VIT
Vellore Institute of Technology

Reg. No. :

Final Assessment Test (FAT) - APRIL/MAY 2023

Programme	**B.Tech**	Semester	**Winter Semester 2022-23**
Course Title	**DATABASE SYSTEMS**	Course Code	**BCSE302L**
Faculty Name	**Prof. Renuka Devi S**	Slot	**E1+TE1**
		Class Nbr	**CH2022235001194**
Time	**3 Hours**	Max. Marks	**100**

Section A (4 X 10 Marks)
Answer All questions

01. a) Assume that you are working as a database administrator for a multinational company. You have decided to organize the records in a hierarchical manner, where the records in a child table must be linked to the records in the parent table. Identify the best-suited data model to store the data and explain your model. (4 marks) [10]

b) Further, as the DBA, you are supposed to describe the overall workflow of any three database users, illustrate with a diagram. (6 marks)

. Consider the following tables [10]

EMPLOYEES TABLE:

Name	Null	Type
EMPLOYEE_ID	NOT NULL	NUMBER(6)
FIRST_NAME		VARCHAR2(20)
LAST_NAME	NOT NULL	VARCHAR2(25)
EMAIL	NOT NULL	VARCHAR2(25)
PHONE_NUMBER		VARCHAR2(20)
HIRE_DATE	NOT NULL	DATE
JOB_ID	NOT NULL	VARCHAR2(10)
SALARY		NUMBER(8,2)
COMMISSION_PCT		NUMBER(2,2)
MANAGER_ID		NUMBER(6)
DEPARTMENT_ID		NUMBER(4)

DEPARTMENT TABLE:

Name	Null	Type
DEPARTMENT_ID	NOT NULL	NUMBER(4)
DEPARTMENT_NAME	NOT NULL	VARCHAR2(30)
MANAGER_ID		NUMBER(6)
LOCATION_ID		NUMBER(4)

Write SQL statements for the following specifications: (5x2=10 marks)

a. Display the last name and salary of employees who earn between $5,000 and 12,000$, and are in department 20 or 50. Label the columns "Employee" and "Monthly Salary", respectively.

b. Create a report to display the last name and job id of all employees who do not have a manager.

c. Create a report to display the last name, salary, and commission of all employees who earn commissions. Sort data in descending order of salary.

d. Find the highest, lowest, sum, and average salary of all employees for each job id. Round your results to the nearest whole number.

e. The HR department needs to find the names and hire dates of all the employees who were hired before their managers, along with their managers' names and hire dates.

03. Consider the three transactions T1, T2, and T3, and the schedules S1 and S2 given below, and check whether both schedules are equivalent or not. Construct the serializability (precedence) graphs for S1 and S2 and check whether each schedule is conflict serializable or not. [10]

$T1$: $r1\ (X)$; $r1\ (Z)$; $w1\ (X)$; $w1\ (Z)$;

$T2$: $r2\ (Y)$; $r2\ (X)$; $w2\ (Y)$;

$T3$: $r3\ (Y)$; $r3\ (Z)$; $w3\ (Z)$;

$S1$: $r2\ (Y)$; $r1\ (X)$; $r2\ (X)$; $r3\ (Y)$; $r3\ (Z)$; $w2\ (Y)$; $w3\ (Z)$; $r1\ (Z)$; $w1\ (X)$; $w1\ (Z)$;
$S2$: $r2\ (Y)$; $r1\ (X)$; $r3\ (Y)$; $r2\ (X)$; $r1\ (Z)$; $r3\ (Z)$; $w2\ (Y)$; $w1\ (X)$; $w3\ (Z)$; $w1\ (Z)$;

04. a) Discuss in detail the relevance of the CAP theorem with respect to NoSQL. (6 marks) [10

b) As a database designer, does the nature of the data have a say in the choice of a NoSQL database? Justify when you will opt to use a NoSQL database. (4 marks)

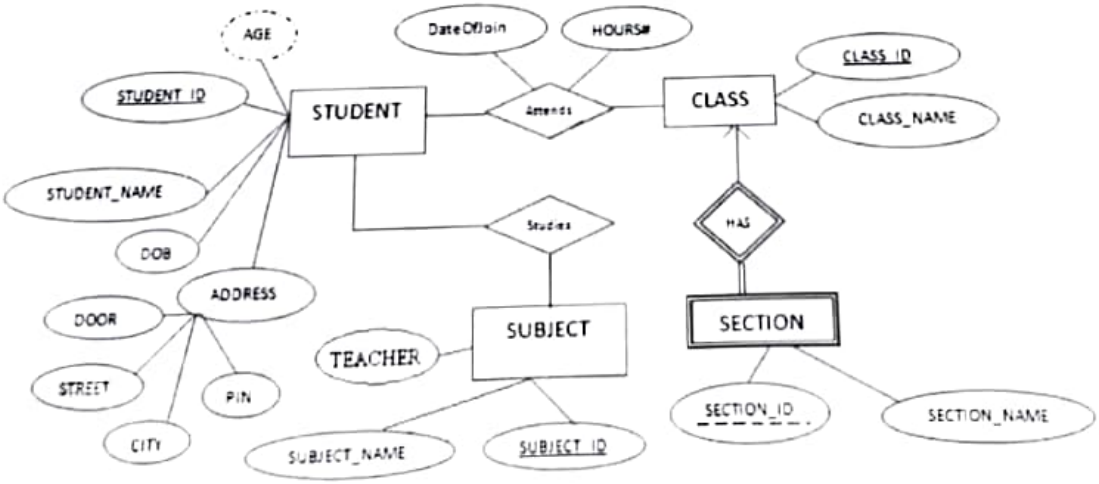
Section B (4 X 15 Marks)

Answer All questions

05. a) Draw an E-R diagram for the banking system based on the following assumptions. (8 marks) [15

- Banks have customers
- Banks are identified by the name, code, and address of the main office.
- Banks have branches.
- Branches are identified by a branch_no, branch_name, and address.
- Customers are identified by name,cust-id, phone number, and address.
- Customers can have one or more accounts.
- Accounts are identified by account_no,acc_type, and amount.
- Loans are identified by loan_id,loan_type, and amount.
- Accounts and loans are related to the bank's branch.

b) E-R diagram for the student class allocation system is given below. Convert the given E-R diagram to a relational schema. (7 marks)



6. a) Consider the relation, R (Doctor_id, Doctor_name, Patient_id, Patient_name, Diagnosis, Treatcode, Amount) with the following functional dependencies: [15]

Doctor_id and Patient_id together determine unique tuples in the relation R.

Patient_id→ Patient_name

Doctor_id→Doctor_name

Treatcode→Diagnosis,Amount

Is the relation R in 3NF? Justify your answer. If not, decompose this relation up to 3NF. (8 marks)

b) Consider the following functional dependencies:

FD 1: A → B

FD 2: AB → C

FD 3: D→ AC

FD 4: D→ E

i) Find any three super keys (3 marks)

ii) Find out the minimal cover corresponding to the given set of functional dependencies. (4 marks)

[15]

07. For the given 'Employee' table,

EmpId	Empname	HoursPerWeek	ContractNo
1022	John Smith	40	C101
1033	Livingstone	42	C102
1042	Sarah White	35	C101
1065	Jafflyn	15	C103
1074	Franklin	45	C103
1092	Louis George	38	C102
1098	Geo Xavier	24	C102
1121	Janet	28	C103
1125	Joice	50	C101

a) Construct a primary dense index for the EmpID attribute (3 marks)

b) Develop a sparse index for the EmpID attribute (3 marks)

c) Apply h(k) = (k+5) mod 11 hashing function after extracting the **'last two digits of EmpID'** *(k) and perform linear probing collision resolution technique. Identify the problem that would arise if a linear probing technique had been used. Suggest an alternative index structure to overcome the problem. (6 marks)*

d) Write relational algebraic expressions to (1 ½ x 2 = 3 marks)

i) Display the number of employees who worked fewer hours than average hours per week

ii) Display the employee IDs and names of every employee working for ContractID C103

08. a) Consider a database with objects X and Y and assume that there are two transactions, T1 and T2. Transaction T1 reads objects X and Y and then writes object X. Transaction T2 reads objects X and Y and then writes objects X and Y. Write the notation for the given **schedule (S1)**. [1

Illustrate S1 for the following conflicts:

i) Read-write conflict. (2 marks)

ii) Write-write conflict. (2 marks)

b) Demonstrate how the strict 2PL protocol allows the above **schedule (S1)**. *(6 marks)*

c) Create a wait-for graph for the following transaction scenario and determine whether deadlock exists or not: (5 Marks)

Transaction	Data items locked by transaction	Data items transaction is waiting for
T1	X2	X1,X3
T2	X3,X10	X7,X8
T3	X8	X4,X5
T4	X7	X1
T5	X1,X5	X3
T6	X4,X9	X6
T7	X6	X5