Final Exam

Class Room: Online
Assignment Points: 15 points
Thursday 7/23/2020

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Exam rules:

- You MUST submit this final exam by today, **7/23/2020, 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.

UNNORMALIZED	1NF	2NF	3NF
DEPTNAME	Department	Department	Department
BLDGNUM	DeptID	DeptID	DeptID
PHONENUM	DeptName	DeptName	DeptName
INSTRUCTORNAME	BldgName	BldgName	BldgName
SUBJECT	PhoneNum	PhoneNum	PhoneNum
GENDER	InstructorID	InstructorID	InstructorID
	Instructor	Instructor	Instructor
	InstructorID	InstructorID	InstructorID
	InstructorName	InstructorName	InstructorName
	Subject	Subject	Subject
	Gender	Gender	Gender
			Classes
			Subject
			InstructorID
			DeptID

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.

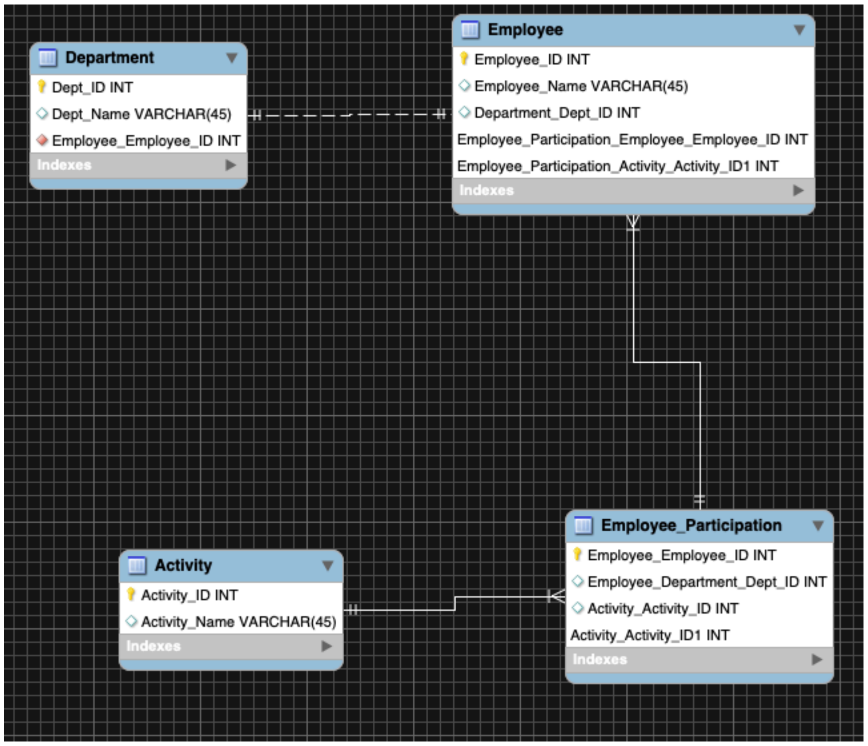
Scenario: There are 3 tables with 2 columns in each table:

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'

```
CREATE TABLE T1 IF NOT EXISTS {

C1 INT(10) NOT NULL,
C2 INT(10) > C3,
C3 INT(10),
C4 VARCHAR(40) DEFAULT ‘HR’,
PRIMARY KEY (C1)

}
```

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.

```
CREATE TABLE T2 IF NOT EXISTS {

C5 INT(10),
C6 INT(10),
PRIMARY KEY (C5)
FOREIGN KEY (C6) REFERENCES T1(C1)
}
```

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

   Referential integrity has to do with the accuracy of the data in a relationship and the consistency of the data shared between tables. This guarantees that whenever a foreign key is used, the reference exists in the primary key, keeping the data and relationships as accurate and consistent as possible.

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 1
OFFSET 4;
```

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

```
SELECT DEPARTMENT, COUNT(NAME) AS Count
FROM Employees
GROUP BY Department
HAVING COUNT(NAME) > 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, INFULL(City, “Broomfield”)
FROM Employees;
```

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

```
SELECT DISTINCT Employees.Name
FROM Employees
INNER JOIN Employees emp ON(Employees.EMPID = emp.ManagerID)
```

ORDER BY 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, ROUND(AVG(Salary),2) AS Average
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 Name, Department, Salary
FROM Employees
WHERE Salary > ALL
        (SELECT AVG(Salary)
        FROM Employees
        GROUP BY Department
        )
;
```

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) “Rank”
FROM Employees;

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

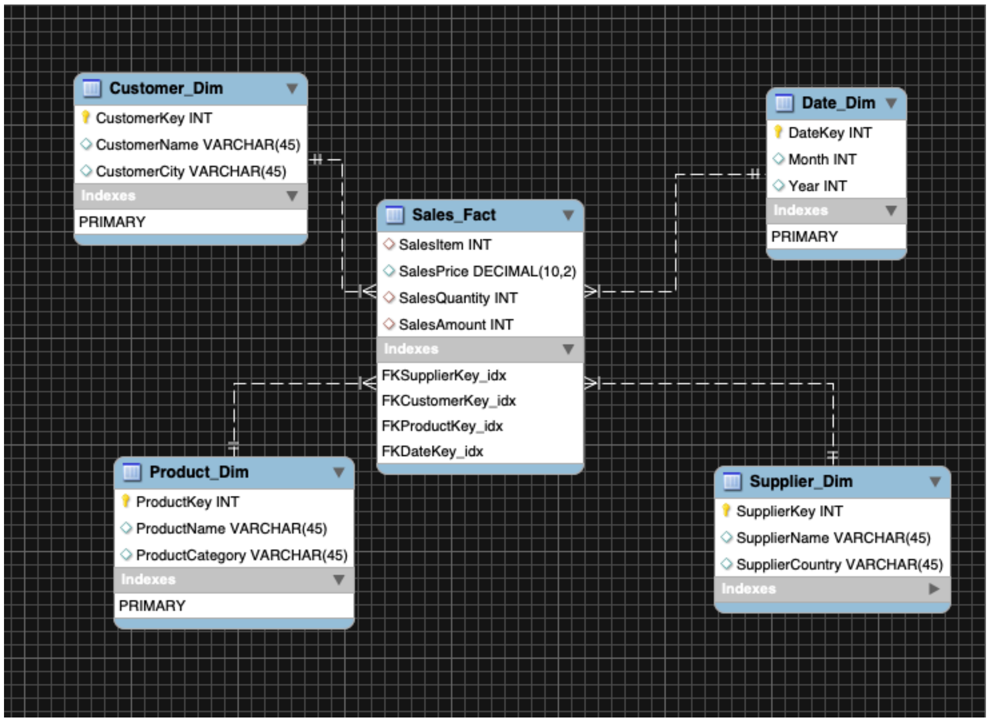
```
SELECT Name
FROM Employees
WHERE Salary IN
        (SELECT MAX(Salary)
        FROM Employees)
;
```

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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