. **[7.5]**

UNIT-II

Q4   a) Explain with an example diagram the functional and behavioral modeling. How do we model the software's reaction to some external event? **[7.5]**

   b) Discuss the term requirement engineering? List the techniques to elicit the requirements. Why requirements elicitation process is difficult? **[7.5]**

Q5   a) Draw ER diagram and DFD level-1 for automation of Stock Management System also mention the requirements, which you have considered for a typical Stock Management System. **[7.5]**

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[2]

   b) Compare evolutionary and throw away prototyping? What is meant by Information flow Continuity? Explain with an example? **[7.5]**

UNIT -3

Q6   a) State different architectural styles that exist for software. Explain any one software architecture in detail. **[7.5]**

   b) Explain automated testing tools. How are test cases generated? Discuss when to stop testing? **[7.5]**

Q7   a) What is transform mapping? Explain the process with an illustration. What are its strengths and weaknesses? **[7.5]**

   b) Discuss the differences between Black box and White box testing? Describe how RST (Reflexive, Symmetric, and Transitivity) is related to black box testing? **[7.5]**

UNIT-IV

Q8   a) Justify the statement "Software maintenance is costlier". Discuss various forms of software maintenance in detail? **[7.5]**

   b) How software reliability is different from hardware reliability? Discuss any two software reliability models with examples. **[7.5]**

Q9   a) Differentiate between the term product quality and the process quality with respect to software also discuss the key process areas at the various levels of SEI-CMM. **[7.5]**

   b) Explain metrics? Describe two metrics which are used to measure the software in detail. Clearly discuss the advantages and disadvantages of these metrics. **[7.5]**

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END TERM EXAMINATION

FOURTH SEMESTER [B. TECH] JUNE 2024

Paper Code: AIDS/AIML/IOT-208

Subject: Computer Networks & Internet Protocol

Time: 3 Hours

Maximum Marks: 75

Note: Attempt five questions in all including Q.No.1 which is compulsory. Select one question from each unit. Only scientific calculators are allowed.

Q1 Answer all the parts:

a)	Why is layering done in networks?	[2.5]
b)	List the two types of data frames in FDDI?	[2.5]
c)	Discuss Optimality principle?	[2.5]
d)	Differentiate between FTP and SMTP?	[2.5]
e)	Differentiate between LAN, MAN and WAN?	[2.5]
f)	Explain the following terms: (a) Routing (b) Firewalls	[2.5]

UNIT-I

Q2
a) Compare Connection oriented and connectionless services. Explain the functions and protocols and services of each layer? [7.5]

b) What are the different types of networks? Explain in detail [7.5]

Q3
a) Explain the ISO-OSI model of computer network with a neat diagram. Explain about coaxial cable and fiber optics media for communication. [7.5]

b) What is network topology? Explain the different network topologies. [7.5]

UNIT-II

Q4
a) Explain in detail the error detection and error corrections. What is the advantage of FDDI over a basic token ring? [7.5]

b) Explain the working of carrier sense multiple access protocol and MAC layer functions of IEEE 802.11? [7.5]

Q5
a) What is necessary for framing? Explain the role of protocols in Data link layer? [7.5]

b) What is Shannon capacity for Noisy Channel? Explain AM, FM and PM. [7.5]

UNIT-III

Q6
a) Describe the distance vector routing algorithm. Mention the limitations of distance vector routing algorithm. [7.5]

b) What is the need of congestion control algorithm? Mention its advantages and disadvantages over Flow based routing algorithm? [7.5]

Q7
a) Explain the building and distribution of link state packets in link state routing algorithm. Also mention the advantages of link state routing algorithm over distance vector routing algorithm. [7.5]

[2]

b) Differentiate between flooding and broadcasting? Also discuss Datagram approach? [7.5]

UNIT-IV

Q8
a) Explain the duties of the Transport layer. Discuss how simple mail transfer protocol (SMTP) works? Can multimedia messages be transmitted using SMTP? Discuss. [7.5]

b) What are the services provided by transport layer protocol? What is the difference between network service and transport service? List some of the Quality-of-service parameters of transport layer? Mention the methods to improve Qos? [7.5]

Q9
a) What is synchronization? Why it is necessary? Compare IPV4 and IPV6? What is the need for IPV6 Addressing? [7.5]

b) Write a short note on the following: - [7.5]
i) Security Management
ii) SNMP
iii) Internet Transport Protocols

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END TERM EXAMINATION ●

FOURTH SEMESTER [B.TECH] JUNE 2024

Paper Code: AIDS/AIML/IOT-210   Subject: **Fundamentals of Machine Learning**

Time: 3 Hours   **Maximum Marks: 75**

Note: Attempt five questions in all including Q.No.1 which is compulsory.
Select one question from each unit. Assume missing data, if any.

Q1
(a) Explain the terms Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning in short? **(1.5)**
(b) What are the different types of Learning/ Training models in ML? **(1.5)**
(c) List all assumptions for data to be met before starting with linear regression? **(1.5)**
(d) How are covariance and correlation different from one another? **(1.5)**
(e) If your dataset is suffering from high variance, how would you handle it? **(1.5)**
(f) What is the difference between stochastic gradient descent (SGD) and gradient descent (GD)? **(1.5)**
(g) What do you mean by Fuzzy c means clustering? **(1.5)**
(h) What do you understand by DQN? **(1.5)**
(i) What are the performance metrics that can be used to estimate the efficiency of a linear regression model? **(1.5)**
(j) There are many machine learning algorithms till now. If given a data set, how can one determine which algorithm to be used for that? **(1.5)**

UNIT-I

Q2
(a) What is Bias, Variance and their trade off? When does regularization (L1, L2) come into play in Machine Learning and how it is different from normalization? **(7.5)**
(b) Mention why feature engineering is important in model building and list out some of the techniques used for feature engineering. What are outliers and mention three methods to deal with outliers. **(7.5)**

Q3
(a) How would you handle an imbalanced dataset? How do you deal with the class imbalance in a classification problem? **(7.5)**
(b) Differentiate between K-Means and KNN algorithms? Are both same types of Learning? Explain in detail with examples **(7.5)**

UNIT-II

Q4
(a) Explain One-hot encoding and Label Encoding. How do they affect the dimensionality of the given dataset? Does Principle Component Analysis do same and how it is different from LDA **(9)**
(b) What's the difference between Type I and Type II error? What do you mean by the ROC And AUC curves. **(6)**

[2]

Q5
(a) ... is the difference between the normal soft margin SVM and SVM with a linear kernel? What is Kernel Trick in an SVM Algorithm? What is the significance of Gamma and Regularization in SVM? List popular kernels used in SVM along with a mention of their applications. **(8)**
(b) Why boosting is a more stable algorithm as compared to other ensemble algorithms? Why does XG Boost perform better than SVM? What is OOB error and how does it occur? **(7)**

UNIT-III

Q6
(a) What is Bayes' Theorem? State at least 1 use case with respect to the machine learning context? What do the terms prior probability and marginal likelihood in context of Naive Bayes theorem mean? Are Gaussian Naive Bayes the same as binormal Naive Bayes? **(8)**
(b) How would you define the number of clusters in a clustering algorithm? How Gaussian Mixture model works using Expectation Maximization algorithm? **(7)**

Q7
(a) What is a confusion matrix and why do you need it? Define precision, recall and F1 Score? Model accuracy or Model performance? Which one will you prefer and why? **(8)**
(b) List the most popular distribution curves along with scenarios where you will use them in an algorithm. **(7)**

UNIT-IV

Q8
(a) List the advantages and limitations of the Temporal Difference Learning Method? **(8)**
(b) Explain Markov decision process and use of bellman equations in learning? **(7)**

Q9
(a) What do you mean by Associative Rule Mining (ARM)? Explain Apriori algorithm with real life example of some dataset **(8)**
(b) How do you select important variables while working on a data set? What is log likelihood and How would you evaluate a logistic regression model? **(7)**

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END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE-2024

Paper Code: AIDS/AIML/IOT-212 **Subject: Computational Methods**

Time: 3 Hours

Maximum Marks:75

Note: Attempt five questions in all including. Q. no. 1 which is compulsory. Select one question from each unit.

Q1 Attempt **any Five** of the following questions: **(5×5=25)**

(a) (i) What is a transcendental equation. Give example.
(ii) What is meant by simple and multiple roots of an equation. Give examples of each.

(b) Taking initial approximation $x_0 = 2$, perform two iterations of Newton-Raphson method to obtain the approximate value of $(18)^{\frac{1}{3}}$ (cube root of 18).

(c) Using LU decomposition with L as the lower triangular matrix and U as the upper triangular matrix to solve the following system of equations. Take U with diagonal entries 1

$$x + y + z = 1, 4x + 3y - z = 6, 3x + 5y + 3z = 4$$

(d) Obtain piecewise linear interpolating polynomials for $f(x)$ using the following data:

x	1	2	4	8
$f(x)$	3	7	21	73

(e) Find the approximate value of α such that the value of $\int_0^1 \frac{\alpha}{1+x} dx$ using trapezoidal rule with step length $h = 0.2$ is 3.

(f) Obtain approximate value of $f'(-3)$ with step size $h = 1$, and $h = \frac{1}{2}$ using the method

$$f'(x_0) = \frac{-3f(x_0)+4f(x_1)-f(x_2)}{2h}$$ for the following data:

x	-3	-2.5	-2	-1
$f(x)$	-25	-14.125	-7	-1

(g) Use Euler method to find $y(0.9)$ for the problem $3\frac{dy}{dx} + 5y^2 = sinx, y(0.3) = 5$ with step length $h = 0.3$.

(h) Consider the boundary value problem $\frac{d^2y}{dx^2} = 4(y - x), 0 \leq x \leq 1, y(0) = 0, y(1) = 2$. Use finite difference method to approximate the solution of the ODE with step size $h = 1/2$.

Q2 (a) Perform three iterations of bisection method to obtain a root of

$$f(x) = cos(x) - xe^x = 0: \qquad \textbf{(6)}$$

(b) Use fixed point iteration method to find a positive root, between 0 and 1, of equation

$xe^x = 1$. Start with initial iteration $x_0 = 1$. Perform 3 iterations. **(6.5)**

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P-1/3
AIDS/AIM4IOT-212

UNIT-I

Q3 (a) Given that a real root of $f(x) = x^3 - 5x + 1 = 0$ lies in the interval $(0,1)$, perform 3 iterations of the following method to obtain this root **(12.5)**

    (i) Secant method

    (ii) Regula-Falsi method

    (iii) Newton-Raphson method with initial approximation $x_0 = 0.5$

UNIT-II

Q4 (a) Use Lagrange interpolation to find a polynomial that passes through the following data points: **(6)**

x	0	1	3	4
$f(x)$	-20	-12	-20	-24

    (b) Solve the following system of equation using Gaussian elimination method: **(6.5)**

$$x + 3y + 5z = 2, \ 2x + y + z = 7, \ 3x + 2y + 4z = 7$$

Q5 (a) Apply two iterations of Gauss-Siedal method with initial approximation $(x^0, y^0, z^0) = (1,0,1)$ for the following system of equation **(4)**

$$12x + 3y - 5z = 1, \ x + 5y + 3z = 28, \ 3x + 7y + 13z = 76.$$

    (b) Find inverse of the following matrix using Cholesky decomposition: **(8.5)**

$$\begin{pmatrix} 1 & 2 & 3 \\ 2 & 8 & 22 \\ 3 & 22 & 82 \end{pmatrix}$$

UNIT-III

Q6 (a) Compute $\int_0^4 \sqrt{1 + 5x^2} \, dx$ using Gaussian quadrature rule with $n = 2$, where n is the number of nodal points. **(4)**

    (b) Find approximate value of $\int_0^2 x^2 e^{-x} by$ taking six subintervals using

    (i) Trapezoidal rule (ii) Simpson's 1/3 rule. **(3.5+5)**

Q7 (a) Find the Jacobian matrix for the system of equations: **(8)**

$$f_1(x,y) = x^2 + y^2 - x = 0,$$
$$f_2(x,y) = x^2 - y^2 - y = 0$$

at the point $(1,1)$ using the methods:

$$\frac{\partial f}{\partial x} = \frac{f_{i+j} - f_{i-j}}{2h}, \ \frac{\partial f}{\partial y} = \frac{f_{i,j+1} - f_{i,j-1}}{2k}$$ at the point (x_i, y_i) with $h = k = 1$.

    (b) Obtain approximate value of $f''(-1)$ using the method $f''(x_0) = \frac{f(x_0) - 2f(x_1) + f(x_2)}{h^2}$ with $h = 1$ for the following data: **(4.5)**

x	-1	-0.5	0	1
$f(x)$	2.7183	1.6487	1	0.3679

UNIT-IV

Q8 (a) Consider $\frac{dy}{dx} = y(1 + x^2), y(0) = 1$. Using the method $y_{i+1} = y_i + hf(x_{i+1}, y_{i+1})$. Find $y(0.2)$ and $y(0.4)$ with step length $h = 0.2$. **(5)**

    (b) Compute $y(0.1)$ by fourth order Runge Kutta method with step size $h = 0.1$ for the ODE $\frac{dy}{dx} = 3x + \frac{y}{2}, y(0) = 1$. **(7.5)**

Q9 Explain the finite difference method. Solve the boundary problem $\frac{d^2 u}{dx^2} = u + x, 0 \le x \le 1, u(0) = 0, u(1) = 0$, with $h = 1/4$ using finite difference method. **(4+8.5=12.5)**

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