SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

AN AUTONOMOUS INSTITUTION

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

23ITB204 – Modern Database Management Systems

Unit II – 16 Marks

1.Discuss the components of an Entity-Relationship (ER) diagram. Illustrate your answer with an example ER diagram for a university database that includes entities such as Students, Courses, and Instructors. Explain the relationships and attributes associated with each entity.

2.Explain the concept of the Enhanced Entity-Relationship (EER) model. How does it extend the traditional ER model? Provide examples of specialization and generalization in an EER diagram, and discuss the implications for database design.

3.Describe the process of converting an ER diagram into a relational schema. What are the key steps involved? Provide a detailed example by converting a given ER diagram into its corresponding relational tables, including primary and foreign keys.

4.Define functional dependencies and their role in database design. Explain the concepts of non-loss decomposition and normalization. Provide an example to demonstrate how to decompose a relation into First, Second, and Third Normal Forms, ensuring dependency preservation.

5.What is Boyce-Codd Normal Form (BCNF)? Explain how it differs from Third Normal Form (3NF). Provide a practical example to illustrate a relation that is in 3NF but not in BCNF. Discuss the decomposition process to achieve BCNF.

6.Define multi-valued dependencies and explain their significance in database design. What is Fourth Normal Form (4NF), and how does it address multi-valued dependencies? Provide an example of a relation that violates 4NF and demonstrate the decomposition to achieve 4NF.

7.Discuss the concept of join dependencies and their relationship to Fifth Normal Form (5NF). Explain what it means for a relation to be in 5NF and provide an example of a relation that violates 5NF. Demonstrate the decomposition process to convert it to 5NF.

8.Explain about primary and foreign keys with its syntax. Give example for the keys.
9.For the same example relation R with the two tuples as in the notes above,decompose it as R1(A,B) and R2(A,C). Try and merge them back using natural join and see if the resulting relation is the sameas R. Do you think this decomposition is a lossless join decomposition?
10. Explain about Armstrong Axiom's with functional dependencies.Consider relation E = (P, Q, R, S, T, U) having set of Functional Dependencies (FD).

P → Q P → R
QR → S Q → T
QR → U PR → U

Calculate some members of Axioms are as follows,

1. P → T
2. PR → S
3. QR → SU
4. PR → SU.

11. Consider the relation schema below.

Depositer_Account(id,acc_num,access_date,balance, and branch_name).

A set of functional dependencies F can be specified for this relation as

F = { {id, acc_num} → access_date and acc_num → {balance, branch_name} }

Find out the closure of {id, acc_num} and acc_num.

12. From the following tables,

i) Write a SQL query to count the number of employees in each designation of a department. Return department id, job name and number of employees.
ii) Write a SQL query to identify the departments in which at least two employees are employed. Return department id, number of employees.
iii) Write a SQL query to list the grade, number of employees, and maximum salary of each grade.
iv) Write a SQL query to identify departments with fewer than four employees. Return department ID, number of employees

mp_id	emp_name	job_name	manager_id	hire_date	salary	commission	dep_id
68319	KAYLING	PRESIDENT		1991-11-18	6000.00		1001
66928	BLAZE	MANAGER	68319	1991-05-01	2750.00		3001
67832	CLARE	MANAGER	68319	1991-06-09	2550.00		1001
65646	JONAS	MANAGER	68319	1991-04-02	2957.00		2001
67858	SCARLET	ANALYST	65646	1997-04-19	3100.00		2001
69062	FRANK	ANALYST	65646	1991-12-03	3100.00		2001
63679	SANDRINE	CLERK	69062	1990-12-18	900.00		2001
64989	ADELYN	SALESMAN	66928	1991-02-20	1700.00	400.00	3001
65271	WADE	SALESMAN	66928	1991-02-22	1350.00	600.00	3001
66564	MADDEN	SALESMAN	66928	1991-09-28	1350.00	1500.00	3001
68454	TUCKER	SALESMAN	66928	1991-09-08	1600.00	0.00	3001
68736	ADNRES	CLERK	67858	1997-05-23	1200.00		2001
69000	JULIUS	CLERK	66928	1991-12-03	1050.00		3001
69324	MARKER	CLERK	67832	1992-01-23	1400.00		1001

(14 rows)

Sample table: salary_grade

grade	min_sal	max_sal
1	800	1300
2	1301	1500
3	1501	2100
4	2101	3100
5	3101	9999

(5 rows)

13) Consider a relation schema R with attributes ABCDEFGH with functional dependencies S:

S = {B → CD; BF → H; C → AG; CEH → F; CH → B}

Which of these functional dependencies violate BCNF (Boyce-Codd Normal Form)

14) Let us assume a table User_Personal as given below;

UserI D	**U_email**	**Fname**	**Lname**	**City**	**State**	**Zip**
MA12	Mani@ymail.com	MANISH	JAIN	BILASPUR	CHATISGARH	458991
PO45	Pooja.g@gmail.co	POOJA	MAGG	KACCH	GUJRAT	832212
LA33	Lavle98@jj.com	LAVLEEN	DHALL	RAIPUR	CHATISGARH	853578
CH99	Cheki9j@ih.com	CHIMAL	BEDI	TRICHY	TAMIL NADU	632011
DA74	Danu58@g.com	DANY	JAMES	TRICHY	TAMIL NADU	645018

I(a) Identify the normal form present in the above table one by one and convert it upto third Normal forms.

15. The relation schema Student_Performance (name, courseNo, rollNo, grade) has the following FDs:

name,courseNo->grade

rollNo,courseNo->grade

name->rollNo

rollNo->name

Identify the highest normal form of this relation and also find out the closure sets and superkey of the functional dependencies.

16) Given a relation R(P, Q, R, S, T, U, V, W, X, Y) and Functional Dependency set FD = { PQ → R, PS → VW, QS → TU, P → X, W → Y }, determine whether the given R is in 2NF? If not convert it into 2 NF.

(ii) Find all the candidate keys of R given R and the set F of functional dependencies (FDs) as follows;

R = (a, b, c, d, e) and F = {a → c, c → bd, d → a}

17) Consider the following relation (table) STUDENT1 to explain the property 1NF and convert it into first normalized form.

RegNo	***SName***	***Gen***	***PR***	***CName_Regd***
R1	Sundar	M	BTech	Database, Data Structures
R2	Ram	M	MS	Database
R3	Kathik	M	MCA	Data Structures, Multimedia
R4	John	M	BSc	Multimedia

Table 1 – STUDENT1

18)From the following tables write a SQL query to find the salesperson and customer who reside in the same city. Return Salesman, cust_name and city.

Sample table: salesman

salesman_id	name	city	commission
5001	James Hoog	New York	0.15
5002	Nail Knite	Paris	0.13
5005	Pit Alex	London	0.11
5006	Mc Lyon	Paris	0.14
5007	Paul Adam	Rome	0.13
5003	Lauson Hen	San Jose	0.12

Sample table: customer

customer_id	cust_name	city	grade	salesman_id
3002	Nick Rimando	New York	100	5001
3007	Brad Davis	New York	200	5001
3005	Graham Zusi	California	200	5002
3008	Julian Green	London	300	5002
3004	Fabian Johnson	Paris	300	5006
3009	Geoff Cameron	Berlin	100	5003
3003	JozyAltidor	Moscow	200	5007
3001	Brad Guzan	London		5005

19) Consider a relation Student (StudentID, ModuleID, ModuleName, StudentName, StudentAddress, TutorId, TutorName). Each student is given a StudentID and each module given a ModuleID. A student can register more modules and a module can be registered by more students. TutorID is the ID of the student's personal tutor, it is not related to the modules that the student is taking. Each student has only one tutor, but a tutor can have many tutees. Different students can have the same name. Different students can be living at the same address. Find all the functional dependencies holding in this relation, all possible candidate keys of functional dependencies and normalize the table to 3NF.