Answer the questions below and turn in a hard-copy of your answers in class by the due date.

Part 1: Reading Assignment. Read the following sections in the textbook and write your answers to the questions below.

- Ch 7: 7.2–7.5 ... note differences with cardinality constraints in lecture vs book

1. In your own words, describe the difference between an entity set and a relationship set.

2. In your own words, describe the notions of one-to-one, one-to-many, many-to-one, and many-to-many.

3. In Section 7.4, examples of “redundant” attributes are given in which the same attributes are stored in multiple entity sets. What rational is given for not storing these attributes redundantly, and what ER construct is used to represent the corresponding information.

4. In your own words, describe the main differences between the ER Model and the Relational Model. Similarly, describe the main differences between ER diagrams and Schema diagrams (the latter consist of table schemas with lines between them for foreign keys, typically produced from a relational schema).

Part 2: 3NF Normalization. Use the relation \( R(a, b, c, d, e) \) with FDs \( a \rightarrow bc, cd \rightarrow e, b \rightarrow d, e \rightarrow a \) for questions 1 below.

1. Use the 3NF algorithm to decompose \( R \). Show your work.

2. Use the 3NF algorithm to decompose your tables and FDs from HW 7. Give the original tables (with example instances), the FDs, and the new tables (with example instances).

3. Come up with an example of your own that results in a different decomposition when using the BCNF and 3NF decomposition algorithms.

Part 3: ER Diagrams (ERDs).

4. Suppose you have been asked to develop a new database for a world-famous ski resort. As a first step, you need to design an ER model (using the conventions described in class) that captures the following requirements.

- There are ski lifts (for getting skiers and snowboarders uphill) and ski runs (for skiers and snowboarders to go down). Each lift is identified by a name and has a bottom and top elevation, an opening and closing time, and a capacity (in persons transported per hour). Each run is identified by name and has a start and a finish elevation, a length, a difficulty, and a last patrol time.
• A lift serves one or more runs, i.e., the start of the run is easily and directly reachable from the top of the lift (without intermediate runs or lifts). A run connects-to one or more lifts, i.e., those lifts whose entry points at the bottom are directly reachable from the bottom of a run (without taking any other runs or lifts).

• Lifts may be be connected via the next-lift relation, (i.e., the bottom of the next lift is directly reachable from the top of another lift). Similarly, runs may be connected via the next-run relation (i.e., the top of the next run is directly reachable from the bottom of another run).

5. Draw an ERD (using the conventions described in class) for the database from HW 1. The first step is to write down the set of requirements that need to be captured by your ERD (based on the homework itself plus any additional information needed to fill in the gaps). The second step is to use the requirements to develop your ERD. Hand in both the requirements and the ERD.

**Turn in** a your answers to the above questions in class on the due date. Note that since this isn’t a programming assignment, you do not need to include a cover sheet. Include an assignment reflection. Be sure your answers are readable and clearly marked.