Final Exam

Classroom: Online

Assignment Points: 25 points

Name: Jaryd Meek
Student ID: 109494970

Exam rules:

- You MUST submit this final exam by **4/28/2022, 11:59 pm.** There will not be any extension or late submission.
- Submission: submit in **Canvas in pdf or word doc**.
- This is open book exam and any kind of resource materials are allowed.
- Collaborations and consultations are NOT allowed. Do your own work.

Section 1: 5 points

1. During normalization process, we tend end up with more tables than we started?

A. True
B. False

2. You should remove partial dependency of non-Key attributes on the entire key in which normalization form?

A. First Normal Form
B. Second Normal
C. Third Normal Form
D. Fourth Normal Form

3. Which one of the following is used to create/define table and alter the of the structure in relational database system?

A. DML (Data Manipulation Language)
B. DDL (Data Definition Language)
C. Query
D. Relational Schema

4. A composite primary key may have a null value so long as other candidate keys remain not null.

A. True
B. False

5. Which of the following clause is used to filter the conditions in the SQL statement?

A. THEN
B. WHILE
C. WHERE
D. IF

6. Which SQL keyword is used to sort the result-set?

A. ORDER BY
B. ORDER
C. SORT BY
D. SORT

7. The BETWEEN operator is inclusive: begin and end values are included.

A. True
B. False

8. ___LIKE_____ operator is used to match a specified pattern in a SQL statement.

9. __Normalization_____ is the process to eliminate data redundancy and to make functional dependency of attributes.
10. The complete SQL statement may be complicated but it must include at least these two keywords: _SELECT_____, __FROM_____

11. Write a SQL statement to select the unique "LastName" column from the "Students" table?
The phrasing of the “unique ‘LastName’ column” confuses me on what is requested, it could either be interpreted as the column is unique
SELECT `LastName` FROM `Students`;
Or the unique items in the column, in which case:
SELECT DISTINCT `LastName` FROM `Students`;

12. Write a SQL statement to select all the records from a table named "Characters" where the ‘FirstName’ starts from ‘A’ or ‘B’.

SELECT * FROM `Characters` WHERE ‘FirstName’ LIKE ‘A%’ OR ‘FirstName’ LIKE ‘B%’;

13. Write a SQL statement to select all the records from a table “Customers” where the “LastName” ends with “c”.

SELECT * FROM `Customers` WHERE `LastName` LIKE ‘%c’;

14. DELETE FROM supplier statement does the following:

A. Delete all rows in the supplier table, including the table structure
B. Delete all rows in the supplier table
C. No data is deleted without WHERE clause
D. Delete the first row in the supplier table

15. In GROUP BY SQL statements, you remove groups that do not meet the conditions with the use of:

A. WHERE clause
B. HAVING clause after GROUP BY
C. WHERE clause first, and then use the HAVING clause
D. HAVING clause first, and then use the WHERE clause

Section 2: 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.
Each department belongs on only one building and department may have multiple phone lines.
Each instructor teaches only one subject and belongs on only one department.
If there is no many to many relation (no concatenated key), 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.

ANSWER ON NEXT PAGE

Unnormalized	1st Normal	2nd Normal	3rd Normal
Dept_Name	Deptartment	Deptartment	Deptartment
Building_Num	Dept_ID (PK)	Dept_ID (PK)	Dept_ID (PK)
Phone_1	Dept_Name	Dept_Name	Dept_Name
Phone_2	Building_Num	Building_Num	Building_Num
Phone_3			
Instructor_Name	Instructor	Instructor	Instructor
Subject	Instructor_ID (PK)	Instructor_ID (PK)	Instructor_ID (PK)
Gender	Instructor_Name	Instructor_Name	Instructor_Name
	Subject	Subject	Subject
	Gender	Gender	Gender
	Dept_ID (FK)	Dept_ID (FK)	Dept_ID (FK)
	Phone	Phone	Phone
	Phone_Number (PK)	Phone_Number (PK)	Phone_Number (PK)
	Dept_ID (FK)	Dept_ID (FK)	Dept_ID (FK)

Section 3: 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.

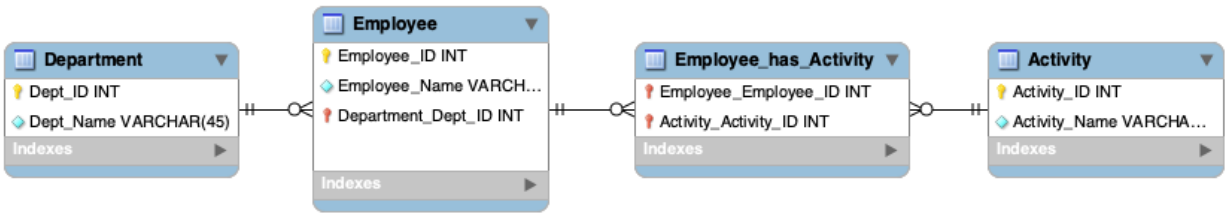
Scenario: There are 3 tables with 2 columns in each table:

Department (Dept ID, Department Name)

Employee (Employee ID, Employee Name)

Activity (Activity ID, Activity Name)

Each Employee must belong 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 4: 3 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 (
        C1 INT(10) NOT NULL,
        C2 INT(10),
        C3 INT(10),
        C4 VARCHAR(40) DEFAULT 'HR',
        PRIMARY KEY (C1),
        CHECK (C3 != 0),
        CHECK (C2 > C3)
);
```

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 (
        C5 INT(10) NOT NULL,
        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 means that a foreign key must have a matching primary key. By maintaining this, it prevents incomplete data being returned, or data being lost in the database because it no longer returns in queries.

Section 5: 8 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(Department) AS `Count` FROM Employees
  GROUP BY (Department)
  HAVING COUNT(Department) > 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, IFNULL(City, 'Broomfield') FROM Employees;
```

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

```
SELECT DISTINCT Name FROM Employees
        WHERE (EmpId IN (SELECT ManagerId FROM Employees));
```

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

```
SELECT MIN(Salary) AS 'Minimum', MAX(Salary) AS 'Maximum', AVG(Salary)  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 > (SELECT AVG(Salary) FROM Employees);
```

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) AS `Rank Within Department` 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.

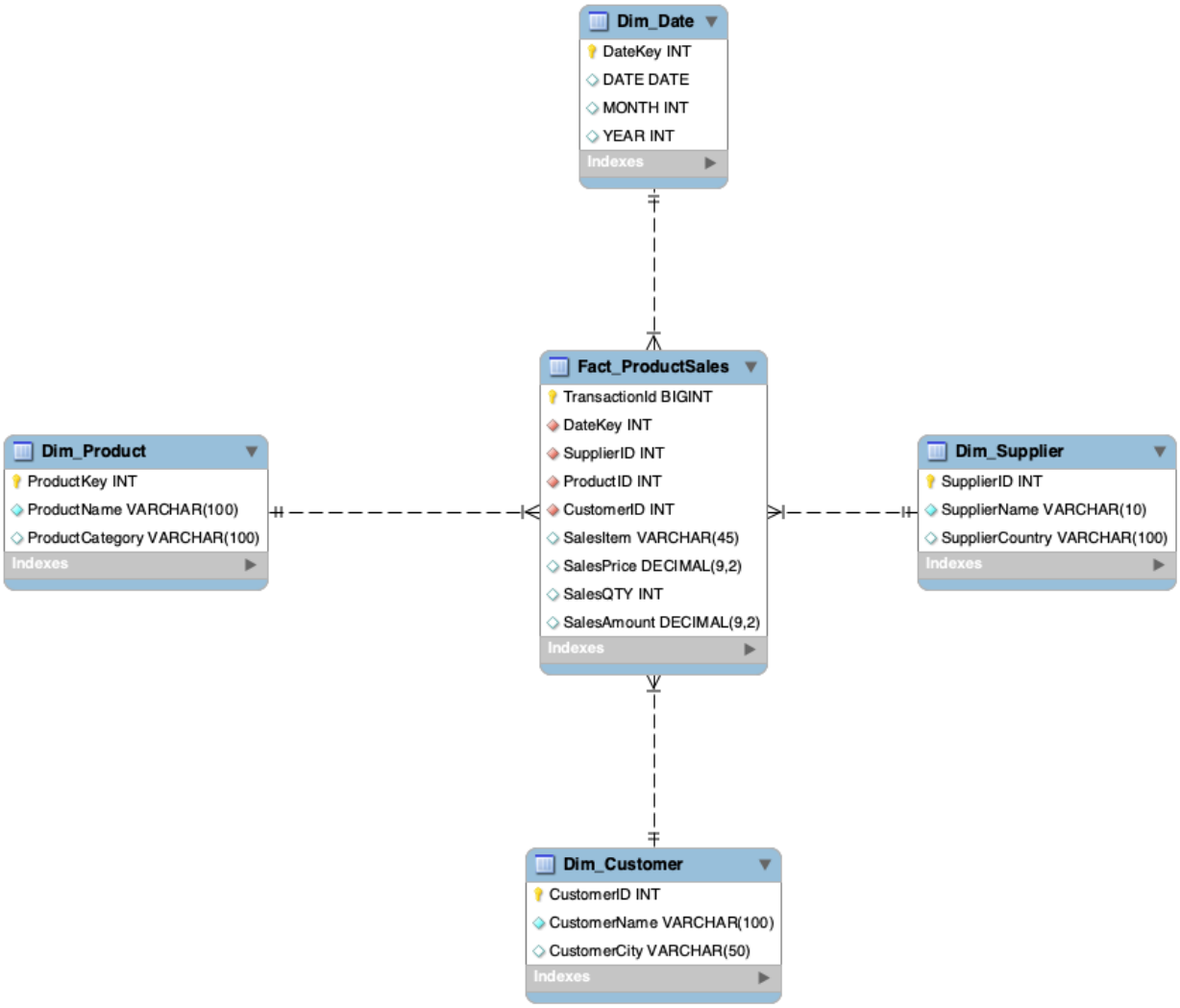
```
SELECT Name, Salary FROM Employees
        WHERE Salary = (SELECT Max(Salary) FROM Employees);
```

Section 6: 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 any tool or just handwritten to create STAR schema data warehouse design.



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