**Free response – 4 questions**

For each of 4 questions, use IE Crow’s Foot notation to create an E-R diagram. Remember to provide entity names and identifiers for each entity, along with all necessary relationships between entities, including minimum and maximum cardinalities.
**Hints:** No problems have recursive relationships. One of the problems requires supertype/subtypes. One of the problems requires an associative entity. One of the problems has a many-to-many relationship that does NOT need to be broken up with an associative entity.
Remember that data models are non-DBMS specific and also do not strictly have to reflect foreign keys (foreign keys are used to design relationships in the DB design stage after the data model is complete).

1. Create an E-R diagram representing the following description:

*A small pet grooming business would like to keep track of customer data. They have just added a new store location that has not groomed any pets yet, so as they grow, they realize the need to have a better way to store their data.
Specifically, they want to track a name, breed, and description of each pet that visits one of their stores, along with the name and phone number of the pets’ owner. Pets can be groomed at any one of multiple store locations, so information must also be stored about the store numbers (like a store ID) and locations (i.e., City).*

Assume that information is only stored about a pet after they have been groomed in at least one location. Information about owners and pets must be put in the system at the same time (i.e., a pet cannot be listed in the system without an owner and vice versa).

2. Create an E-R diagram representing the following description:

*A small bookstore wants to keep track of the books it sells. The bookstore wants to keep track of each book’s title, author, publisher, and publishing date. Currently, the bookstore sells two* types *of books: textbooks and novels. For textbooks (but not novels), the bookstore would also like to track the topic of book. For novels (but not textbooks), the bookstore would like to track the age group that is targeted by each book.*

Please draw only the entities representing books and the relationship between them. You do not need to draw additional entities for authors, publishers, topics, etc. Assume that multiple books could have the same title.

3. Create an E-R diagram representing the following description:

*A small publisher publishes a single magazine on a monthly basis, and must keep track of information about each issue. (Hint: because there is only one magazine, there is not a “magazine” entity; however, you will have an “issue” entity.) For each issue, they track the issue date (e.g., March 2015), the cover headline, the names and summaries of each article in the issue, and the name and email of each articles’ author (only one author per article is currently allowed).*

Assume that each issue has several articles and that author information is only stored if an author has written an article for the magazine. Assume that the issue date will never be repeated.

4. Create an E-R diagram representing the following description (6 pts):

*A professor wants to use a small database to track information about personal student software use during a course. He would like to store student names and email addresses, the name and installation instructions of each type of software required for the course, and the date each student installed the software on their personal machine.*

Assume that there are multiple different software packages available for use during the class. Assume that students are not required to download the software on their personal machine, but they can choose to download any of the multiple software programs, and the professor wants to keep track of which students download which software on their personal machine so that he can better assist them with the homework.