COMP 3311: Database Management Systems

Lecture 5 Exercises
Relational Model and Relational Database Design

Exercise 1: Given relation schema R(X, Y, U, V, W) and F = {X→Y, UV→W, V→X}

a) Determine the closure of each attribute.

X^+ = Y^+ = U^+ =

V^+ = W^+ =

b) What are the candidate keys of R?

Exercise 2: We want to create the database for a bank that contains accounts (A), branches (B) and customers (C). We are given the following constraints.

- An account cannot be shared by multiple customers.
- Two different branches do not have the same account.
- Each customer can have at most one account in a branch (but different accounts in different branches).

a) What are the functional dependencies implied by the above constraints?

b) What are the candidate keys?

Exercise 3: Given R(A, B, C, D, E) F = {A→BC) Decomposition: R_1(A, B, C) and R_2(A, D, E)

a) Is the decomposition lossless? Why?

b) Is the decomposition dependency preserving? Why?

c) Is the decomposition R_1(A, B, C) and R_2(C, D, E) lossless? Why?

Exercise 4: Identify the candidate key(s) and the current highest normal form for each of the following relation schemas given their corresponding FDs.

a) R(A, B, C, D, E) F = {A→B, C→D} = F^+

What are <u>all</u> the candidate keys?

What is the current highest normal form (√ one)? ☐ 1NF ☐ 2NF ☐ 3NF

b) R(A, B, C) F = {AB→C, C→B} = F^+

What are <u>all</u> the candidate keys?

What is the current highest normal form (√ one)? ☐ 1NF ☐ 2NF ☐ 3NF

c) R(A, B, C, F) F = {AB→C, C→F} = F^+

What are <u>all</u> the candidate keys?

What is the current highest normal form (√ one)? ☐ 1NF ☐ 2NF ☐ 3NF

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Exercise 5: Given relation schema R(A, B, C, G, H, I) and F = {A→B, A→C, CG→H, CG→I, B→H}

a) Determine the closure of each attribute.

A^+ = B^+ = C^+ =

G^+ = H^+ = I^+ =

b) What are the candidate keys of R?

Exercise 6: Given: Sale(customer, store, product, price) and the constraints:
A customer buys from only one store.
There is a unique price for each product in a store, but the same product can have a different price in different stores.

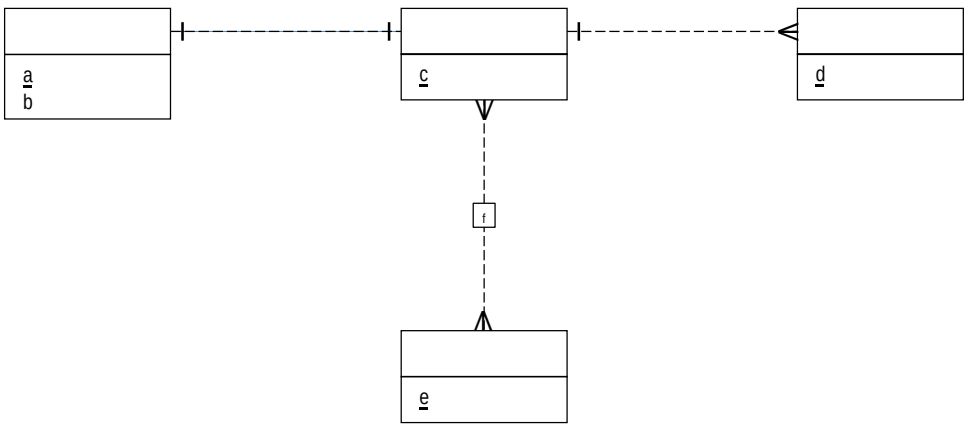
a) What are the FDs implied by the above description? b) What are the candidate keys?

b) Explain why Sale is not in 3NF.

c) Decompose Sale into 3NF relation schemas.

d) Is the decomposition dependency preserving? Briefly explain why?

Exercise 7: What are the FDs implied by the E-R diagram?



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