



MGM University
Aurangabad-431003
Second Term Exam A.Y. 2021-22

Program :Information Technology

Sem -IV

Course :Data Structures

Marks : 60

Course Code :20UIT403D

Instructions to the students

1. Each question carries 10 marks.
 - 2 All questions are compulsory
 3. Illustrate your answers with neat programs and diagram etc. wherever necessary
 4. If some part or parameter is noticed to be missing,you may appropriately assume it and should mention it clearly
-

Q1. Solve any two

a)

Marks

(5)

1. Performance measurement of an algorithm depends on
 - A. Processor & Memory
 - B. Complexity and capacity
 - C. Time and space
 - D. Date and space
2. Linked list are best data structures
 - A. for relatively permanent collections of data
 - B. for the size of the structure and the data in the structure are constantly changing
 - C. Both A & B
 - D. None

3. Static memory allocation has following feature
 - A. fixed memory space
 - B. variable memory space

4. An algorithm can have zero or more inputs
 - A. True
 - B. False

5. The time complexity is a measure of
 - A. Input size
 - B. Output size
 - C. Only A
 - D. both A & B

b) Compute time complexity for the given code:

(5)

Algorithm AddNum(A,n)

```
{  
    for(i=1: i<=n; i++)  
    {  
        Sum = sum+ A[i];  
    }
```

c) Write an algorithm to find even numbers from a set of numbers.

(5)

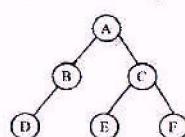
- a) What is the working principle of a queue. Write an algorithm to demonstrate operations on a queue. (5)
- b) Convert the given expression into prefix and postfix (5)
 $A+B*C+(E*F/G)$
- c) Demonstrate the steps to evaluate a postfix expression using a stack. (5)

Q3. Solve any two

- a) Write an algorithm to perform following operations on a singly linked list (5)
1. Insert node at end
 2. Search a node
- b) Write an algorithm to perform following operations on a doubly linked list (5)
1. Insert node at start
 2. Delete a node from start
- c) Demonstrate polynomial subtraction operations using linked list (5)

Q4. Solve any two

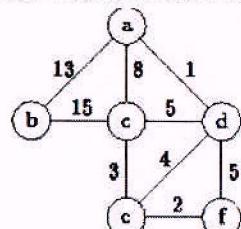
- a) Define a binary search tree? Represent the given tree using available methods (5)



- b) Construct a maximum heap tree for given data: (5)
{ 50, 25, 45, 15, 55, 30, 20, 50, 110, 125, 45}
- c) Traverse the constructed tree in question 4(b) in postorder and preorder (5)

Q5. Solve any two

- a) Describe graph data structure. Explain graph adjacency list representation (5)
- b) Write an algorithm for graph traversal method DFS (5)
- c) Find the minimum cost spanning tree for the given graph (5)



Q6. Solve any two

- a) Sort the given set of numbers using insertion sort (5)
{ 25, 10, 20, 35, 45, 30, 45, 22}
- b) Sort the set of numbers given in 6 (a) using heap sort (5)
- c) Write an algorithm for binary search method. (5)

End of paper

AIML Question Bank

Unit-1

1. Define Best full search and explain in details about heuristics algorithms .
2. Explain in details about Hill Climbing
3. Discuss Knowledge representation with examples
4. Discuss the design of search algorithms
5. Explain Representing simple facts in logical examples.

UNIT-2

1. Explain Monotonic reasoning with examples
2. Explain the contribution of Probability and Bayes' Theorem in AIML
3. Explain in details about Forward and backward reasoning.
4. Explain Non Monotonic reasoning with examples.
5. Define Bayes' Theorem, and how it is application in ML

6.Explain the Procedural and Declarative Knowledge

7. Discuss the reasoning and its types for AI with neat diagram

Unit-3

1. Explain two types of planning in AI

2. Discuss in details about learning in AI

3. Explain the architecture of expert systems

4. Define planning and discuss the various planning for AI.

5.Discuss the significance of learning in AI

Unit-4

1. Discuss the python library for linear regression and write the code

2. Write the main difference between supervised and unsupervised

3. Explain the linear regression model with neat diagram.

4. Write the python code for House price prediction using linear regression
5. Explain linear regression model and why it is highly needed for ML.
6. Explain the supervised and unsupervised learning.
7. Explain Various application of ML with special reference to medical sector.
8. What are the components of ML Model.

UNIT-5

1. Explain the Principal Components Analysis.
2. What do you mean by Decision tree and explain decision tree algorithms with examples
3. Explain in details about Linear Discriminant Analysis.
4. Write the python code for Linear discriminative analysis with python libraries
5. Why Data dimensionality is needed? Explain any one dimensionality reduction techniques.

6. Why data dimensionality is essential for ML, and Explain any one method.

7. write a Python code for PCA

8. State and Explain Factor Analysis.

UNIT-6

1. Explain hierarchical clustering with neat diagram.

2. Define K mean clustering and Explain with neat diagram

3. Why clustering is performed for datasets discuss the application of clustering

4. Define dendrogram and explain how it is performed for hierarchical clustering

5. Write a Code for K means Clustering

6. Write application of Clustering techniques using Machine learning.

Unit-01:

1. Explain

Mean	Median	Mode
mean Deviation	standard Deviation	variance
Probability	Mathematical expectation	Binomial distribution
Random Variables	Sample space	Event

2. What is an event? Explain different types of events.
3. Define random variable and explain types of random variable with example.
4. State the axioms of probability.
5. State and prove multiplication and addition theorem of probability .
6. Find Mean, variance and standard deviation of the probability distribution given below:

x	0	1	2	3	4
P(x)	1/16	1/4	3/8	1/4	1/16

7. What are conditions of Binomial distribution
8. Ten unbiased coins are tossed simultaneously .Find the probability of obtaining
- Exactly six heads
 - at least 8 heads
 - No heads
 - at least one head
 - not more than three heads
 - At least 4 heads
9. What is the probability of guessing correctly at least six of ten answers in a TRUE –FALSE objective test .
10. A die is tossed twice. Getting “an odd number” is termed as a success. find the probability distribution of the number of success.

Unit-02:

11. Let X be a random variable, and $P(X=X)$ is the PMF given by

X	0	1	2	3	4	5	6	7
$P(X=X)$	0	K	$2k$	$2k$	$3k$	K^2	$2K^2$	$7K^2+k$

Determine the Value of K. 2) Find the probability $P(X \leq 6)$.

12. A random variable X is defined as the sum of faces when a pair of dice is thrown. Find the expected value of X
13. What is an Empirical and Axiomatic approach of probability? Describe.

14. Three identical boxes contain red and white balls. The first box contains 3 red and 2 white balls, the second box has 4 red and 5 white balls, and the third box has 2 red and 4 white balls. A box is chosen very randomly and a ball is drawn from it. If the ball that is drawn out is red, what will be the probability that the second box is chosen?
15. If two dice are thrown, what is the probability that the i) The sum is greater than 8 ii) The sum is neither 7 nor 11.

Unit-03:

16. Write the formula of Normal Distribution.
17. Write the rules of Set Theory
18. Where PDF and PMF are used?
19. Give one example of Random variable.
20. What is mean by the expected value? Calculate it, when a single fair 6 sided die is rolled?

Outcome	1	2	3	4	5	6
Probability	1/6	1/6	1/6	1/6	1/6	1/6

21. What is Bernoulli Distribution? Explain with one example.
22. If a coin is tossed 5 times, find the probability of: Exactly 2 heads. Use Binomial Distribution.
23. Find the probability of 4 customers arriving in 3 minutes when the mean is 3.6. Use Poisson Distribution.
24. What are the types of Distributions? Explain any two, with suitable example
- Let X be a random variable, and $P(X=X)$ is the PMF given by

X	0	1	2	3	4	5	6	7
$P(X=X)$	0	k	2k	2k	3k	K^2	$2 K^2$	$7K^2+k$

Determine the Value of K. 2) Find the probability $P(X \leq 6)$.

Unit-04:

25. What is hypothesis?
26. What is hypothesis testing ?
27. What is null Hypothesis and alternative Hypothesis?
28. What is Type I error and Type II error?
29. What is Critical Region?
30. Differentiate between null Hypothesis and alternative Hypothesis

31. Give the fundamental types of hypotheses.

Unit-05:

32. What is a Linear Regression?

33. Can you list out the critical assumptions of linear regression?

34. What is Homoscedasticity?

35. Can linear regression be used for representing quadratic equations?

36. A researcher has found that there is a co-relation between the weight tendencies of father and son. He is now interested in developing regression equation on two variables from the given data:

Weight of father (in Kg)	69	63	66	64	67	64	70	66	68	67	65	71
Weight of Son (in Kg)	70	65	68	65	69	66	68	65	71	67	64	72

Develop

Regression equation of Y on X.

Regression equation of X on Y.

37 Below are a few solved examples that can help in getting a better idea:

Find the linear regression equation for the data given below:

X	22	33	55	88
Y	33	66	55	12

Unit-06:

38 Does correlation and dependency mean the same thing? In simple words if two events have correlation of zero, does this convey they are not dependent and vice-versa?

39 If two variables have a high correlation with a third variable, does this convey they will also be highly correlated? Is it even possible that A and B are positively correlated to another variable C? Is it possible that A and B are negatively correlated with each other?

40 Can single outlier decrease or increase the correlation with a big magnitude? Is Pearson coefficient very sensitive to outliers?

41 Does causation imply correlation?

42 What's the difference between correlation and simple linear regression?

43 How to choose between Pearson and Spearman correlation?

44 How would you explain the difference between correlation and covariance?

45 Write the differences between Correlation Coefficient and Regression Coefficient

46 Calculate the correlation coefficient for the following heights (in inches) of fathers (X) and their sons (Y) :

X : 68 66 67 67 68. 69 70 72

Y: 61 68 68 68 12 12 69 71

47. Suppose we have ranks of 8 students of B.Sc. in Statistics and Mathematics. On the basis of rank we would like to know that to what extent the knowledge of the student in Statistics and Mathematics is related.

Rank in Statistics 1 2 3 4 5 6 7 8

Rank in Mathematics 2 4 1 5 3 8 7 6

48. Calculate rank correlation coefficient from the following data:

x 78 89 97 69 59 79 68

y 125 137 156 112 107 136 124

49. Calculate rank correlation coefficient from the following data:

Expenditure on advertisement 10 15 14 25 14 14 20 22

Profit 6 25 12 18 25 40 10 7

50. Calculate rank correlation coefficient from the following data

x 10 20 30 30 40 45 50

y 15 20 25 30 40 40 40

UNIT 1: Introduction

1. Define database. Also explain characteristics of database approach.
2. Define DBMS. Explain it with suitable example of database.
3. Enlist and explain components of DBMS.
4. Write in brief history of Database applications.
5. Define and explain Data Model.
6. Explain schemas and instances with suitable example.
7. Define DBMS. Also explain advantages of DBMS.
8. Write a short note on:
 - a) Two-tier client server Architecture
 - b) Three-tier client server Architecture
 - c) Actors on the scene
 - d) Database Designers
 - e) Database Administrator
 - f) Data model
9. Explain three schemas Architecture with neat labelled diagram.
10. Compare Traditional file system with Database systems.

UNIT 2: ER Model

1. What are the components of ER model? Explain it.
2. Explain with suitable example Entity types, entity sets, keys and values.
3. Write a short note on
 - a) Relationship types
 - b) Relationship sets
 - c) Relationship Degree
 - d) Constraints on Relationship
 - e) Types of cardinality
 - f) Inheritance and Aggregation
4. Draw and explain different naming convention used for ER diagram.
5. Design an ER diagram for library considering following conditions
 - Library should have books with id, title, author, price, availability
 - It should also have publisher details with id, address, name
 - It should also maintain records of its members with id, name, address, date of expiry, member type
 - books should be borrowed by members with due date, issue date, return date
 - One member can have minimum of 2 books and maximum of 3.

6. Explain with suitable example Total and Partial Participation Constraints.
7. Explain with suitable example Specialization and Generalization Example.
8. Explain with suitable example subclass and superclass of Inheritance.
9. Define and explain Data abstraction with suitable example.

Unit 3: Structured Query Language

1. Compare ER model and Relational model.
2. Explain with example Domains, Attributes, Tuples, and Relations.
3. What are views in SQL? Explain it with suitable example how to create views from multiple tables.
4. What are views in SQL? Explain example of creating view from single table and multiple tables.
5. Consider the below two tables for reference

EmpId	FullName	ManagerId	DateOfJoining	City
121	John Snow	321	01/31/2019	Toronto
321	Walter White	986	01/30/2020	California
421	Kuldeep Rana	876	27/11/2021	New Delhi

Table – EmployeeSalary

EmpId	Project	Salary	Variable
121	P1	8000	500
321	P2	10000	1000
421	P1	12000	0

- a)** Write an SQL query to fetch the EmpId and FullName of all the employees working under the Manager with id – ‘986’.

- b)** Write an SQL query to fetch the different projects available from the Employee Salary table.
- c)** Write an SQL query to fetch the count of employees working in project ‘P1’.
- d)** Write an SQL query to find the maximum, minimum, and average salary of the employees.
- e)** Write an SQL query to find the employee id whose salary lies in the range of 9000 and 15000.
- f)** Write an SQL query to fetch those employees who live in Toronto and work under the manager with Manager Id – 321.
- g)** Write an SQL query to fetch all the employees who either live in California or work under a manager with Manager Id – 321.
- h)** Write an SQL query to fetch the project-wise count of employees sorted by project’s count in descending order.
6. Enlist commands of Data Definition Language? Explain each command with suitable examples.
 7. Enlist commands Data Manipulation language? Explain each command with suitable examples.
 8. Explain with example difference between drop, delete and truncate.
 9. Write separate queries for following commands
 - a) Select
 - b) order by
 - c)group by
 - d) where
 10. Enlist and explain SQL constraints with suitable example.
 11. Explain any five aggregate functions with suitable queries.

Unit 4: Relational Algebra

1. Explain relational algebra with suitable example.
2. Enlist and explain relational operators with suitable example.
3. Enlist and explain join types with suitable examples.
4. Given below are a few examples of a database and a few queries based on that.
Suppose there is a banking database which comprises following tables:
 Customer (Cust_name, Cust_street, Cust_city)
 Branch (Branch_name, Branch_city, Assets)
 Account (Branch_name, Account_number, Balance)
 Loan (Branch_name, Loan_number, Amount)
 Depositor (Cust_name, Account_number)
 Borrower (Cust_name, Loan_number)
 - a) Find the names of all the customers who have taken a loan from the bank and also have an account at the bank.
 - b) To rename the first attribute of the table Depositor with attributes P.
 - c) Selects tuples from customer where Customer name is 'yogita' and Customer city is 'Pune'.

- d) Selects tuples from Loan where Branch_name is 'Jaya' and amount is greater than 1,00,000.
- e) Project Customer name and city from Customer.
5. Write queries for the following
- Selects tuples from Tutorials where topic = 'Database'.
 - Selects tuples from Tutorials where the topic is 'Database' and 'author' is Navathe.
 - Selects tuples from Customers where sales is greater than 50000.
 - Given the schemas R(A, B, C, D), S(A, C, E), what is the schema of $R \times| S$? What will be the degree of resultant schema $R \times| S$?
 - Given R(A, B, C), S(D, E), what is $R \times| S$?
 - Given R(A, B), S(A, B), what is $R \times| S$?
 - Write a semijoin query for: find the ssn from employee where age of employee is greater than 55.
Employee(ssn, name)
Dependents(ssn, age)

6. Calculate a natural join for following and also write SQL queries for the same.

Students S

sid	S.name	gpa
001	John	3.4
002	Bob	1.3



People P

ssn	P.name	address
1234545	John	216 Rosse
5423341	Bob	217 Rosse

7. Write a query to get the last names and salaries of employees and their managers whenever the employee earns more than the manager.

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

8. Consider the following two tables:

Table A

Num	Square
2	4
3	9
4	16

Table B

Num	Square
2	8
3	18
5	75

Find

- a)
- b)
- c)

<https://www.guru99.com/relational-algebra-dbms.html>

Unit 5: Normalization

1. Explain in brief anomalies in DBMS.
 2. Define Normalization. Explain 1 NF and 2 NF with suitable examples.
 3. Define Normalization. Explain 3 NF and BCNF with suitable examples.
 4. Define Normalization. Explain BCNF and 4NF with suitable examples
 5. Write a note on Multivalve dependency and Join dependency
 6. Compare Super key and Candidate key.
 7. Compare Primary key and Candidate key.
 8. Find out candidate key, primary key and Non-prime key for following:
 - a) R(ABCD)
 - b) R(ABCD)

FD: AB->C , C->D FD:AB->CD, D->A

Unit 6: Transaction Management

1. Explain with suitable example ACID properties for transaction.
 2. Define schedule. Explain serial and non-serial schedule with suitable examples.
 3. Explain how to characterize schedules Based on serializabilty.
 4. Explain with suitable example dirty read problem in transaction.
 5. What is concurrency control? Explain Lock based protocol with suitable example.
 6. What is concurrency control? Explain Timestamp Ordering Protocol with suitable example.
 7. What is concurrency control define Validation Based protocol with suitable example.
 8. What is database recovery? Explain any technique for database recovery.
 9. Explain Multiple granularity with suitable example.