12-741: Data Management
Assignment#4

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Some notes before you begin:

When answering the following questions, please provide all of your calculations to arrive at the answer (in addition to the answer itself). Your calculations should be very clear and easy to understand. They should include your assumptions, and a step-by-step explanation of how you arrived at the solution. Also, make sure you type your name and AndrewID on the top of each page.

Some final recommendations:

- Before finding the answer to each question or looking at the next step in the solution, take some time to think about how you can come up with this on your own.
- Again, make sure you document everything you do, and not just write down the answer to the question. This will both help during grading as well as improving your learning process.
- Do not write down any solution or process that you do not understand. If you feel that you do not understand how to do something, seek some help. The preferred method for this is to post your questions on the discussion board for the course, in Canvas and/or Piazza.

1 More Entity-Relationship Diagrams (20%)

Take a look at the (incomplete) diagram in Figure **??**:

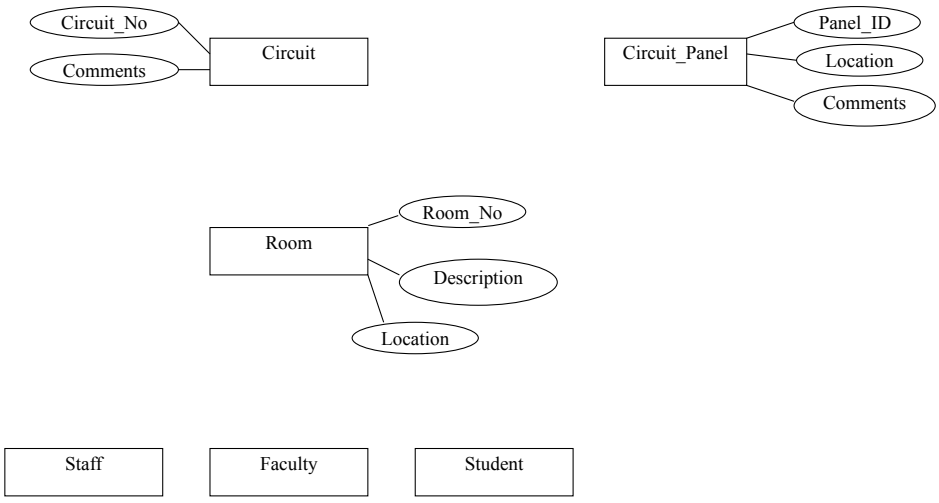

Figure 1: Incomplete E-R Diagram for an electrical distribution system in a building

Finish the diagram above so that the following constraints can be satisfied[1]

In order to finish the ER diagram above, you have to name the relationships, determine the nature of each relationship (one-to-many, many-to-many, many-to-one, etc.), key attributes, weak entities (if any).

1. (4%) Every circuit panel is composed of various circuits, and each circuit belongs to a single circuit panel.
2. (4%) Circuits are only uniquely defined in the context of a given circuit panel (i.e. there are many circuit #5, but only one circuit #5 for panel A).
3. (4%) Each circuit can feed many rooms, and a room can be fed by many different circuits.
4. (4%) Additionally, the circuit feed relationship can serve different loads (lighting, receptacles, air conditioner units, etc.). In other words, one electrical circuit can be feeding a receptacle, or a ceiling light, etc.
5. (4%) Rooms can be of different types: faculty, student and staff.

2 Relational Models (20%)

Answer the following questions:

1. (15%) Design data tables according to the finished E-R diagram in Problem 1. Just list the names and attributes of each table only and no examples are required. Also, show the functional dependencies in each table. Please underline the primary key on your relations.
2. (5%) Does your design violate BCNF? Why or why not?

[1]Note: No additional assumptions should be made in order to finish the E-R diagram.

3 SQL (15%)

Write the following SQL queries, which should be applicable to the tables that you designed in the previous problem.

1. (5%) List the description of the room whose room number is 118E.
2. (5%) Create the table structure for Circuit.
3. (5%) Delete the records from the table Circuit Panel whose comment is: "TO BE DELETED".

4 More SQL (45%)

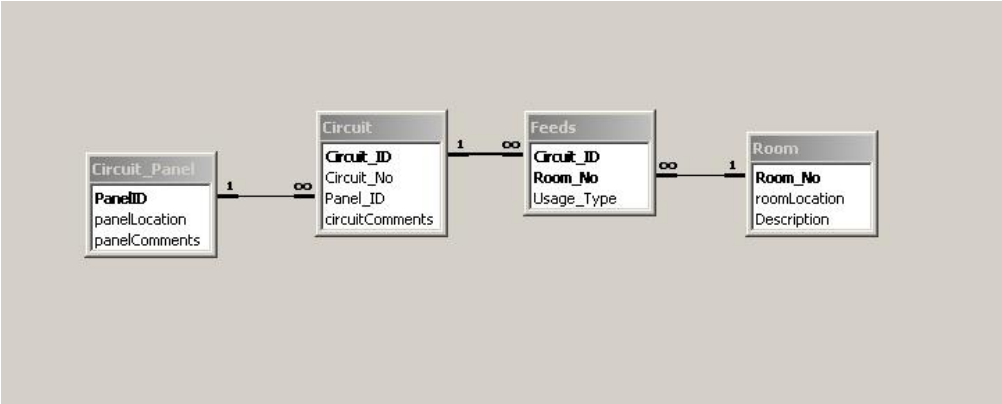

Figure 2: A database schema, shown in the Microsoft Access format

1. (20%) In Figure **??**, we have the relationship among the tables "Circuit_Panel", "Circuit", "Feeds" and "Room". All attributes including are clearly shown in the figure, and those belonging to the primary key are in bold. Because of the constraints among the tables, the tables have to be created in a specific order. Please select the correct order in the following solutions (by circling the correct one):

   (a) Circuit, Feeds, Room, Circuit_Panel

   (b) Circuit_Panel, Feeds, Circuit, Room

   (c) Room, Feeds, Circuit_Panel, Circuit

   (d) Circuit_Panel, Circuit, Feeds, Room

   (e) Room, Circuit_Panel, Circuit, Feeds

   In one sentence, please explain your answer

2. (20%) Write a query to list all circuits that contain the word "old" in their comments. Order that list by circuit panel, and then by circuit number (not Circuit_ID)
3. (5%) Write a query to find the number of circuits (without repetition) feeding room number 121