Project number: 01 Class: CS355 Submission date: 03/08/21
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Project One
Vaccine Database

Objective
- Create a database to manage requests for NYC vaccine scheduling.
- Create a UML diagram
- Create searches and output using relational algebra.

Database Design

Your design must include at least the following:
- *Patients*
  - Definition: Patients schedule vaccine appointments.
  - Attributes: Identify the patient first and last name, date of birth, street, city, state and zip, phone number, email, age, pre-existing conditioning and occupation. For instance, pre-existing conditions can be diabetics, cancer, or any number of medical conditions.
  - Multi-value attributes: There can be more than 1 pre-existing conditions or occupation.

- *Location*
  - Definition: Physical location where NYC is administering vaccines to patients.
  - Attributes: Identify the address, city, state, zip, phone number, is parking available, wheelchair accessibility, name of organization (for instance, Yankee Stadium, Jones Beach, Walgreens, a church, etc).
  - Multi value attributes: none.

- *Vaccine*
  - Definition: The vaccine administered to patients.
  - Attributes: Identify the vaccine manufacturer (Pfizer, Moderna, etc), quantity, location where the vaccine is located.
  - Multi value attributes: 1 vacation can be available at many locations and can have different quantities at each location.

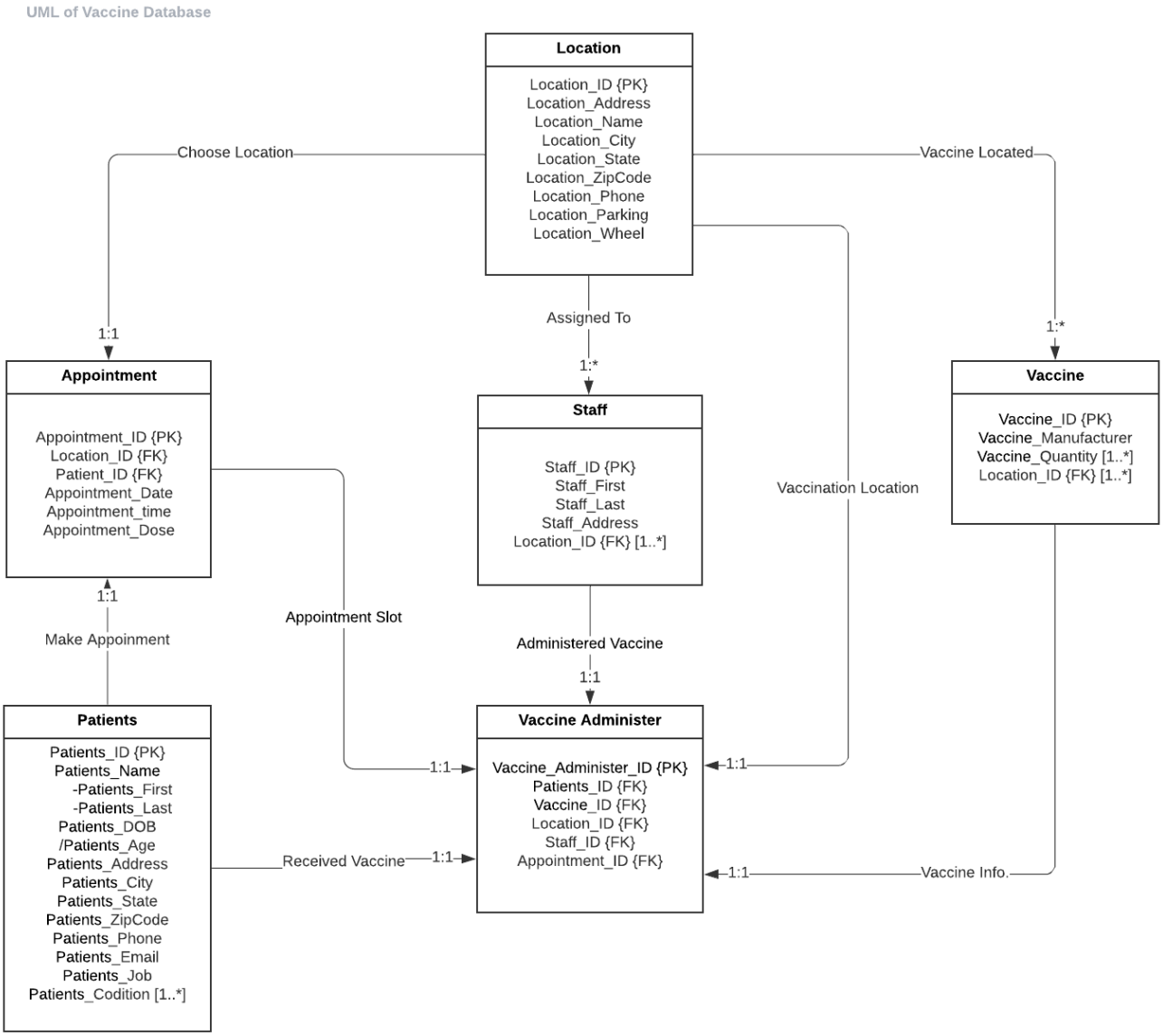
- *Staff*
  - Definition: Staff assist and administer the vaccine to patients.
  - Attribute: Identify the staff name, staff address and assigned location.
  - Multi value attributes: Staff can be assigned to more than 1 location.

- *Appointment*
  - Definition: Time slots available at locations for patients to schedule a vaccine. For instance, Yankee Stadium will have 500 appointments on Monday.
  - Attributes: Identify the location, date, time, patient who is requesting vaccine and is this the first or second of 2 doses.
  - Multi value attributes: none

- *Vaccine Administer*
  - Definition: Tracks patients who actually receive a vaccine from staff at a location.
  - Attributes: Identify **patient** who received the vaccine, which **vaccine** was administered, **staff** who administered the vaccine, **location** where the vaccine was administered and **appointment** slot.
  - Multi value attributes: none

Patients are not required to pay for a vaccine.

UML



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Convert UML to relations

Location (Location_ID, Location_Address, Location_Name, Location_City, Location_State, Location_ZipCode, Location_Phone, Location_Parking, Location_Wheel).

Appointment (Appointment_ID, Location_ID, Patient_ID, Appointment_Date, Appointment_time, Appointment_Dose).

Staff (Staff_ID, Staff_First, Staff_Last, Staff_Address, **Location_ID**).

Vaccine (Vaccine_ID, Vaccine_Manufacturer, **Vaccine_Quantity**, **Location_ID**).

Patients (Patients_ID, Patients_Name, Patients_First, Patients_Last, Patients_DOB, Patients_Age, Patients_Address, Patients_City, Patients_State, Patients_ZipCode, Patients_Phone, Patients_Email, Patients_Job, **Patients_Codition**) .

Vaccine_Administer (Vaccine_Administer_ID, Patients_ID, Vaccine_ID, Location_ID, Staff_ID, Appointment_ID).

Staff_Location (Location_ID, Staff_ID).
This will allow staff to be assigned to one or more locations.

Location_Vaccine(Vaccine_ID, Location_ID).
This will show vaccine to be assigned to one or more locations.

Patients_ Vaccine_Administer (Patients_ID, Vaccine_Administer_ID).
This will allow patients to be tracked.

Note
- Primary key attributes are underlined.
- Foreign key attributes are in Blue.
- Multi-Value attributes are **Bold**.

Domain
- Date: Valid date
- Time: From 8 a.m. (0800) to 8 p.m. (2000)
- Name, First, Last: Letters
- Address: Valid NY address
- Phone: Valid phone numbers with all integers.
- City: All cities in NY
- State: NY
- ZipCode: Valid NY zip code
- Vaccine_Manufacturer: Registered vaccine manufacturer
- Vaccine_Quantity: integers
- Location_ID: integers
- Appointment_ID: Letters
- Vaccine_ID: integers

- Staff_ID: integers
- Vaccine_Administer_ID: integers
- Patients_ID: integers
- Location_Name: Valid name of NY's bulidings
- Location_Parking: True / False
- Location_Wheel: True / False
- Appointment_Dose: 'First' or 'Second'
- Patients_Age: integers
- Patients_DOB: integers, Valid birthday form MM/DD/YYYY
- Patients_Codition: Letters
- Patients_Job: Letters.

Relational Algebra

- Generate relational algebra to answer the queries below.
- Use standard notation and replace all underlined terms with your own values and maintain the intent of the search. For instance: replace Yankee Stadium with another location and replace Monday with another day.
- Create descriptive attribute labels.

1. Identify available appointment slots on March 1 at Yankee Stadium. Display the location, date and time slots available.

   Appointment slots ← δ Appointment_Date = 'March 8' ∧ Appointment_ID (Appointment)

   A ←δ Appointment.Location_ID = Location. Location_ID (Appointment slots × Location)

   Answer ← Π Location_Name = 'Queens Library' (A)

2. Identify patients with appointments today at Yankee Stadium. Display the patient's name, vaccine manufacturer, patient address and email.

   A_Today ← δ Appointment_Date = 03/08/20 (Appointment)

   A_Location ←δ Appointment.Location_ID = Location.Location_ID (A_Today ×Location)

   A_VaccMaker ←δ Location.Location_ID = Vaccine. Location_ID (A_Location ×Vaccine)

   A_Patient ←δ Appointment.Patient_ID = Patients.Patients_ID (A_VaccMaker ×Patients)

   A ←δ Location_Name = 'Queens Library' (A_Patient)

   Answer ← Π Vaccine_Manufacturer, Patients_address, Patients_Email, Patients_Name(A)

3. Identify patients that cancelled or didn't show up for appointments yesterday at Yankee Stadium. Display the patient's name, vaccine manufacturer, appointment date, time and location.

   A_Yesterday ← δ Appointment_Date = 03/07/20 (Appointment)

   A_Location ←δ Appointment.Location_ID = Location.Location_ID (A_Yesterday ×Location)

   VccineMaker ←δ Location.Location_ID = Vaccine.Location_ID (A_Location ×Vaccine)

   A ←δ Location_Name = 'Queens Library' (VccineMaker)

   No-Show ←δ Appointment.Appointment_ID - Vaccine_Administer.Appointment_ID (A ×Vaccine_Administer)

   PatientInfo ←δ Appointment.Patient_ID = Patients.Patients_ID (No-Show ×Patients)

   Answer ← Π Patients_Name, Vaccine_Manufacturer , Appointment_Date, Appointment_Time, Location_Name (PatientInfo)

4. Identify staff assigned to the Yankee Stadium vaccine administration site on March 1. Display the staff name.

   A ← δ Staff.Location_ID = Location.Location_ID (Staff×Location)

   B ← δ Location.Location_ID = Appointment.Location_ID (A×Appointment)

   C ←δ Location_Name = 'Queens Library' ∧ Appointment_Date = "March 8" (B)

   Answer ← Π staff_first, Staff_Last (C)

5. Identify eligible patients without appointments. Eligible could be based on age, occupation, pre-existing medical conditions. Display the patient name, age address, pre-existing conditions and occupation.

   No_Appointment ← δ Patients.Patients_ID – Appiontment.Patients_ID (Patients × Appiontment)

   Eligible_Patients ← δ Patients_Age ∧ Patients_Job ∧ Patients_Codition (No_Appointment)

   Answer ← Π Patients_Name, Patients_Address**,** Patients_Codition**,** Patients_Job (Eligible_Patients)

6. Identify the number of vaccine doses available by borough now. Display two columns: Borough and number of vaccine doses available. Display one row for each distinct Borough. Use an aggregate function and grouping operation to answer this question.

   Now ← δAppointment_Date = 03/08/20 and Appointment_Time = 5pm (Appointment)

   A ← δ Appointment. Appointment_ID = Vaccine_Administer. Appointment_ID

   (Vaccine_Administer × Vaccine)

   B ← δ Vaccine.Vaccine_ID = Vaccine_Administer.Vaccine_ID (A ×Vaccine)

   Doses_available ←δ Vaccine.Vaccine_ID - Vaccine_Administer.Vaccine_ID (B)

   C ←δ Vaccine_Administer.Location_ID = Location.Location_ID (Doses_available

   ×Location)

   ρ *answer* (Borough, number of vaccine doses available) Location_ID ℑ count

   Doses_available, sum amount (C)

7. Identify the number of appointments scheduled by borough tomorrow. Display two columns: Borough and number of appointments requested. Display one row for each distinct Borough. Use an aggregate function and grouping operation to answer this question.

   Today ← δ Appointment_Date = 03/08/21 (Appointment)

   A ← δ Appointment.Location_ID = Location.Location_ID (Tomorrow × Location)

   ρ *answer* (Borough, number of appointments requested) Location_ID ℑcount

   appointment_ID, sum amount (A)

8. There are insufficient available vaccine dosages to satisfy all the appointments tomorrow. Identify appointments of patients less than age 65 in Brooklyn. Display the patient name, address and email.

   Tomorrow ← δ Appointment_Date = 03/09/20 (Appointment)

   B ← δ Appointment.Patients_ID = Patients.Patients_ID (Tomorrow ×Patients)

   C ← δ Patients_Age < 65 ∧ Patients_ZipCode = all zip codes in Brooklyn (B)

   Answer ← Π Patients_Name, Patients_Address**,** Patients_Email (C)

9. Identify vaccine dosages administered in the last 6 months by patient zipcode. Display two columns: Patient zip code and number of dosages administered. Display one row for each distinct patient zipcode. Use an aggregate function and grouping operation to answer this question.

   Last_Six_Month ← δ Appointment_Date > 10/08/20 (Appointment)

   A ← δ Vaccine_Administer_ID.Appointment_ID = Appointment.Appointment_ID

   (Vaccine_Administer_ID × Last_Six_Month)

   B ← δ Vaccine_Administer_ID.Patients_ID = Patients. Patients_ID (A×Patients)

   ρ *answer* (Patient zip code, number of dosages administered) Patients_ZipCode ℑcount

   Vaccine_Administer_ID, sum amount (B)

10. Identify vaccine dosages administered in the last 6 months by vaccine manufacturer. Display two columns: Vaccine manufacturer and number of dosages administered. Display one row for each distinct vaccine manufacturer. Use an aggregate function and grouping operation to answer this question.

    A ← δ Vaccine_Administer_ID.Appointment_ID = Appointment.Appointment_ID

    (Vaccine_Administer_ID ×Appointment)

    B ← δ Vaccine_Administer_ID.Vaccine_ID = Vaccine. Patients_ID (A×Vaccine)

    C ← δ Appointment_Date > 10/08/20∧ Vaccine_Manufacturer ∧ Vaccine_Administer_ID

    (B)

    ρ *answer* (Vaccine manufacturer, number of dosages administered) Vaccine_Manufacturer

    ℑcount Vaccine_Administer_ID, sum amount (C)