

SASTRA DEEMED UNIVERSITY
(A University under section 3 of the UGC Act, 1956)

End Semester Examinations

Dec 2023

Course Code: INT104

Course: **DATABASE MANAGEMENT SYSTEMS**

QP No. :UD116-3

Duration: 3 hours

Max. Marks:100

PART – A

Answer all the questions

10 x 2 = 20 Marks

1. Compare physical and logical data independence.
2. What is the need of meta-data? Where is it stored in the database?
3. Create a table with primary key constraint and another table with referential integrity.
4. How to differentiate between primary index and secondary index. Explain it with example.
5. How do we identify multivalued dependency in a table? Explain with an example.
6. How to identify insert update and delete anomalies in a table? Explain with an example.
7. There is a table A (a, b, c) and B (d, e, f). Can the natural join operation be performed? Justify.
8. Check whether the Schedule A is conflict serializable or not?
A: w1(x)w2(y)r1(x)r2(y)w3(x)r3(x).

9. Among the two-phase and strict two phase which of the locking protocol is best suited for concurrency control? Justify.

10. Compare centralized database and distributed database.

PART - B

Answer any Four questions

4 x 15 = 60 Marks

11. a) For the following scenario, draw the entity-relationship model. The entity relationship model should specify entity sets, relationship sets, participation details, cardinality ratio, primary key and weak entity sets (if any). Player will have id, name, country and price. Team will have short name, name, owner and home ground. Each team will have at least one player. Each player plays for only one team. Each team plays a match against at least one other team, on specified date, time and ground. Winner of the match should be recorded. (10)

b) Discuss the roles of Database Administrator in DBMS. (5)

12. Consider the following tables.

Emp (empid, name, salary, supervisor_id, sex, dept_id)

Dept (dept_id, dept_name)

Write down queries in SQL for getting following information:

a) Employees getting more salary than their supervisor. (3)

b) Department name and total number of employees in each department who earn more than average salary for their department. (3)

c) Department(s) having maximum employees earning more than 25000. (3)

d) Find the top 3 highest salaries amongst the employees. (3)

e) Find names of employees whose salary is greater than average salary. (3)

13. With a neat example discuss the concepts of deadlock detection, deadlock avoidance and deadlock prevention.

14. An engineering consultancy firm supplies temporary specialized staff to bigger companies in the country to work on their project for certain

amount of time. The table below lists the time spent by each of the company's employees at other companies to carry out projects.

NIN	Contract No	Hours	Employee Name	Company ID	Company Location
616681B	SC1025	72	P. White	SC115	Belfast
674315A	SC1025	48	R. Press	SC115	Belfast
323113B	SC1026	24	P. Smith	SC23	Bangor
616681B	SC1026	24	P. White	SC23	Bangor

- Create a table in SQL and write queries to insert the values with appropriate constraints. (4)
 - What is partial functional dependency. Convert the table to 2NF. (4)
 - What is transitive dependency. Convert the tables to 3NF. (4)
 - What is trivial and non-trivial dependency. Convert the table to BCNF. (3)
15. a) Consider three transactions: T1, T2 and T3. Draw the precedence graph for the following schedule consisting of these three transactions and determine whether it is serializable. If so, give its serial order(s). (8)

Time	T1	T2	T3
t1:			read(Y)
t2:			read(Z)
t3:	read(X)		
t4:	write(X)		
t5:		write(Y)	
t6:			write(Z)
t7:			read(Z)
t8:		read(Y)	
t9:		write(Y)	
t10:		read(Y)	
t11:		write(Y)	
t12:	read(X)		
t13:	write(X)		

- Discuss the features of Object-oriented databases. (7)

16. Discuss in detail the data warehouse architecture and its components with a neat diagram.

PART - C

Answer the following

1 x 20 = 20 Marks

17. a) Explain 5NF with an example. (5)
b) Discuss the steps involved in query processing with a neat diagram. (5)
c) Discuss the advantages of distributed databases. (5)
d) Discuss the time stamp-based concurrency control technique. (5)

86
46
40 80

SASTRA DEEMED UNIVERSITY
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End Semester Examinations

Dec 2023

Course Code: CSE214

Course: **COMPUTATIONAL STATISTICS**

QP No. :UD102-3

Duration: 3 hours

Max. Marks:100

PART- A

Answer any **FOUR** questions

4 x 20 = 80 Marks

1. a) Calculate Fisher discriminant score for the data $X_0^T = [-2, -1]$ and allocate it to the appropriate groups. $p_1=p_2=0.2$, $p_3=0.6$.

$$G1: X_1 = \begin{bmatrix} -2 & 0 \\ -2 & 1 \\ -2 & 5 \end{bmatrix}; S_1 = \begin{bmatrix} 1 & -1 \\ -1 & 4 \end{bmatrix}$$

$$G2: X_2 = \begin{bmatrix} -2 & 3 \\ 2 & 3 \\ 0 & 3 \end{bmatrix}; S_2 = \begin{bmatrix} 1 & -1 \\ -1 & 4 \end{bmatrix}$$

$$G3: X_3 = \begin{bmatrix} 3 & -1 \\ 0 & 0 \\ -3 & -5 \end{bmatrix}; S_3 = \begin{bmatrix} 1 & 1 \\ 1 & 4 \end{bmatrix}$$

$$S_{pooled}^{-1} = \frac{1}{35} \begin{bmatrix} 36 & 3 \\ 3 & 9 \end{bmatrix} \quad (15)$$

- b) Recall the steps of Agglomerative clustering. (5)

2. a) Consider the hypothetical distance between pairs of five objects as follows. Construct dendrogram using single linkage clustering.

$$D = \begin{bmatrix} 0 & & & & \\ 8 & 0 & & & \\ 2 & 6 & 0 & & \\ 5 & 4 & 8 & 0 & \\ 10 & 9 & 1 & 7 & 0 \end{bmatrix} \quad (15)$$

- b) Apply Fisher discriminant distance calculation and allocate $X_0^T = [3, 495]$ to either of group π_1 or π_2 . Mean of points in π_1 and π_2 are $\bar{X}_1 = \begin{bmatrix} 3 \\ 560 \end{bmatrix}$; $\bar{X}_2 = \begin{bmatrix} 2 \\ 446 \end{bmatrix}$ and

$$S_{Pooled}^{-1} = \begin{bmatrix} 2.5075 & 0.0014 \\ 0.0014 & 0.0002 \end{bmatrix} \quad (5)$$

3. a) Two dimensional data $X=(7,5,8,6,10)$, $Y=(5,3,6,4,8)$ are given. Apply kmeans clustering to divide the items into two groups. (15)
 b) Distinguish exploratory factor analysis and confirmatory factor analysis. (5)
4. a) Determine the probability density function for multivariate normal distribution for independent variables. (15)
 b) Recall the way to fix the k value in k-means clustering. (5)
5. a) From the below given data, find factor loadings and error for the number factor $m=4$. (15)

Covariance of 4 variables:

$$S = \begin{bmatrix} 3.19 & -0.67 & -0.65 & 1.52 \\ -0.67 & 0.29 & 0.28 & -0.08 \\ -0.65 & 0.28 & 0.54 & 0.33 \\ 1.52 & -0.08 & 0.33 & 2.61 \end{bmatrix};$$

Eigen values = 4.55, 1.83, 0.17, 0.08

$$\text{and eigenvectors} = \begin{bmatrix} 0.78 & -0.14 & -0.09 & 0.6 \\ 0.46 & -0.25 & -0.47 & -0.72 \\ -0.42 & -0.42 & -0.73 & 0.35 \\ 0.05 & 0.86 & -0.5 & 0.06 \end{bmatrix}$$

- b) Recall the verification process of factor ability criteria. (5)
6. a) Fit a linear straight-line model using the given data $X^T = [9, 7, 11, 5, 13]$; $Y^T = [15, 12, 17, 9, 19]$. And find the error. (15)

- b) Prove that $Y^T Y = \hat{Y}^T \hat{Y} + \hat{\epsilon}^T \hat{\epsilon}$ for the values you found for the question 6.a (5)

PART- B

Answer the following

1 x 20 = 20 Marks

7. a) Consider you and your friend are processing d features of customer data. Processing d features becomes difficult for you and now you need to reduce the features. Discuss PCA algorithm steps to reduce the features. (15)
- b) Interpret the following confusion matrix by calculating APER and accuracy percentage. (5)

Confusion matrix		Predicted	
Actual		No	Yes
	No	430	37
	Yes	82	325

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End Semester Examinations

Dec 2023

Course Code: CSE213

Course: **OBJECT ORIENTED PROGRAMMING**

QP No. :UD299-3

Duration: 3 hours

Max. Marks:100

PART – A

Answer all the questions

10 x 2 = 20 Marks

1. Distinguish between void pointer and Null Pointer.
2. What is the purpose of “using namespace” directive in C++?
3. Write a function fact() to calculate factorial of a given positive number using inline function.
4. Predict the output

```
#include <iostream>
class sample{
sample()
{
std::cout<<"Constructor"<<endl;
}
};
int main() {
sample s;
return 0;
}
```
5. What is meant by late binding and how it can be achieved in object-oriented programming?

6. List the operators that cannot be overloaded.
7. Compare and Contrast overriding and hiding with example.
8. Find the output for the below code and reason it.

```
#include <stdio.h>
int main() {
float num1 = 3.14567;
int num2;
num2 = (int) num1;
printf("Float: %f\n", num1);
printf("Integer: %d\n", num2);
return 0;
}
```
9. What is the purpose of the ofstream and ifstream classes in C++?
10. Define "inclusion" and "exclusion" relationship in UML diagram with suitable example.

PART - B

Answer all the questions

4 x 15 = 60 Marks

11. Explain the paradigms of OOP.

(OR)

12. Raising a number 'N' to the power 'P' is the same as multiplying N by itself P times. Write a function called power() that takes N (double) and P (int) as input, and returns the result N, P as a double value. Use a default argument of 2 for P, so that if this argument is omitted, the number N will be squared. Overload power() function, to work with int, long, and float. Overload the power() function for char datatype also, which should print P times the given character N. Write the main() program to exercise these overloaded functions with all argument types.

13. Write a C++ program to create a class called Complex to implement the following functions on Complex type objects. READ/INPUT, ADD, SUBTRACT, MULTIPLY and PRINT with return the resultant object. Write the program with required constructors, member functions with necessary arguments and return types.

(OR)

14. Create a class student with attributes name, register number, department, an array for storing 5 subject marks, total. In main(), find the student who has scored the highest total using the '>' operator(friend) to compare the objects and display the details of the student. Include necessary member functions and constructors.
15. a) Write a C++ program to calculate net pay of employee using virtual base class concept. (7)
b) Discuss the purpose of friend function in C++? Explain it with an example. (8)

(OR)

16. Explain the different types of inheritance with suitable example.
17. Create a templated C++ function called arraySum() that calculates the sum of elements in an array of any numeric type. The function should take the address of the array and its size as arguments and return the sum of elements. Write a main program that demonstrates the usage of arraySum() with arrays of integer, double and float.

(OR)

18. A library management system needs to be designed to keep track of books and manage borrowing and returning processes. Here are the main entities and interactions in this scenario:
Entities:

- **Library:** Represents the library itself and contains a collection of books.
- **Book:** Represents individual books with attributes like title, author, and ISBN.
- **Member:** Represents library members who can borrow and return books. Members have attributes like name and membership ID.

Interactions:

- Members can borrow books from the library, and each member can borrow multiple books.
- Members can return books to the library.
- The library keeps a record of available books and borrowed books.
- The library staff can add new books to the collection.
- The library staff can remove books that are no longer available.

Now, based on this scenario, draw **Class Diagram** and **Activity diagram**.

PART – C

Answer the following

1 x 20 = 20 Marks

19. a) Write a program using function to swap the given number using call by value and reference. (10)
- b) Write a C++ program to read and write student details into a file. (10)

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End Semester Examinations

Dec 2023

Course Code: CSE212

Course: COMPUTER ORGANIZATION & ARCHITECTURE

QP No. :UD105-3

Duration: 3 hours

Max. Marks:100

PART – A

Answer all the questions

10 x 2 = 20 Marks

1. Solve the following Boolean expressions to a minimum number of literals. a) $A'B'C + AB'C + BC$ b) $(BC' + A'D)(AB' + CD')$.
2. Convert the following numbers with the indicated bases to decimal.
a) $(11010.0101)_2$ b) $(16.5)_{16}$
3. Represent the unsigned decimal numbers 694 and 538 in BCD.
4. Define program counter.
5. Find the effective address, if the addressing mode of the instruction is base with index and displacement mode. [Base register = 2000, Index register = 60 with scale factor of 2 and displacement is 200].
6. Define stack and its operations.
7. Write the basic computer instruction code format.
8. Define vector processing.
9. Define hazards in Pipelining.

10. Explain cache memories.

PART – B

Answer any Four questions

4 x 15 = 60 Marks

11. a) Simplify the following Boolean function in sum-of-products form by means of a four-variable map. Draw the logic diagram with AND-OR gates and NAND gates. (8)
- $$F(A, B, C, D) = \sum (0, 2, 8, 9, 10, 11, 14, 15)$$
- b) Derive and explain an algorithm for fixed point unsigned binary multiplication with an example. (7)
12. a) Discuss in detail about the IA-32 register structure and the association with earlier processor. (10)
- b) Explain in detail about the RISC addressing modes. (5)
13. a) Explain in detail about timing and control unit with the flow chart for different type of instructions. (10)
- b) Design the basic computer with logic diagram. (5)
14. a) Justify the Operation of Superscalar processor. (8)
- b) Explain in detail about serial port and interface circuits. (7)
15. a) Justify the use of DMA controllers in a computer system. (10)
- b) Explain in detail about Memory Management Unit (MMU). (5)
16. a) Explain in detail about the Instruction execution and straight-line sequencing. (8)
- b) Determine the functions of program controlled I/O. (7)

PART - C

Answer the following

1 x 20 = 20 Marks

17. a) Design a sequential circuit with two JK flip-flops A and B and two inputs E and X. if $E=0$, the circuit remains in the same state regardless of the value of X. When $E=1$ and $X=1$, the circuit goes through the state transitions from 00 to 01 to 10 to 11 back to 00, and repeat. When $E=1$ and $x=0$, the circuit goes through the state transitions from 00 to 11 to 10 to 01 back to 00, and repeat. (10)
- b) Discuss in detail about memory reference instructions with flow chart. (10)

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End Semester Examinations

Dec 2023

Course Code: CSE211

Course: FORMAL LANGUAGE & AUTOMATA THEORY

QP No. :UD189-3

Duration: 3 hours

Max. Marks:100

PART - A

Answer all the questions

10 x 2 = 20 Marks

1. Find a regular expression for language $L = \{a^{2m}b^{2m+1} : m \geq 0\}$.
2. State Kleene's theorem.
3. Let $\Sigma = \{a, b\}$ and $\Gamma = \{a, b, c\}$. Defined h by $h(a) = ab$, $h(b) = bbc$. Find homomorphic image of $L = \{aa, aba\}$.
4. Show that the following grammar is ambiguous.
 $S \rightarrow AB / aaB$
 $A \rightarrow a / Aa$
 $B \rightarrow b$.
5. Mention the rules of pumping lemma for context free languages.
6. Convert the given CFG to NPDA:
 $S \rightarrow aSA / a$
 $A \rightarrow bB$
 $B \rightarrow b$.
7. Define Linear Bounded Automata.
8. Write down the production rules format of unrestricted grammar.

9. State Rice theorem.

10. Describe cook's theorem in computational complexity.

PART - B

Answer any Four questions

4 x 15 = 60 Marks

11. Write Down the procedure for conversion of Non-Deterministic Finite Automata to Deterministic Finite Automata. Convert the given NFA into an equivalent Deterministic Machine.

State	i/p = 0	i/p = 1
q ₀	q ₀ , q ₁	q ₁
q ₁	q ₂	q ₂
q ₂	∅	q ₂

Note: q₀ → initial state and q₁ → final state.

12. Write Down the procedure for converting Non-Deterministic Finite Automata to Regular Expression. Find the regular expression for the language $L = \{w \in \{a, b\}^* : n_a(w) \text{ is even and } n_b(w) \text{ is odd}\}$.

13. Remove all unit productions, useless productions and λ - productions from the given grammar.

$S \rightarrow aA / aBB$

$A \rightarrow aaA / \lambda$

$B \rightarrow bB / bbC$

$C \rightarrow B$

What language does this grammar generate?

14. Construct an NPDA for accepting the language $L = \{ww^R : w \in \{a,b\}^+\}$.

15. Given two positive integers x and y, design a Turing Machine that computes $x + y$.

16. a) Prove that there exists a recursively enumerable language whose complement is not recursively enumerable. (8)

- b) Explain the complexity classes P and NP with suitable example. (7)

PART - C

Answer the following

1 x 20 = 20 Marks

17. a) Design a Turing Machine (TM) that copies strings of 1's for any $w \in \{1\}^+$. (10)
- b) Convert the grammar with productions into Chomsky normal form.
S \rightarrow ABa
A \rightarrow aab
B \rightarrow Ac. (10)
