M&IS 44043 NAME Key - Public

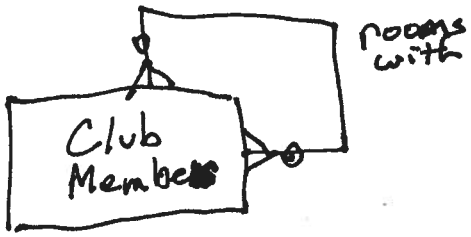
Design Practicum (100 points total)

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:

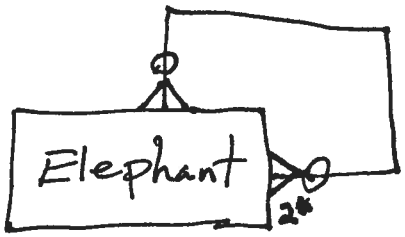
a. A student social club keeps track of its membership using a database. The members' basic information needs to be stored as well as which members live with other members in a roommate relationship. Each member may have zero-to-many member roommates and each member may be the roommate of zero or many other members.



b. A company keeps track of shipments to its customers. Each shipment of materials must be related to exactly one customer and each customer must have at least one shipment (since customers are not added until the company ships to them) and may have many shipments.

c. A campground has campsites, some of which have electrical connections. Multiple campsites are connected to a single electrical meter. They are creating a database that keeps track of which campsites are connected to which electrical meter. Each electrical meter in the campground is connected to zero (some are connected only to camp buildings) to many campsites but each campsite is connected to a maximum of just one meter and is possibly not connected to any meter (recall, some campsites do not have electrical service).

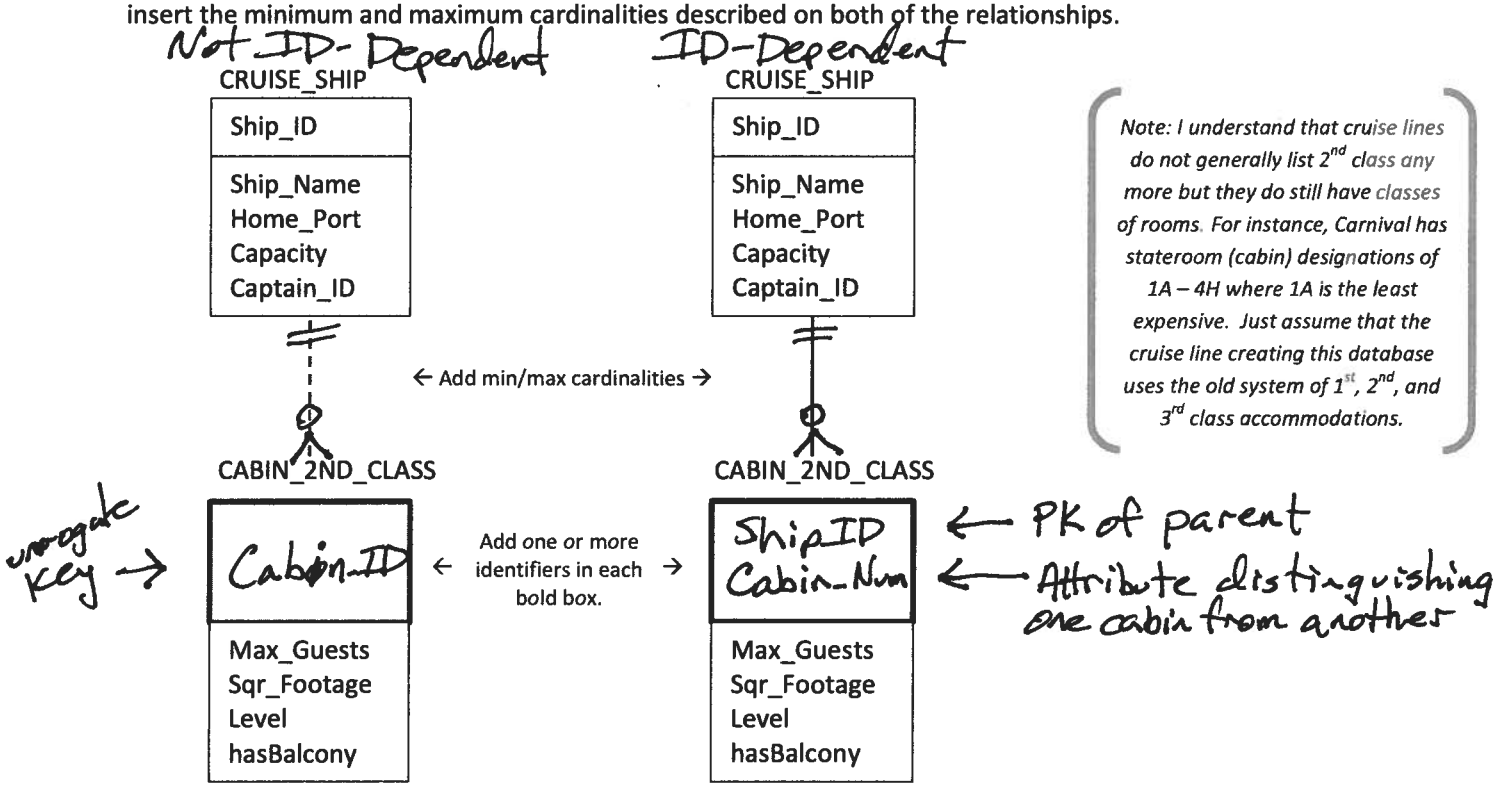
d. A wildlife preserve in Kenya is setting up a database to track the preserve's wildlife. As part of this effort they are storing information on each individual elephant that has been cataloged within the preserve. One thing they want to keep track of is the known ancestry of each elephant to provide information on genetic traits. Only the parentage is stored. Each elephant may be related to zero, one, or two parents in the database (of course, biologically we know each elephant has two parents but some of that data is often *not known* for an individual elephant so *in the database* an elephant may have 0, 1, or 2 parents listed). Each elephant may also be the parent of no other elephant or any number of other elephants.



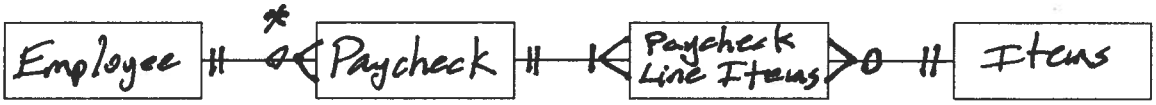
*some notation systems allow the specification of an upper bound on "many" type max cardinalities. The '2' in the diagram zone is optional for our purposes— just the "many" crowsfoot is sufficient.

2. (24 points total)

a. (10 pts) Consider two entities: CRUISE_SHIP and CABIN_2ND_CLASS. These entities are related to each other. CRUISE_SHIPs have zero to many 2nd class cabins (CABIN_2ND_CLASS). They may have zero since some luxury cruise ships in the line do not have any 2nd class accommodations. Of course, those that do have a 2nd class will often have many 2nd class cabins. Each 2nd class cabin must be related to one and only one cruise ship. CABIN_2ND_CLASS is a weak entity in this relationship. Fill in the identifiers for CABIN_2ND_CLASS below (**bold boxes**) to show it as ID-Dependent or Non-ID-Dependent (use the relationship line format below to determine which to make ID-Dependent and Non-ID-Dependent and do not worry about the absence of 'rounded corners' on the weak entity box). Finally, insert the minimum and maximum cardinalities described on both of the relationships.



b. (14 pts) We spent some time in class discussing the importance of 'line-item patterns' or 'transaction-processing patterns' (these are synonyms). A company is designing a line-item pattern structure as part of its human resources database. The line item pattern must contain data relating to employees, their paychecks and line items, and information on those items that are available for entry as a line item. The four entities in this structure would be (not in any order): 'Paycheck line items', 'Items', 'Employee' and 'Paycheck'. On the diagram below, fill in the entity names and the most likely minimum and maximum cardinalities for the described scenario.



*This min cardinality is the "most likely" given the scenario but 1 here will also be accepted.

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 organization (www.reef.org) and their real database found in the news.

"REEF's mission, to educate and enlist divers in the conservation of marine habitats, is accomplished primarily through the Volunteer Fish Survey Project. The Project was developed in 1990 with support from The Nature Conservancy (TNC) and guidance by the Southeast Fisheries Science Center of the National Marine Fisheries Service (NMFS). The project allows volunteer SCUBA divers and snorkelers to collect and report information on marine fish populations as well as selected invertebrate and algae species in temperate reef areas (West Coast of the US and Canada, the South Atlantic States, and the Northeast US & Eastern Canada). The data are collected using a fun and easy standardized method, and are housed in a publicly-accessible database on REEF's Website. These data are used by a variety of resource agencies and researchers."

Problem: The database generally focuses on storing data about the dive sites, the aquatic species, and the sightings of species at dive sites.

To store data about dive sites, first, general data about the region involved (example: Hawaiian Islands) needs to be stored. The regions then are associated with one-to-many geographic zones (example: Island of Maui) that need basic data to be stored about each zone. Finally, each geographic zone has one-to-many dive sites (example: Cook's Bay) with associated data. Dive sites are related to one and only one geographic zone and geographic zones are related to one and only one region. There are two types of dive sites that share a lot of common data but each requires some additional data to be stored only about it. Dive sites in protected areas such as National Parks store data about who is in charge of monitoring the area and other relevant data. Dive sites in unprotected areas list the legal authority in charge of the area (police department, coast guard, etc.).

Information on the aquatic species starts with storing data about each genus (genus represents a more general classification of living things than species). Each genus would be associated with one-to-many species with their associated data (common name, physical description, etc.).

To store the information about which species have been sighted at which dive sites we must also store data about the individual dives (date/time, lead diver, duration, weather conditions) that occur at each dive site. So, each dive site will have zero-to-many dives and each dive will occur at one and only one dive site. Since we want to catalog species sighted on each dive we need to relate them. Each species may be sighted on zero-to-many dives and each dive may sight zero-to-many species. Other data about species sightings, such as the dive-time of the sighting, the depth of the sighting, and the sighting environment (open water, around coral reef, etc.), also needs to be stored in the database.

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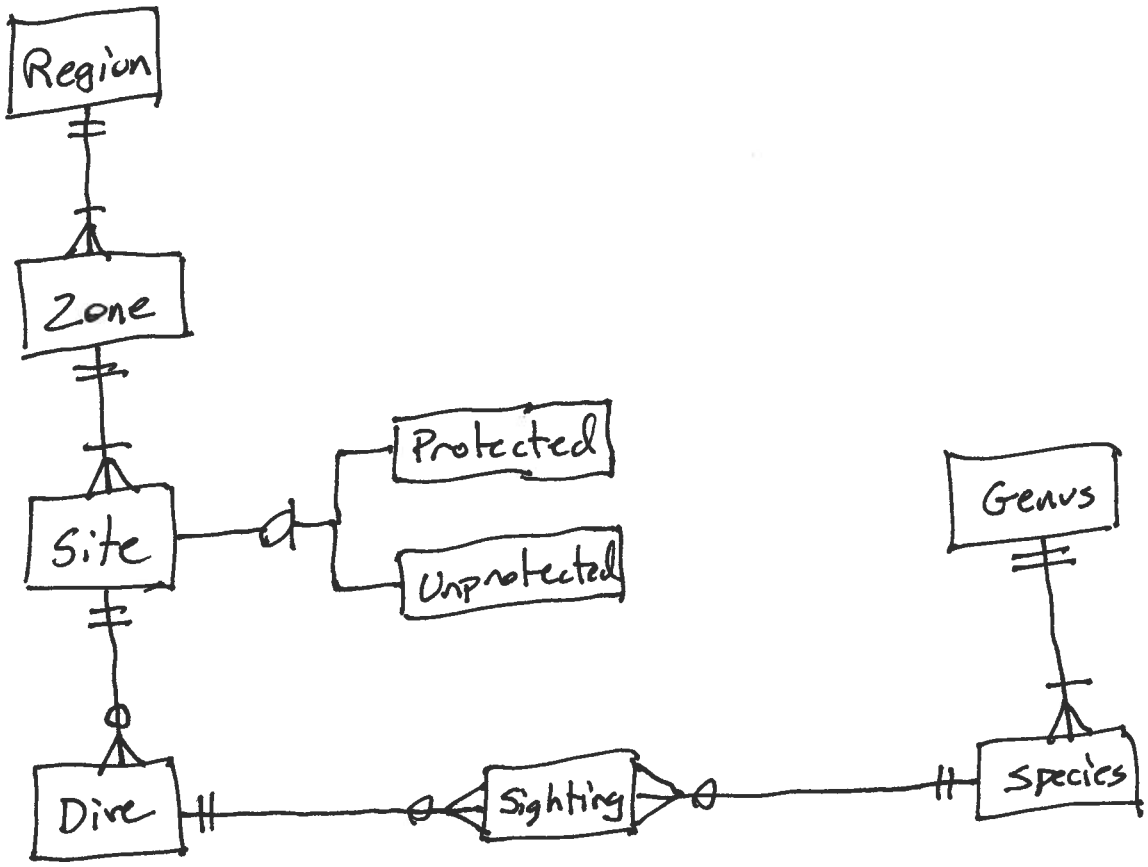
3. Draw your diagram for question three here. If you remove this sheet write your name where indicated.



	Points	
Grading:		
Entities	17	(7 'regular' entities x 2 + 2 subtype entities x 1.5)
Has-a rel.	9	(6 x 1.5 each)
Is-a rel.	4	(1 x 4pts each)
Assoc. entity	4	(1 x 4pts each)
Cardinalities	12	(24 x 0.5pts each)
	46	