Mohamad Salaam
3/1/23

COMP 5210-D01
Assignment 2

1. A foreign key is a column in a table whose values must match values of a column in some other table. It is used to prevent actions that would destroy links between tables. Foreign Key constraints enforce referential integrity, which essentially says that if column value A refers to column value B, then column value B must exist.

2. Ans:
    a. a. An external schema describes the logical view of the database as seen by the application programs or the end-users. It specifies the subset of the database that is relevant to a particular user or group of users and hides the complexity of the underlying data model.
    b. An internal schema describes the physical organization of the database on the storage devices, such as the disk blocks, files, and indexes. It specifies the data structures, access methods, and storage allocation techniques used by the database management system (DBMS) to store and retrieve data efficiently.
    c. A conceptual schema describes the overall logical structure of the database as a set of interrelated entities, attributes, and relationships. It defines the data elements and their relationships in a database-independent and user-friendly way.
    d. They are related in the concepts of physical and logical independence. Logical data independence refers to the ability to change the conceptual schema without affecting the external schema or the application programs that use it, physical data independence refers to the ability to change the internal schema without affecting the conceptual schema or the external schema.

3. Ans:
    a. We can query this with the following and we use INNER for table relations:
    ```
    SELECT DISTINCT pname
    FROM Parts
    INNER JOIN Catalog ON Parts.pid = Catalog.pid;
    ```
    b. For sname of who charges the most:
    ```
    SELECT Parts.pname, Suppliers.sname
    FROM Parts
    INNER JOIN Catalog ON Parts.pid = Catalog.pid
    INNER JOIN Suppliers ON Catalog.sid = Suppliers.sid
    WHERE Catalog.cost = (
            SELECT MAX(Catalog.cost
            FROM Catalog
            WHERE Catalog.pid = Parts.pid );
    ```

Mohamad Salaam
3/1/23

c. For suppliers of red color only we use:

```
SELECT Catalog.sid
FROM Catalog
INNER JOIN Parts ON Catalog.pid = Parts.pid
WHERE Parts.color = 'red'
GROUP BY Catalog.sid
HAVING COUNT(*) = (
        SELECT COUNT(*)
        FROM Parts
        WHERE color = 'red' );
```

d. For suppliers of every part:

```
SELECT Suppliers.sname
FROM Suppliers
WHERE NOT EXISTS (
        SELECT pid
        FROM Parts
        WHERE NOT EXISTS (
                SELECT sid
                FROM Catalog
                WHERE Catalog.sid = Suppliers.sid AND Catalog.pid =
                 Parts.pid )
                );
```

4. Ans:
   a. <u>πperson-name(σcompany-name='Auburn Bank'(Works))</u>
      The query finds the names of all employees who work for Auburn Bank using the selection and projection operators in relational algebra.

   b. <u>πperson-name, city(σcompany-name=Auburn Bank'(Works ⋈ Employee))</u>
      The query finds the names and cities of residence of all employees who work for Auburn Bank using the natural join, selection, and projection operators in relational algebra.

   c. <u>πperson-name, street, city(σcompany-name=Auburn Bank' ∧ salary>50000(Works ⋈ Employee))</u> The query finds the names, street address, and cities of residence of all employees who work for Auburn Bank and earn more than $50,000 per year using the natural join, selection, and projection operators in relational algebra.

   d. <u>πperson-name(σEmployee.city=Company.city(Works ⋈ Company ⋈ Employee))</u> The query finds the names of all employees in the database who live in the same city as the company for which they work using the natural join, selection, and projection operators in relational algebra.