

# **DAT 560G: Database Design and SQL**

## **Fall 2022, Mini A**

### **Final Exam – Sample Questions with Solutions**

#### **Instructions**

1. This is an individual assignment. You may not discuss your approach to solving these questions with anyone, other than the instructor or TA.
2. Please include only your Student ID on the submission.
3. The only allowed material is:
  - a. Class notes
  - b. Content posted on Canvas
  - c. Textbook
4. You are not permitted to use other online resources
5. **Due on Canvas. Due date is posted on Canvas.**

#### **Background**

There are numerous challenges with the rollout of the Covid-19 vaccine. Getting vaccines to pharmacies and vaccinating patients requires overcoming multiple logistical challenges. One of these challenges is keeping track of shipments of vaccines to pharmacies.

There are several aspects of the vaccine supply chain, which need to be coordinated. On the one hand the distribution centers have vials of vaccine ready to be shipped. These distribution centers are owned by pharmaceutical supply chain companies. These companies developed expertise in supplying medical products to pharmacies and others.

Using shippers such as FedEx and UPS, vaccines are sent to pharmacies. Covid-19 vaccines are in short supply and especially vulnerable to spoilage. Each shipment needs to be tracked. Additional information about the batch shipped is also maintained.

Finally, pharmacies need to receive the vaccines. Pharmacies will eventually administer the vaccine to patients.

#### **Additional Information**

Details of the database are described below. The information stored in the database is the following.

There are several distribution centers scattered around the Midwest. The data stored for a **distribution center** includes:

- DistCenter is the name of the distribution center
- City
- Start Date, which is the first date that the distribution center received vaccinations to distribute.
- Annual capacity of the distribution center. This is the number of vials of vaccine the distribution center can ship out in a year.
- The number of bays in the distribution center where trucks can load vaccines.
- The corporate affiliation of the distribution center. Most distribution centers are affiliated with a national company. You can think of the distribution center as a franchise.
- The manager of the distribution center
- Manager's gender

**Shippers** are used to send vaccines from distribution centers to pharmacies. For shippers we have information:

- Shipper is the name of the shipping company
- Annual revenue, in millions of dollars
- Number of employees, in thousands
- Number of locations in the country
- The name of the CEO
- Gender of the CEO
- The date the shipping company was established

weixin: scs\_ryan

Vaccines are shipped to pharmacies. For **pharmacies**, we have the following information:

- Name of the pharmacy
- City
- Corporate affiliation of the pharmacy. Similar to shippers, pharmacies belong to a national network.
- First case of vaccine that the pharmacy administered. This is the date and time of vaccinating the first patient.
- Number of patients the pharmacy wants to vaccinate
- Type of pharmacy. There are several different types in the database
- Name of the pharmacist
- Gender of the pharmacist

Each batch of the vaccines is monitored throughout its useful lifetime. The database stores information about each **batch**, including:

- BatchID, which is also used for tracking the batch during shipping
- The date the batch was shipped from the distribution center
- The number of vaccine vials in the batch. Assume each vial is one vaccine, for one patient
- **Shipper** is the shipping company, which ships the batch. This is a Foreign Key.
- The date the batch arrived (or will arrive) at the pharmacy
- **Origin** is the distribution center, which sent the batch. This is a Foreign Key.
- **Destination** is the pharmacy, which will receive the batch. This is a Foreign Key.
- Distance the batch will travel from origin to destination
- Cost of shipping the batch
- Driver, who works for the shipping company
- Gender of the driver
- Type of vehicle used for shipping. Several different types of vehicles are used.

weixin: scs\_ryan

The database is posted on Canvas

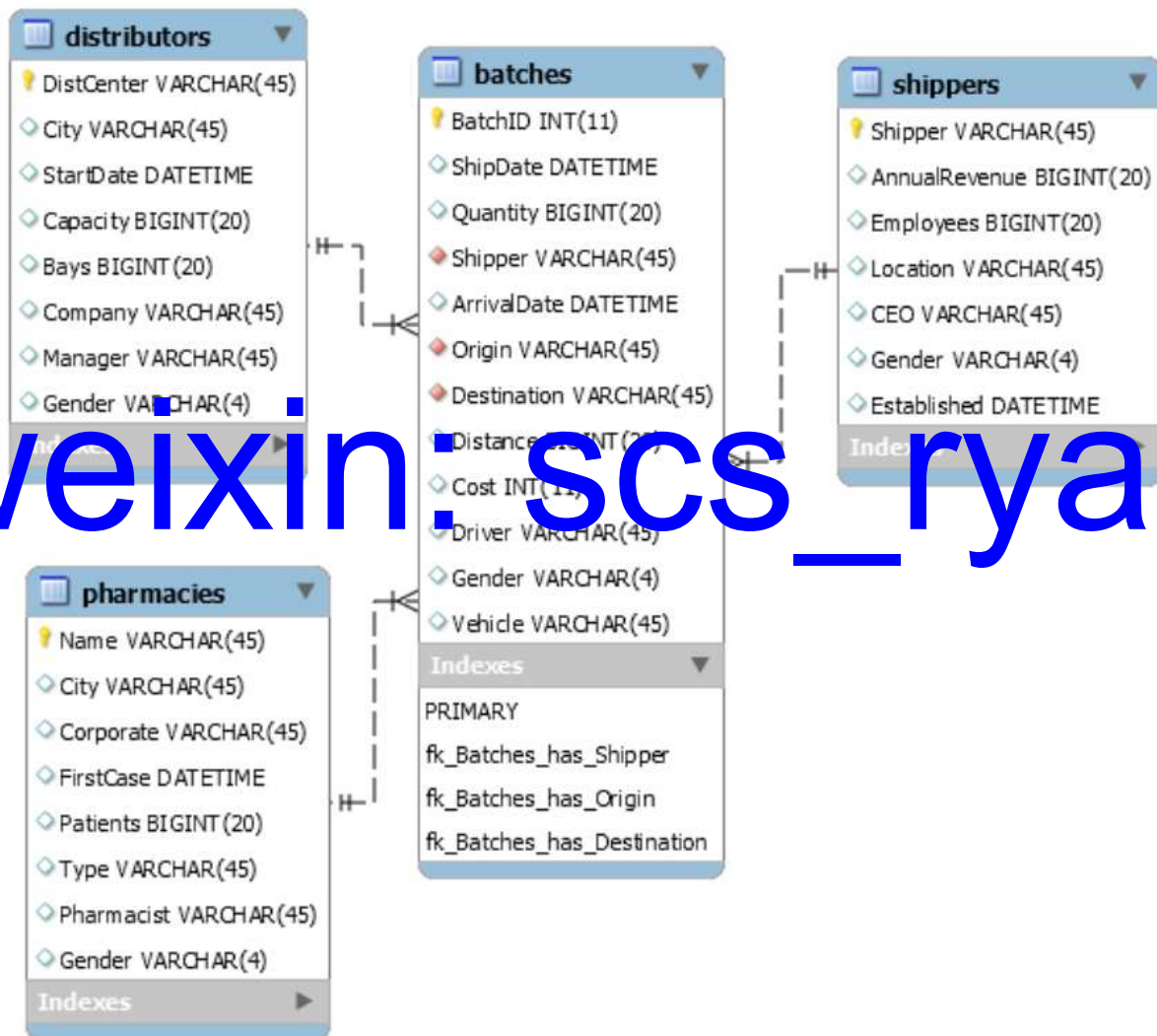
The E/R diagram for this database is below:

**Distributors** (DistCenter, City, StartDate, Capacity, Bays, Company, Manager, Gender)

**Pharmacies** (Name, City, Corporate, FirstCase, Patients, Type, Pharmacist, Gender)

**Shippers** (Shipper, AnnualRevenue, Employees, Locations, CEO, Gender, Established)

**Batches** (BatchID, ShipDate, Quantity, Shipper, ArrivalDate, Origin, Destination, Distance, Cost, Driver, Gender, Vehicle)



For each question, submit your SQL code and a screen-shot of the results. If the results are too long, partial results are fine. Include relevant attributes for each result, to explain that the result is correct. Do NOT include many unnecessary attributes. Do NOT use SELECT \*.

## Practice Questions

These questions are intended to help you understand the database. They will not be on the test.

- A) Find all shipments from a distribution center that has a capacity of more than 15,500, which were sent to one of the *Walls* locations. Sort the results by shipping date. List the BatchID, ShipDate, Origin, Destination, and Capacity in your final result.

```
SELECT BatchID, ShipDate, Origin, Destination, Capacity
FROM Batches JOIN Distributors ON Origin = DistCenter
WHERE Destination Like '%Walls%' AND Capacity > 15500
ORDER BY ShipDate;
```

**/\* 8 rows returned**

BatchID	ShipDate	Origin	Destination	Capacity
20157	2020-12-21 04:30:00	Supply Dallas	Walls Grand	16000
20497	2021-02-06 09:00:00	Express Chicago	Walls Grand	19000
20265	2021-03-16 08:30:00	Supply Chicago	Walls Cincinnati	20000
20113	2021-04-07 15:30:00	Supply Dallas	Walls Grand	16000
20409	2021-04-25 07:30:00	Supply Chicago	Walls Grand	20000
20521	2021-04-26 04:30:00	Supply Chicago	Walls Grand	20000
20165	2021-06-05 04:00:00	Supply Dallas	Walls Cincinnati	16000
20337	2021-06-14 01:00:00	Supply St. Louis	Walls Grand	16000

- B) For each batch sent from St. Louis, identify the distribution center it was sent from, the shipping company, the number of locations the shipping company has, the date of arrival, the pharmacy it was sent to, and the city where the pharmacy is located.

```
SELECT BatchID, DistCenter, ArrivalDate, Shipper, Locations, Origin, Destination,
Pharmacies.City
FROM ((Batches JOIN Distributors ON Origin = DistCenter)
JOIN Shippers USING(Shipper))
JOIN Pharmacies ON Destination = Name
WHERE Distributors.City = 'St. Louis';
```

**/\* 10 rows returned**

BatchID	DistCenter	ArrivalDate	Shipper	Locations	Origin	Destination	City
20133	MedCo St. Louis	NULL	American	7	MedCo St. Louis	HealthCo Fort Worth	Fort Worth
20153	MedCo St. Louis	2020-12-25 03:00:00	DBS	15	MedCo St. Louis	Walls Grand	Grand
20185	MedCo St. Louis	2021-01-18 19:00:00	DBS	15	MedCo St. Louis	Nurses Cincinnati	Cincinnati
20305	MedCo St. Louis	NULL	Pensk	90	MedCo St. Louis	BestOf Lincoln	NULL
20385	MedCo St. Louis	2021-03-04 20:00:00	Pensk	90	MedCo St. Louis	Walls Grand	Grand
20417	MedCo St. Louis	NULL	DBS	15	MedCo St. Louis	BestOf Lincoln	NULL
20105	Supply St. Louis	2020-12-25 12:30:00	Federal	12	Supply St. Louis	HealthCo Fort Worth	Fort Worth
20221	Supply St. Louis	2021-02-28 02:00:00	United	10	Supply St. Louis	Pharma Akron	Akron
20337	Supply St. Louis	NULL	Pensk	90	Supply St. Louis	Walls Grand	Grand
20465	Supply St. Louis	NULL	Federal	12	Supply St. Louis	Care Houston	Houston

- C) For each pharmacy, find the number of batches being sent to it, the total quantity sent, and the pharmacist. Sort the results by the quantity sent to it. If there is no shipment, total quantity sent must be 0.

```
SELECT Name, MIN(Pharmacist), COUNT(BatchID), IFNULL(SUM(Quantity),0) AS
TotalShipped
FROM Pharmacies LEFT JOIN Batches ON Destination = Name
GROUP BY Name
ORDER BY TotalShipped;
```

/\* 36 rows returned

Name	Pharmacist	COUNT(BatchID)	TotalShipped
First Grand	Bonnie Miller	0	0
Nurses Fort Worth	Eleanor Dixon	0	0
Care Toledo	Amelia Walker	0	0
First Lincoln	Beth Welch	0	0
HSUSA Fort Worth	Natalie Aguilar	0	0
CXS Branson	Guadalupe Richardson	0	0
HSUSA Grand	Jodi Ramirez	0	0
Pharma Fort Worth	Sophia Chandler	0	0
CXS Cincinnati	Louise Smith	0	0
HealthCo Akron	Lana Davis	0	0
HSUSA Houston	Pam Bryant	0	0
Pharma Madison	Ernestine Holland	0	0
BestOf Madison	Kay Barber	0	0
CXS Houston	Agnes Edwards	0	0

- D) For each pharmacy, list the name of the pharmacy, number of patients who need the vaccine at the pharmacy, total quantity received, and the ratio of vaccines received to the number of patients who need the vaccine. Sort the results by this ratio. Include only pharmacies that received vaccines.

```
SELECT Name, MIN(Patients), SUM(Quantity), SUM(Quantity)/Patients AS ReceivedRatio
FROM Pharmacies JOIN Batches ON Destination = Name
GROUP BY Name
```

ORDER BY ReceivedRatio;

**/\* 10 rows returned**

Name	MIN(Patients)	SUM(Quantity)	ReceivedRatio
Walls Cincinnati	15000	14400	0.9600
Nurses Cincinnati	18000	19700	1.0944
Care Houston	11000	13900	1.2636
Pharma Akron	15000	23800	1.5867
CXS Madison	13000	21100	1.6231
First Toledo	20000	33700	1.6850
BestOf Lincoln	13000	22300	1.7154
HealthCo Fort Worth	10000	18200	1.8200
HSUSA Aurora	10000	29600	2.9600
Walls Grand	10000	44700	4.4700

weixin: scs\_ryan