Final Exam

Class Room: Online
Assignment Points: 15 points
Thursday 12/3/2020

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Exam rules:

- You MUST submit this final exam by **12/5/2020, 11:59 pm.** There will not be any extension or late submission.
- Submit your assignment in PDF format in Canvas. You can use word, excel or similar tools and convert into pdf.
- This is open book exam and any kind of resource materials are allowed.
- Collaboration and consultation is NOT allowed. Do your own work.

Section 1: 3 points

Normalize the following form into **3NF.** Only your 3rd NF will be graded.

University Departments Sample Form

Dept Name	………………………..	
Building Num	………………………..	
Phone 1	xxx-xxx-xxxx	
Phone 2	xxx-xxx-xxxx	
Phone 3	xxx-xxx-xxxx	
Instructor Name	Subject	Gender
……….. …………….	……………..	X
……….. …………….	……………..	X
……….. …………….	……………..	X
……….. …………….	……………..	X

This is the University departments sample form used by many departments.

If there is no concatenated key or many to many relationship, many times you can put directly into 3rd NF, i.e., do not carried away with unnecessary normalization. There is not always 1st, 2nd and 3rd NF needed.
Normalize, as you did in HW-1 Normalization.

Hints: List all attributes.
Identify the repeating group of attributes.
Create entities and keys e.g. PK/FK.
You don't need more than 3 entities in your 3 NF.

Tabular Form:						
UNNORMALIZED		**1st NF**		**2nd NF**		**3nd NF**
University Departments Sample Form		**Departament**		**Departament**		**Departament**
dept_name		dept_id - (PK)		dept_id - (PK)		dept_id - (PK)
building_num		dept_name		dept_name		dept_name
phone_1		building_num		building_num		building_num
phone_2		phone_1		phone_1		phone_1
phone_3		phone_2		phone_2		phone_2
instructor_name		phone_3		phone_3		phone_3
subject						
gender		**Instructor**		**Instructor/Dept**		**Instructor/Dept**
		dept_id - (PK)		dept_id - (PK)		dept_id - (PK)
		instructor_id - (PK)		instructor_id - (PK)		instructor_id - (PK)
		instructor_name				
		subject		**Instructor Info**		**Instructor Info**
		gender		instructor_id - (PK)		instructor_id - (PK)
				instructor_name		instructor_first_name
				subject		instructor_last_name
				gender		subject
						gender

Section 2: 3 points

Create **ERD design** for following scenario:

Your data model design (ERD) should include relationships between tables with primary keys, foreign keys, optionality and cardinality relationships. Captions are NOT required.

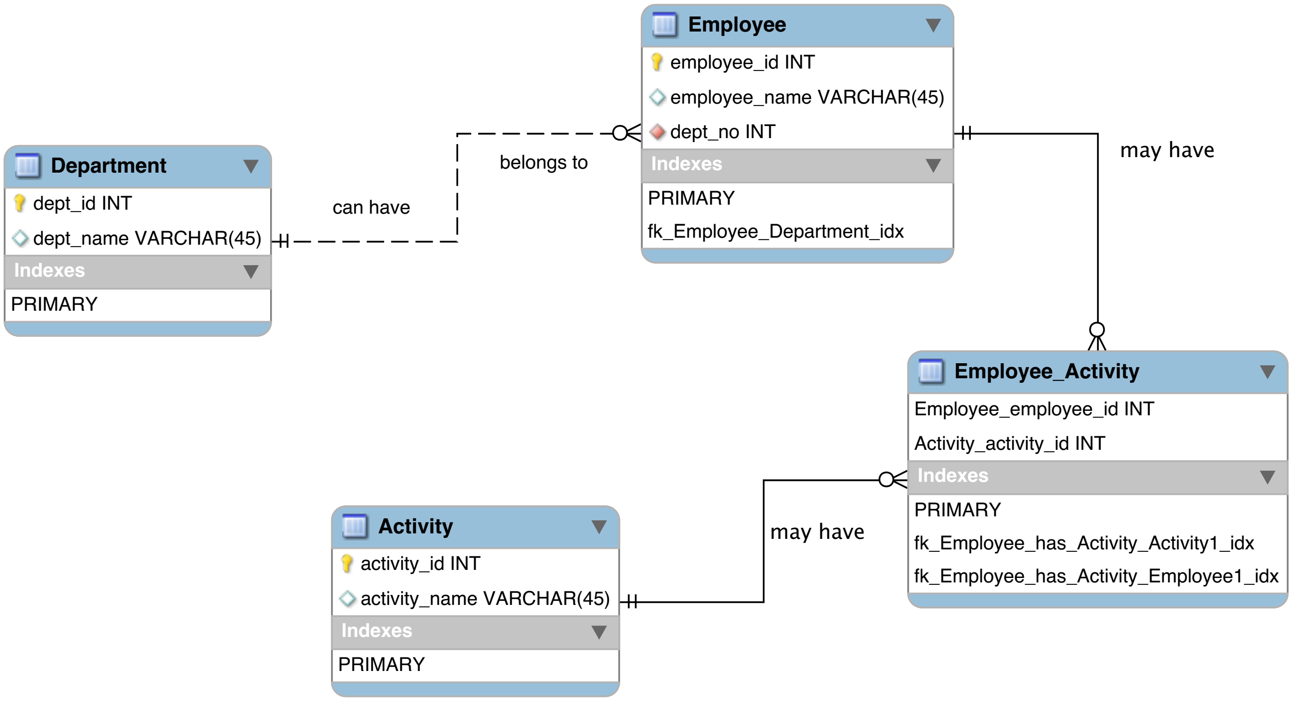
Scenario: There are 3 tables with 2 columns in each table:

Department (Dept ID, Department Name)

Employee (Employee ID, Employee Name)

Activity (Activity ID, Activity Name)

Each Employee must belongs to ONLY ONE Department.
Department may have ZERO, ONE OR MORE Employees, i.e. Department may exists without any employee.
Each Employee may participate in ZERO, ONE OR MORE Activities
Each Activity may be performed by ZERO, ONE OR MORE Employees.



Section 3: 2 points

a. Create table **T1** with following columns and constraints.
   Note: DO NOT use alter table, list all constraints while creating table.

   C1 INT (10) Primary key
   C2 INT (10)
   C3 INT (10)
   C4 VARCHAR (40)

   Constraints:
   C3 NON-ZERO
   C2 greater than C3
   C4 default value of 'HR'

```
DROP TABLE IF EXISTS T1;
CREATE TABLE T1
(
C1 INT (10) PRIMARY KEY,
C2 INT (10),
C3 INT (10) NOT NULL,
C4 VARCHAR (40) DEFAULT 'Data Analyst',
CHECK (C2>C3),
CHECK (C3 != 0)
);
```

b. Create table **T2** with following columns and Foreign Key.
Note: DO NOT use alter table, create FK while creating table.

C5 INT (10) Primary key
C6 INT (10)
FK on C6 column referencing to C1 column in table T1 above.

```
DROP TABLE IF EXISTS T2;
CREATE TABLE T2
(
C5 INT (10) PRIMARY KEY,
C6 INT (10),
FOREIGN KEY (C6) REFERENCES T1(C1)
);
```

c. Explain, in short, the meaning and importance of Referential Integrity (RI).

Referential Integrity (RI) is a Foreign Key Constraint used to prevent that changes in one part of the system don't lead to unanticipated problems elsewhere. For example, it prevents inserting a row into a child table where the parent key value is missing, and deletions and updates are also restricted. This makes it so that connected fields (keys that reference other keys in other tables) update together and not separately.

Section 4: 4 points

All questions are based on below **Employees table**:

EmpId	ManagerId	Name	Department	Salary	City
1	0	Alex Smith	Admin	$90,000	Boulder
2	1	Amy Mars	Admin	$50,000	Longmont
3	1	Logan Mars	Admin	$70,000	Longmont
4	1	James Mont	Marketing	$55,000	
5	6	John Smith	Marketing	$60,000	Boulder
6	1	Lily Mars	Marketing	$95,000	
7	6	Ravi Grace	Database	$75,000	Longmont
8	6	Tara Frank	Database	$80,000	Longmont
9	6	Tom Ford	Database	$65,000	
10	6	William Cruze	Database	$85,000	Longmont

a. Write a SQL statement to find the Name and Salary who has **5th HIGHEST** Salary in the entire Employee table.

```
SELECT Name, Salary FROM Employees ORDER BY `Salary` DESC LIMIT 4,1;
```

b. Write a SQL statement to find the Department and their count whose count is more than 3.

```
SELECT Department, COUNT(Department) AS Count
        FROM Employees
        GROUP BY Department
        HAVING Count > 3;
```

c. Write a SQL statement to show Name, Department and City.
However, if City is NULL, then display 'Broomfield' otherwise display City itself.

```
SELECT Name, Department, IF (City IS NULL, "Broomfield", City) AS City
        FROM Employees;
```

d. Write a SQL statement to find distinct employee Name who is also a Manager

```
SELECT e.Name
        FROM employees e
        INNER JOIN employees m
        ON (e.EmpId = m.ManagerId)
        GROUP BY e.Name;
```

e. Write a SQL statement to find Maximum, Minimum and Average Salary from the entire Employee table.

```
SELECT MAX(Salary)AS "Max", MIN(Salary) AS "Min", AVG(Salary) AS "Avg"
        FROM Employees;
```

f. Write a SQL statement to show Name, Department and Salary who earn MORE THAN the Average Salary in **THEIR department**. You must use sub-query.

```
SELECT e.Namee, e.Department, e.Salary
        FROM Employees e
        INNER JOIN (SELECT Department, AVG(Salary) AS Av FROM Employees GROUP BY
Department) avgs
        ON e.Department = avgs.Department
        WHERE Salary > avgs.Av
        GROUP BY e.Namee, e.Department, e.Salary;
```

g. Write a SQL statement to show Name, Department, Salary and their Rank **WITHIN Department** from highest to lowest salary.
i.e, Salary rank must reset and re-rank start from 1 for EACH Department.

```
SELECT Name, Department, Salary, RANK() OVER (
        PARTITION BY Department
        ORDER BY salary DESC) salary_rank
        FROM employees
        GROUP BY  Name, Salary, Department;
```

h. Write a SQL statement to find HIGHEST paying employee's Name and Salary from the entire Employee table. You must use sub-query.

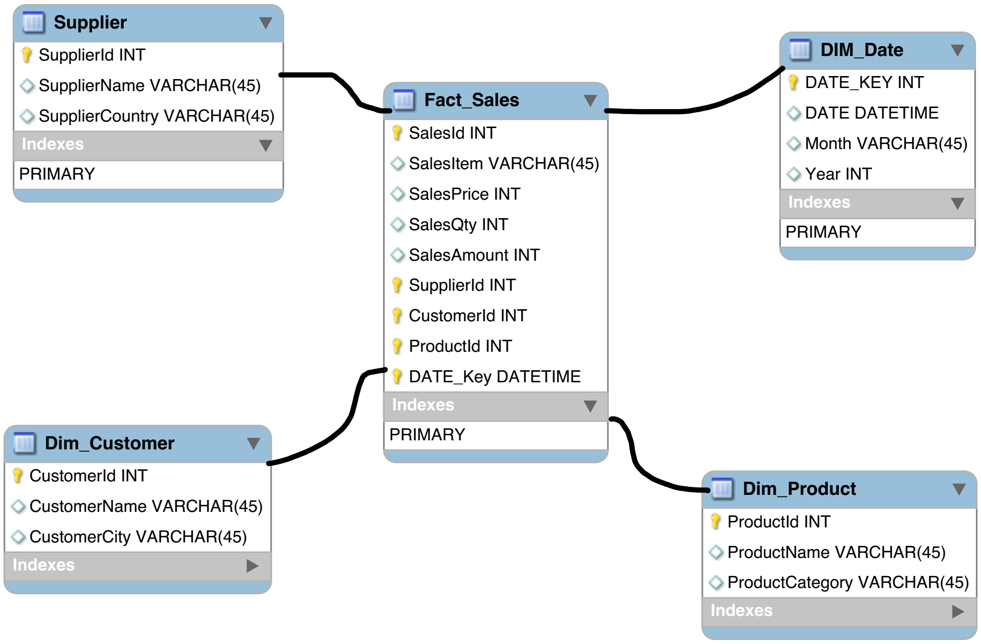
```
SELECT Namee, Salary FROM(SELECT Namee, Salary,
        RANK () OVER (
        ORDER BY Salary DESC) ranking
        FROM Employees)t1
        WHERE ranking = 1;
```

Section 5: 3 points

Create a Retail Sales Company **Data Warehouse design** using **STAR schema** from following info. Make sure to indicate proper _DIM and _Fact tables and their PKs/FKs. You need to join those tables using JUST straight lines (optionality and cardinality relationships are NOT required).

Date, Month, Year, SupplierName, SupplierCountry, ProductName, ProductCategory, CustomerName, CustomerCity, SalesItem, SalesPrice, SalesQty, SalesAmount

Note: You may use MySQL workbench or just handwritten to create STAR schema Data Warehouse design.



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