DSAA 5012: Database Management Systems in Data Science

Lecture 9 Exercises
Functional Dependencies 1: Introduction

Exercise 1: Assume that this table contains the *only* set of tuples that may appear in a relation R(X, Y, V, W). Which of the following FDs hold in R?

tuple	X	Y	V	W
1	x_1	y_1	v_1	w_1
2	x_1	y_1	v_2	w_2
3	x_2	y_1	v_1	w_3
4	x_2	y_1	v_3	w_4

X→X ☐ Yes ☐ No Y→X ☐ Yes ☐ No

X→Y ☐ Yes ☐ No W→X ☐ Yes ☐ No

X→V ☐ Yes ☐ No XV→Y ☐ Yes ☐ No

X→W ☐ Yes ☐ No YV→X ☐ Yes ☐ No

Exercise 2: In Exercise 1, we assumed that we know all possible records in the table, which is not usually true. In general, by looking at an instance of a relation, we can only tell FDs that are <u>not</u> satisfied. List 5 FDs that are <u>not</u> satisfied in the table.

A	B	C
a_1	b_1	c_1
a_1	b_1	c_2
a_2	b_1	c_1
a_2	b_1	c_3

Exercise 3: 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^+ = U^+ = W^+ =

Y^+ = V^+ =

b) What are the candidate keys of R?

Exercise 4: Given relation schema R(A, B, C, G, H, I) and F = {A→B, A→C, CG→H, CG→I, B→H}

a) Is AG a (super)key of R given F?

b) Is AG a candidate key?

c) Does A^+→R hold?

d) Does G^+→R hold?

<u>Do not</u> upload this exercise worksheet to Canvas.

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

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Exercise 5: Given relation schema R(A, B, C, D, E) and F = {A→B, AB→C, D→AC}

a) Determine the following attribute closures.

A^+ = C^+ = E^+ =

B^+ = D^+ =

b) What are the candidate keys of R?

c) Find a canonical cover of F.

Exercise 6: We want to create the database for a bank that contains accounts (A), branches (B) and customers (C). We are given the following constraints.

i. An account cannot be shared by multiple customers.
ii. Two different branches do not have the same account.
iii. 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 7: Given relation schema R(A, B, C). Assume we do not know the keys of the relation. Write a valid SQL query whose result can be used to determine if A is a potential candidate key. Explain how to interpret the query result to determine if A is a potential candidate key.

Upload this completed exercise worksheet to Canvas by **11 p.m. March 3rd.**