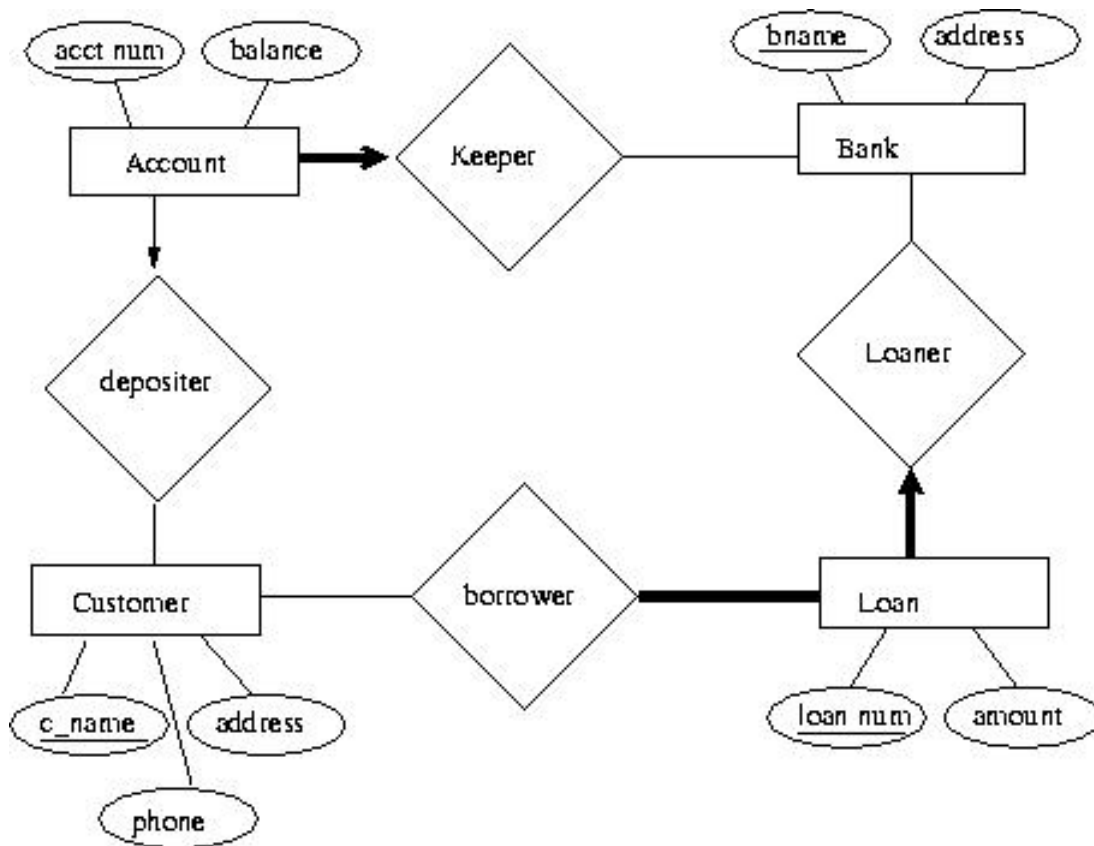


## Lab 4: Relational Models and Relational Algebra

You may work with one other person on this lab. To submit your assignment, place a PDF in your `~/cs44/labs/4/` directory and use `handin44` to electronically submit the lab. Be sure both names are on the document. Your assignment should be submitted by 11:59pm on **Sunday, March 9, 2014**. Yes, an odd date but this will allow me to provide feedback before the exam.

### Relational Models

1. Briefly, explain how *relational data models* (and their query language) provide *physical data independence*. That is, describe the abstraction that a language like SQL provides.
2. Briefly, explain how *views* can provide *logical data independence*.
3. Provide one reason why *super keys* make for poor *primary keys*. Does your argument apply for making super keys *candidate keys* instead? Explain why or why not.
4. Exercise 3.8, Ramakrishnan and Gehrke
5. Show the SQL statements for converting the following ER diagram to relations. Indicate any constraints in the ER diagram that you cannot capture in the SQL statements.



## Relational Algebra

6. Exercise 4.2, Ramakrishnan and Gehrke
7. Exercise 4.3, Ramakrishnan and Gehrke. Relational algebra only.
8. Exercise 4.4, Ramakrishnan and Gehrke
9. What is the difference between a *natural join*  $R \bowtie S$  and a conditional join  $R \bowtie_C S$  on two tuples,  $R$  and  $S$  where  $C$  is  $R.A = S.A$  for the only shared attribute,  $A$ , of both relations.

## History of Relational Models

Read the seminal paper on relational models by E.F. Codd in 1970 titled “A Relational Model of Data for Large Shared Data Banks”. The paper is linked on the main schedule.

10. What is the advantage to having a normalized form?
11. What is Codd’s main argument for relational models with respect to data dependencies?
12. Open-ended question: briefly, describe how some of the central points apply today, almost 45 years after the release of the paper. Are some ideas obsolete based on current technology? Which still apply or are even more applicable today? Spend a paragraph exploring 2 or 3 central ideas.