M&IS 44043 NAME KEY-Public

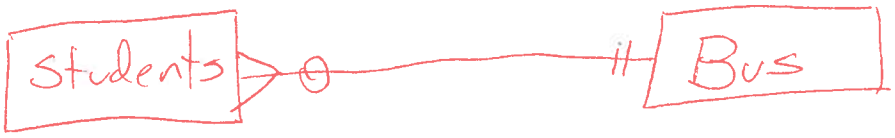
Entity-Relationship Diagramming In-Class Practicum (100 points total)

1. (32 points) The following set of brief scenarios describes the relationships between various entity classes. Draw the entity classes (only show entity name – no attributes or identifiers) and the relationship making sure to add notation (use crow's foot notation) that shows reasonable minimum and maximum cardinalities given the implied scenario. All scenarios will only have one relationship. The one relationship may be between a maximum of two entity classes (binary) or between an entity class and itself (recursive). *If you make any assumptions beyond what is stated be sure to note that in your answer.*

Example: *Students can take no sections or may take any number of sections. Each section has anywhere from zero to an unlimited number of students.*

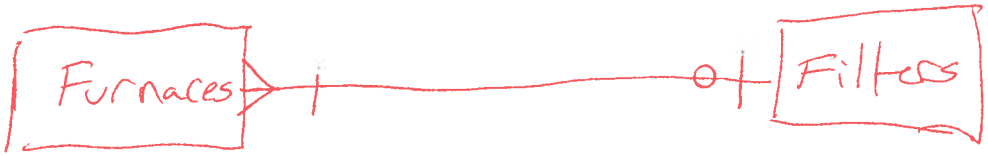
Example Answer:

a. A travel agency is arranging charter bus travel as part of a spring break package for groups of college students in major universities. They need to keep track of the students going on the trip as well as their basic account data. They have several buses and they are assigning students to buses and storing the information in their database. Each student in the database has already signed up for the trip and must be assigned to exactly one bus. Each bus may be empty or it may be assigned the maximum of 45, or anywhere in between. Obviously, buses with no students assigned will not go on the trip.

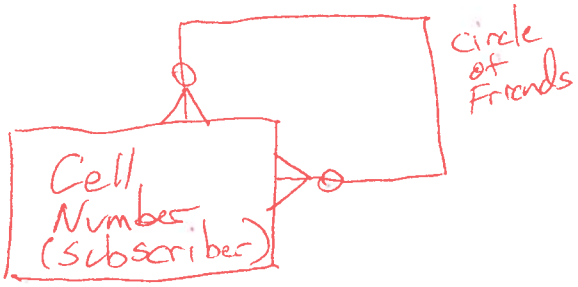


b. A hospital keeps track of their nurses and their nursing stations. There is always exactly one nurse assigned to each nursing station as "Head Nurse". Each nurse can be assigned to at most one station as Head Nurse. Many of the nurses are never assigned this duty as it is restricted to senior staff.

c. A hardware store has a database that keeps track of their supply of furnace filters and which furnaces they fit. They also store information on all major manufacturers' furnaces. Each furnace requires a specific filter but they do not stock every single filter type (unpopular ones are special order) so each furnace has at most one matched filter but may have no matched filters. Each filter may fit anywhere from one to many furnaces.



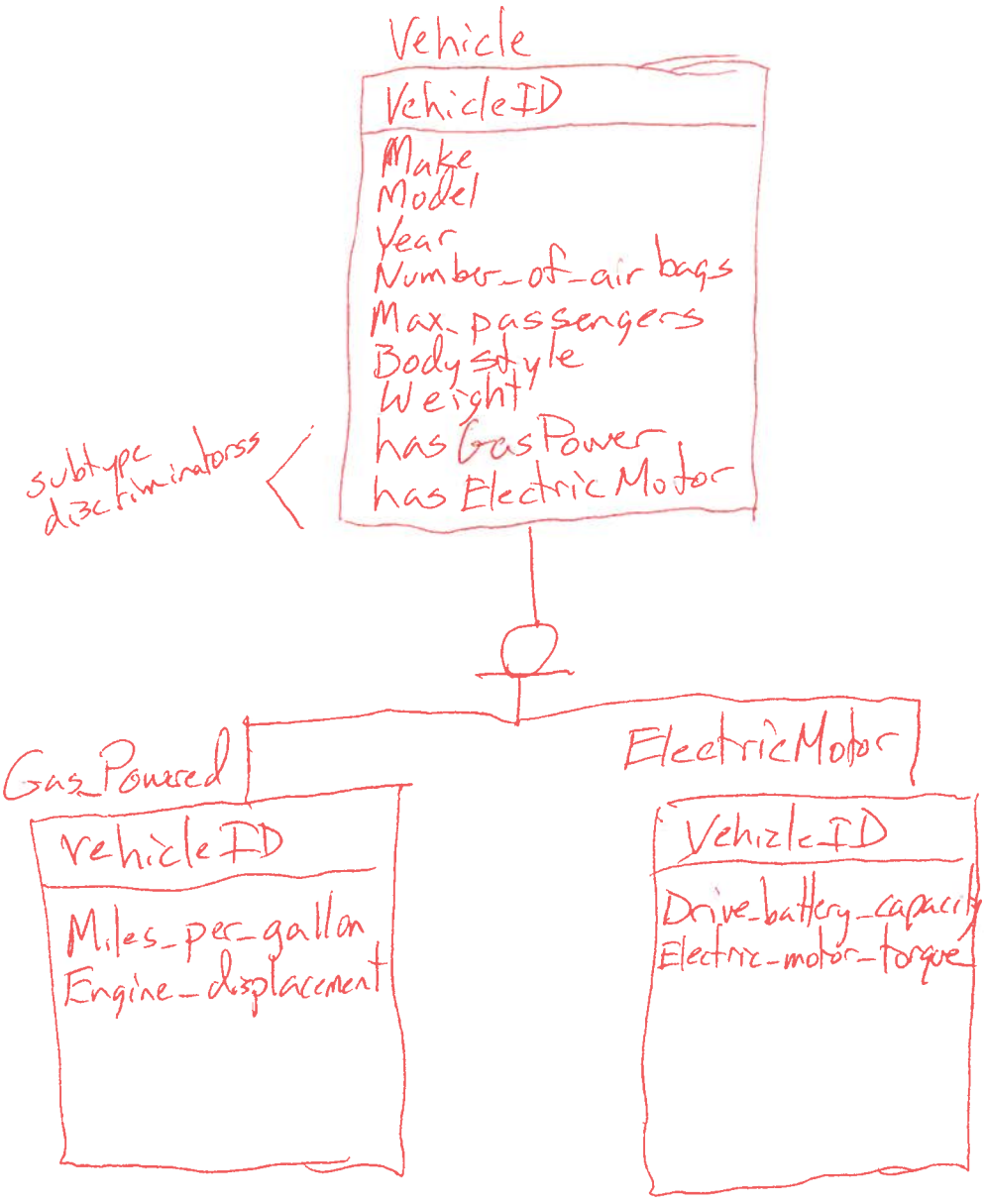
d. A cell phone company wants to keep track of their cell numbers and associated account information. An additional relationship that needs to be tracked is which phones are in a "Circle of Friends" association. Each subscriber can list up to ten other numbers to be in their circle but does not need to list any. Each subscriber may also be in zero to many of their friend's Circles.



2. (22 points) An automobile manufacturer has historically used a single entity to store information on all of its manufactured vehicles. Recently it has come to light that several of their new models require additional data to be stored about them that isn't stored for all vehicles. In addition to the standard gas-powered vehicles, they now have 100% electric vehicles and vehicles that are in both the gas-powered and electric motor categories (hybrid vehicles). Originally the new attributes were simply added to the existing entity (see graphic below). However, they have noticed this creates type-specific null values in those attributes. You have been asked to redesign how they are storing this data to minimize type-specific nulls. The attributes of concern are Miles_per_ gallon and Engine_displacement since they only apply to vehicles with gasoline engines as well as Drive_battery_capacity and electric_motor_torque since they only apply to vehicles with electric motors. Design appropriate discriminator attributes in your revised diagram.

Vehicle

VehicleID
Make Model Year Miles_per_gallon Number_of_airbags Max_passengers BodyStyle Engine_displacement Drive_battery_capacity Electric_motor_torque Weight



correct subtypes	8
correct identifiers	4
correct attributes	3
non-exclusive	3
subtype discriminator	4
	22

3. (46 points) draw an E-R diagram to represent this database.

- Where and if a relationship needs to be an association entity, show correctly on diagram.
- Show all minimum and maximum cardinalities.
- Do not show attributes for entities. Some attributes are given as examples in the problem so that you understand what is being stored and the structures they require. These should not be shown on diagram.
- Do not use any structures that imply multi-valued attributes would exist.
- List any non-obvious assumptions you made.
- *ID-Dependent vs. non-ID-Dependent relationships do not have to be distinguished for this diagram (will not be a grading point).*

This problem is inspired by a real organization (http://www.ovations365.com/public_art/listing) and their real database found in the news: http://www.macon.com/2014/02/03/2914724/mercer-macon-arts-alliance-partner.html

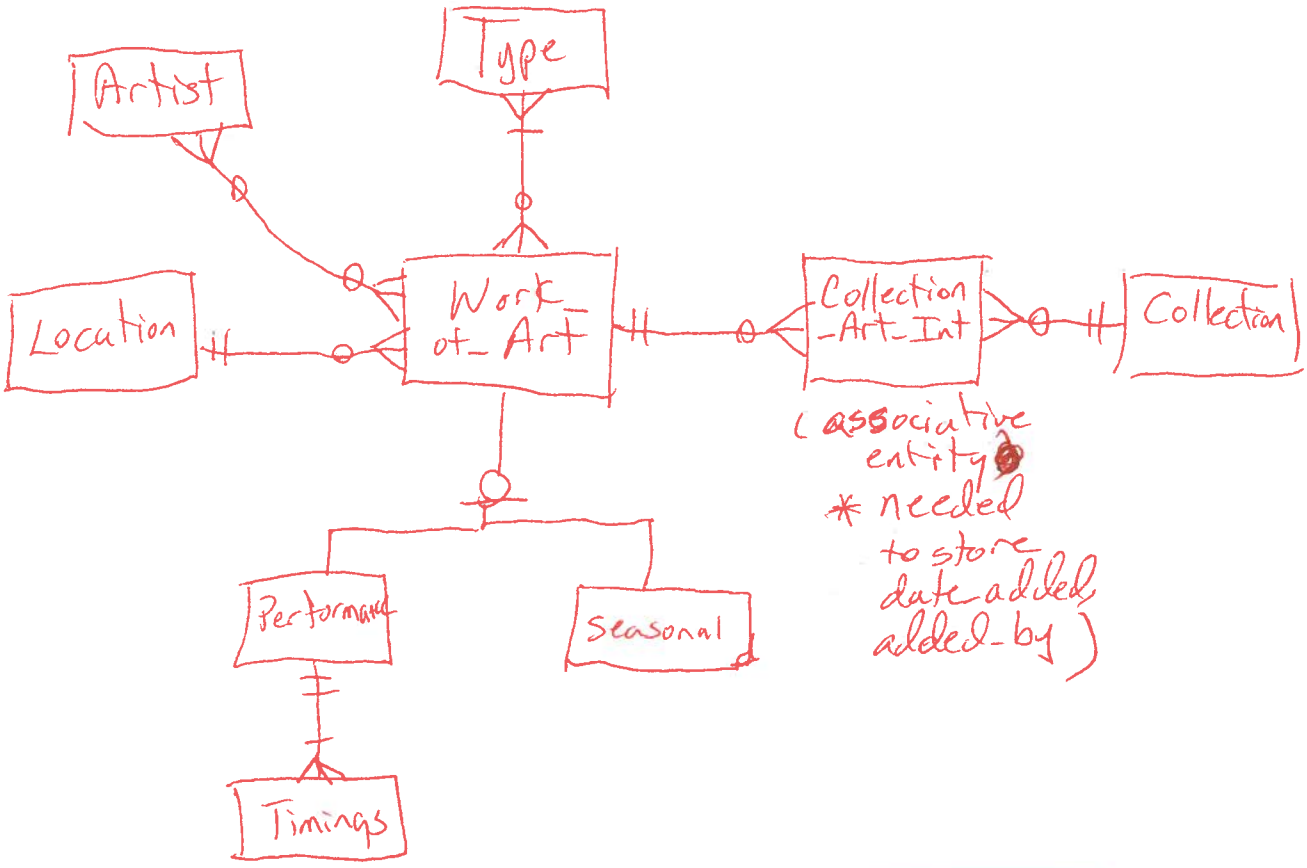
Ovations 365 is a website that serves the citizens of Macon, Georgia. The database is designed to store information on public works of art in the Macon, Georgia area. The database will need to store information on these public works of art (description, photograph, etc.). Additionally, the database is to be searchable by *artist*, *type* (type of art: sculpture, performance, garden, etc.), *location*, and *collection* (works grouped together by some common theme, for instance, there may be a bicentennial collection for works of art related to the city's bicentennial). Therefore, information will need to be stored in the database about each of these.

Artists in the database may have zero or many works of art in the database and each work of art may be related to zero artists (anonymous works) or a group of artists. Each collection will contain zero to many works of art and each work of art could be in zero to many collections. In addition to keeping track of which art is in which collection, the database should also be able to store the date a work of art was added to the collection and the name of the person who added it. Each type of art listed may have zero to many examples in the works of art and each work of art must be in one category (there is a 'general' category for hard to classify art) and could be in many types of art. The location stored by the database may be a street address or something more general (Museum of Modern Art or Newbury Park, for instance). Each location may contain zero to many works of art but each work of art is in one and only one location.

Most of the categories of art can be represented in the database using a standard set of attributes. There are a couple of categories that would require additional data to be stored about them. One of those is artistic performances. In addition to the standard data being stored about all of the works of art, this category must also keep track of the timings of performances (date, beginning time, ending time). A performance may have one to many performance timings (date/time of each performance) but each performance timing would be related to one and only one performance art piece. The second category is seasonal art. For this category we must store the beginning of season date and the end of season date. A single work of art may be both a performance and seasonal.

NAME_____

3. Draw your diagram for question three here. If you remove this sheet write your name where indicated.



9 entities (18 pts)
5 has-a relationships (10 pts)
1 is-a relationship (4 pts)
1 associative entity (4 pts)
20 cardinalities (10 pts)

If you are missing portions of the diagram make sure you add up all the points associated with it. For instance, if you leave off the entire subtype structure and entities (Performance, Seasonal, Timings), you miss 3 entities (6 pts), 1 has-a relationship (2 pts), 1 is-a relationship (4 pts) and four cardinalities (2 pts) for a total of 16 pts.