NYU Tandon School of Engineering Computer
Science and Engineering
CS-UY 3083, Introduction to Database Systems, Fall 2025 Prof Dey

HOMEWORK #2

Instructions: You may work alone or with a group of up to 3 people. Hand in your solutions via Gradescope as a single pdf file. **Follow the Gradescope instructions to mark your solution to each problem or subproblem as indicated in the outline; otherwise the graders will have trouble finding them and will apply a small penalty to your score.** See student workflow section in GradeScope help to learn how to do this. If you're working with a group, use GradeScope's group submission feature to indicate all members of your group.
Note: You may find it useful to use *draw.io* or another drawing tool to draw ER diagrams. Alternatively, you may draw them *neatly* by hand. You must use the notation used in class ... rectangles for entity sets, diamonds for relationship sets, double lines and arrows for participation/cardinality constraints, etc.

Problem 1

1. Draw an ER diagram, similar to those shown in class, with three entity sets, Student, Movie, and Actor and relationship sets Saw, Favorite, and other(s) as needed. A Student has a unique ID; a name, composed of a first name and a last name; a class (such as Freshman, sophomore, etc); and some (zero, one, or multiple) e-mail addresses. An Actor has a unique name composed of a first name and lastname, and a URL. Each movie has a title, a release year, an MPAA rating and a synopsis. No two movies have the same title and the same release year. If a person saw a movie, they may rate it with some number of stars and they may write a comment about it. Each person has exactly one favorite movie. (We will not worry about whether a person can designate a movie as their favorite even if they didn't see it or saw it and gave it few stars or bad comments) Actors are in movies; for each movie that an actor is in, we also want to record the role they played (e.g. Saoirse Ronan played the role of Jo in Little Women, 2019.

2. List some members of each of the entity sets: For example

   (12345, *Joe, Smith, sophomore, js@gmail.com, js*123@*nyu.edu*) ∈ Student

   Your Student set should include all members of the group with whom you're doing this homework.

3. List at least one member of each of the relationship sets. (You may use any reasonable format to do this; it should be clear which entities are paired with which and which relationship set the pair belongs to.)

Problem 2 Suppose you're designing a database for a restaurant. The restaurant manager says they want to keep track of customers who are currently seated, dishes (e.g. "hamburger", "fried chicken", etc). Customers are identified by their table number and their seat number (at the table), e.g. Table 5, Seat 2. Each dish has a unique name, a description, a category (e.g. appetizer, main dish, dessert) and a price. The database will keep track of which dishes were ordered by which customer, along with the status (e.g. "in preparation", "ready","served, finished", etc).

1. Draw an ER diagram modeling this information. It should have an entity set representing customers, an entity set representing dishes, and one relationship set.

2. While reviewing this ER diagram with you, the restaurant manager realizes that some of the dishes have different sizes with different prices (e.g., "small tomato soup for $3.00 and large tomato soup for $5.00). Draw a new ER diagram to deal with this. Hint: use a weak entity set. Think about which entity sets participate in the relationship set representing orders.

3. You did such a good job on the database for "eat-in" orders, that the restaurant has hired you to design a database for their online orders. In this case, customers do not have table numbers and seat numbers, but each customer has a unique phone number and an address, composed of a building number, street name, and apartment number. In this scenario, a customer may order multiple servings of the same dish (e.g. three hamburgers). The database will keep track of how many of which dish was ordered by which customer, along with its status (e.g. "in preparation", "ready", "out for delivery", etc). The database only keeps track of current orders and you may assume that a customer can't change an order once it's in the system or place simultaneous orders for the same food. Draw an ER diagram for the online orders. (You may include different sizes of dishes or not, whichever youprefer.)

4. Now the manager decides that the restaurant would also like to keep track of the date and time on which each order was made and keep historical data, so that they'll know which customers have ordered which dishes in the past. Note that adding date and time attributes to the ordered relationship set is not sufficient, as this still will not allow the a

customer to order the same dish at different date/times. (Why not?). Instead, you can take one of the following approaches:

- use a ternary relationship set, involving an additional entity set representing dates/time;
- or, change the **ordered** relationship set into an entity set representing orders, with relationship sets indicating who the order is by and what item is ordered). You may represent the orders with a strong entity set, adding an OrderNumber or with a weak entity set that has *two* identifying strong entity sets.

Draw an ER diagram for the online orders with historical data.

Problem 3 Consider the bookstore E-R in Fig 6.30 in the 7th ed of textbook (Figure 7.29 in 6th edition) which is also attached here.

Submit one E-R diagram with the following modifications:

1. Modify the E-R diagram to indicate that a book is published by at most one publisher.
2. Modify the E-R diagram to indicate every book has at least one author.
3. Modify the E-R diagram to indicate that a basket is owned by exactly one customer. (However a customer could have more than one basket.)