

1. Alice has a large DVD movie collection. Her friends like to borrow her DVD's, and she needs a way to keep track of who has what. She maintains a list of friends, identified by unique FID's (friend identifiers) and a list of DVD's, identified by DVDID's (DVD identifiers). With each friend is the name and the all-important telephone numbers, which she can call to get the DVD, back. With each DVD is the star actor name and title. Whenever a friend borrows a DVD, Alice will enter that fact into her database along with the date borrowed. Whenever the DVD gets returned, that fact, too, gets noted along with the date returned. Alice wants to keep a complete history of her friends' borrowing habits so that she can ask favors of the heavy borrowers (or perhaps refuse to make further loans to those who habitually don't return them quickly).

a. (5 points) create an ER diagram for a database to help Alice. Provide appropriate names for entities, attributes, and relationships and show cardinality constraints.

b. (5 points) Represent this database as a collection of relational tables. Include Primary and Foreign Keys. Do NOT specify data types for columns or write SQL commands.

2. (8 points) Bert the payroll guy is about to retire after 40 years and it's time to replace his manual time card system with some sort of computerized database. You have been asked to come up with the database design. At best we can tell, the time card system has the following properties:

- A *timecard* contains hours worked and date submitted.
- Each *timecard* is associated with exactly one *employee*.
- Each *timecard* has a unique id.
- Each *timecard* has a status: approved, not approved, or pending (not examined yet).
- Each *employee* has a name, address, and a unique id.
- Each *employee* submits a time card every pay period.
- Each *employee* is associated with exactly one *manager*.
- Each *manager* is also an *employee*.
- Each *manager* is in charge of one or more employees.
- Each *manager* approves time cards for one or more employees.

Draw an ER diagram that captures this information. Provide appropriate names for entities, attributes, and relationships and show cardinality constraints. DO NOT translate the diagram into a set of tables.

3. We have a database of documents. Each document consists of several sections, each section contains several words:

Doc(docID, docTitle) - documents

Section(docID, secNumber, secTitle) - sections

WordOcc(docID, secNumber, word) - word occurrences

Section(docID) is a foreign key to Doc(docID)

WordOcc(docID, secNumber) is a foreign key to Section(docID, secNumber)

Each document has at least one section; each section has at least one word.

(a) (2 points) write an SQL query that computes for each document the total number of distinct words used in that document. The answer should consist of attributes: document id, document title, and word count.

(b) (5 points) write an SQL query that finds all documents containing both keywords "midterm" and "solution" in the same section. For each such document you should return its document id and title.

(c) (5 points) You are also given a table QW(word) of keywords. Write an SQL query that finds all documents that contain all the keywords listed in QW. For each such document you should return its document id and title.