DSAA 5012: Database Management Systems in Data Science

Lecture 10 Exercises
Relational Database Design: Normalization

Exercise 1: 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 2: Given: R(A, B, C, D, E) F = {A→BC, CD→E, B→D, E→A}

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?

Exercise 3: a) Given: R(A, B, C, D) F = {AB→CD, B→C} Is R in 2NF? Why?

b) Given R(A, B, C, D) F = {AB→CD, C→D} Is R in 2NF? 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}

What are all the candidate keys?

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

b) R(A, B, C) F = {AB→C, C→B}

What are all 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}

What are all the candidate keys?

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

Do not upload this exercise worksheet to Canvas.

Name: _____/_____ **Student#:** _____ **Date:** _____
Family/Last (PRINT) Given/First (PRINT)

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Exercise 5: Decompose R(A, B, C, D, E, F, G) into 3NF relations for the FD set F = {AB→CD, C→EF, G→A, G→F, CE→F}

What are the candidate keys?

What are the 3NF relations?

Exercise 6: Decompose R(A, B, C, D) into 3NF and BCNF relations for each of the following FD sets.

a) F = {B→C, D→A)

What are all the candidate keys?

What are the 3NF relations? What are the BCNF relations?

b) F = {ABC→D , D→A}

What are all the candidate keys?

What are the 3NF relations? What are the BCNF relations?

Dependency preserving? Dependency preserving?

Exercise 7: 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?

c) Explain why Sale is not in 3NF.

d) Decompose Sale into 3NF.

e) Is the decomposition dependency preserving? Why?

Upload this completed exercise worksheet to Canvas by **11 p.m. March 5th.**