M&IS 64082 **NAME_____**

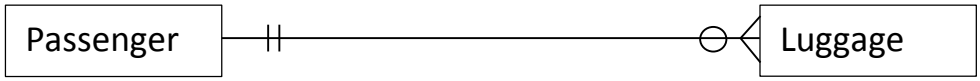
Design Practicum (100 points total)

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.*

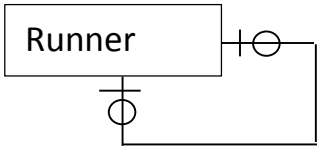
Example: *Students can take no sections or may take any number of sections. Each section has anywhere from zero to an unlimited number of students.*

Example Answer:

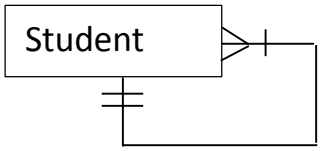
a. An airline uses a database to keep track of passenger's checked luggage. Passengers may have any number of checked luggage items (including zero). Each luggage item must be linked to exactly one passenger.



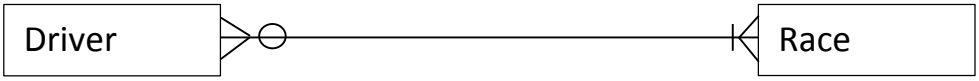
b. The running order of runners in a relay race is stored in a database. Each runner may have a following runner but may not if he/she is last in the order. Similarly each runner may have a runner ahead but may not if he/she is the first runner.



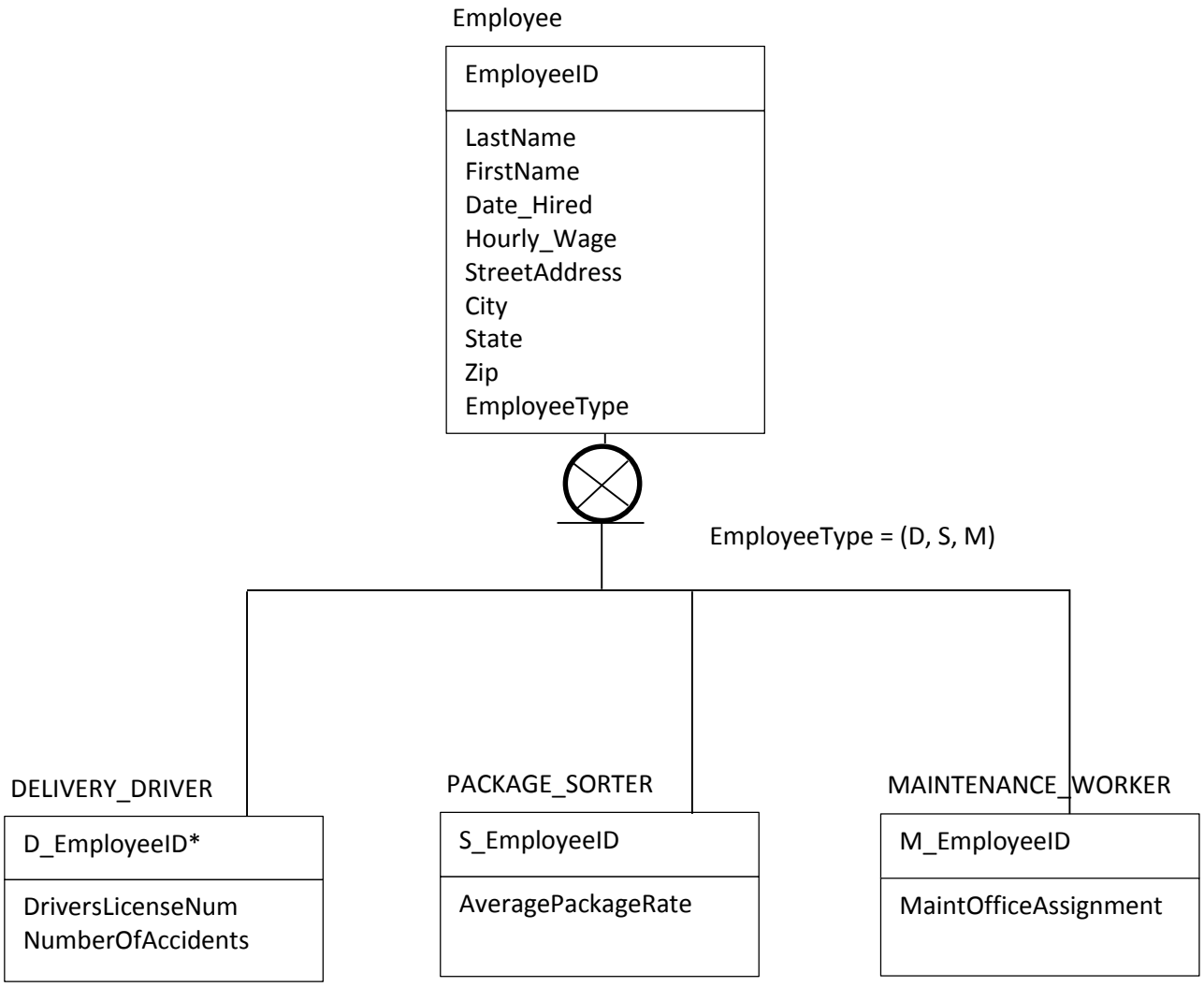
c. A university is organizing a student trip. There will be students signing up for the trip and each student will get a seat on a bus (it is anticipated that multiple busses would be required but that is currently unknown). The database stores a list of students who will be going on the trip. One of the students on the list will be assigned as a student leader for every group of 20 students on the list. Design all entities and relationships required to obtain the list of all students *and also* the list of students have been assigned to a student leader. Each student who is not a student leader is assigned to one and only one student leader. Each student leader must have at least one student assigned to them and they probably have many.



d. Drivers of race cars are stored in a database along with races that they have raced in. Each driver in the database must be associated with driving at least one race and each race in the database may be associated with many drivers but may also be associated with zero drivers since future races are entered into the database as they are scheduled.



2. (22 points) A parcel delivery company (such as UPS or FedEx) stores information on its employees in three entities (one for each type of employee) as shown below. They also have noticed that there are several other database entities (not shown) that have relationships to all three employee types. They recognize that these separate employee entities can be generalized so that they have a common supertype. Draw the supertype/subtype structure (IS-A relationship) that is implied. Show the attributes and identifier for each involved entity (supertype and subtype). Represent on the diagram that employees can only be one type of employee (e.g. you cannot be both a delivery driver and a package sorter). Add an appropriate subtype discriminator attribute to the model.



*Subtype identifiers such as these are common and good practice. However, using EmployeeID for all of them or using the original identifiers would also be 'correct' in scoring.

Supertype w/ appropriate identifier – 3 pts
Common attributes in supertype – 3pts
Correct symbols used for connection – 4 pts
Discriminator + 2
Subtypes (3) with appropriate identifiers – 6 pts
Correct attributes in subtype – 6 pts

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).*

Background: This problem is inspired by a real news story, "Cross-Canada vaccination database needed to prevent, handle outbreaks: study" (http://atlantic.ctvnews.ca/cross-canada-vaccination-database-needed-to-prevent-handle-outbreaks-study-1.2275944).

Excerpt from news article – *this information is provided to explain the context of the database. Use the information in the "Problem" section below to create your database – nothing in this "Background" section should be used directly in the database design.*

"Published Thursday, March 12, 2015 7:35AM ADT
ST. JOHN'S, N.L. -- As Quebec health officials deal with a measles outbreak affecting 119 people, a new study says Canada needs a national database to help prevent and deal with future incidents. "A key step forward is to track immunization status from birth," said Colin Busby, co-author of "A Shot in the Arm: How to Improve Vaccination Policy in Canada." The research paper released Thursday by the C.D. Howe Institute was funded by the economic think-tank and reviewed by immunization researchers, Busby said in an interview. It finds that coverage across the country ranges from 70 to 95 per cent of children, depending on the vaccine. Vaccination rates of about 95 per cent or more are generally considered ideal for a population to develop so-called protective 'herd immunity.'" …

Problem: The database generally focuses on storing data about Canadian citizens, their confirmed illnesses, their vaccinations, and their current and previous residential addresses. Basic information about the people in the database (Canadian citizens) needs to be stored (such as names, previous names, identification numbers, etc.). Additionally, basic information about infectious diseases, vaccines, and Provinces (Canadian 'Provinces' are similar to 'States' in the United States) also needs to be stored.

Each person in the database may have had many confirmed infectious 'illness events' and may have had no illness events. Each of these illness events would be associated with one and only one person. Infectious diseases also has a relationship to illness events in that each infectious disease may be related to zero-to-many illness events and each illness event can be related to zero (if a firm diagnosis cannot be made) or one infectious disease.

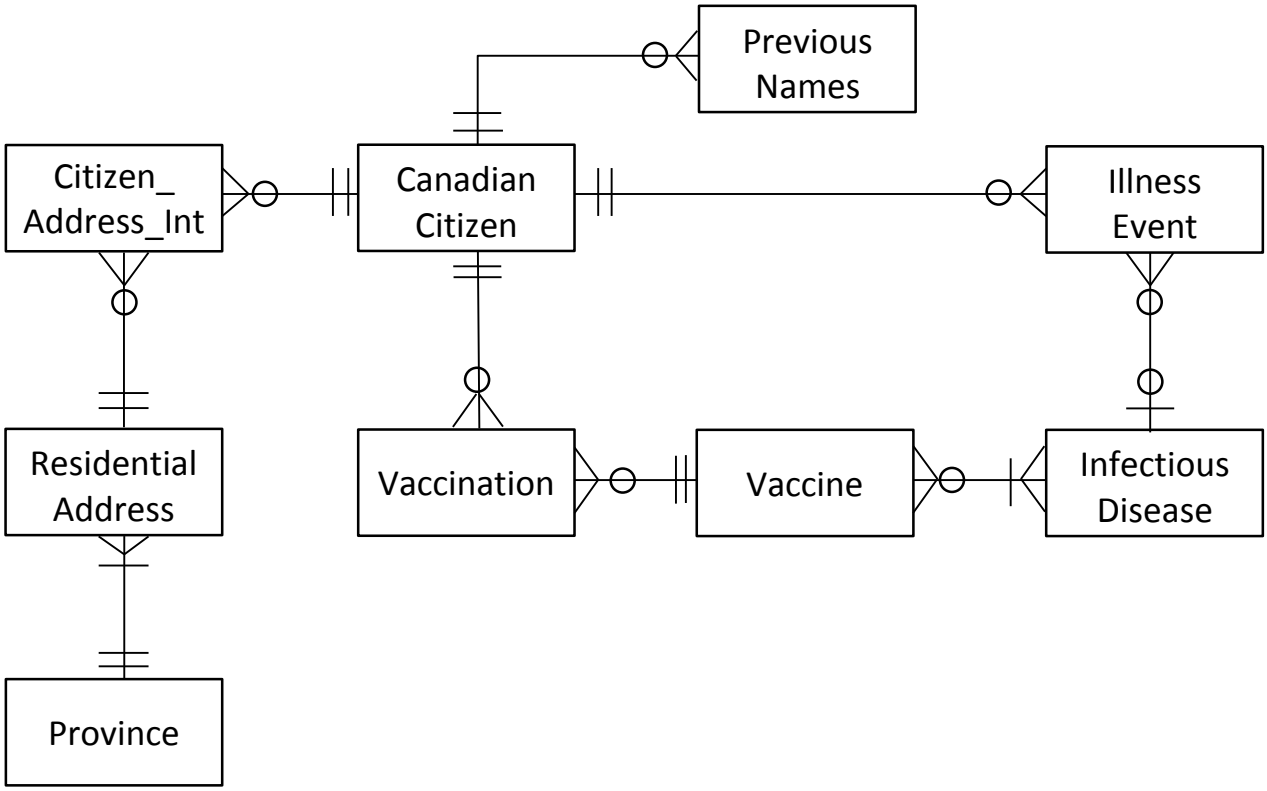
Vaccines are related to persons in that each specific vaccine may be given to zero-to-many persons and each person may have been administered zero-to-many vaccines. In addition to which vaccines have been given to which persons, the database must also keep track of the date the person received the vaccine and where it was administered.

Vaccines are related to infectious diseases in the database. Each vaccine targets one-to-many infectious diseases (there are many combination vaccine formulations that vaccinate against more than one disease). Each infectious disease has zero (such as ebola) to many (such as a specific influenza strain) vaccines that target it.

Each person's residential address history must also be stored. Each address they resided at in Canada needs to be stored so each person has zero-to-many Canadian addresses and each address can have zero-to-many residents over time. Since this must store historic residences instead of just the current address, the beginning and ending dates of each person's stay at an address must also be stored. Finally, the information stored about provinces (population, median income, etc.) needs to be associated with addresses in that province. Each province is associated with one-to-many addresses and each address is associated with one and only one province.

NAME_____

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



Regular entities (6) – 12 pts

Relationships (8) – 8 pts

Cardinalities (32) – 16 pts

Associative entities (2) – 10 pts

Previous names structure + 4 pts