

Homework 2

Due 11:59PM October 23, 2016. **READ ALL DIRECTIONS VERY CAREFULLY!** **Only PDF** will be accepted. **No scans** of handwritten work will be accepted. You **MUST** put each problem on a separate page with 1a on the first page, for example 1a will be on page 1 and 1b will be on page 2. You **MUST** put every problem in the submission, even if you are not answering the problem, just leave a blank page. You **MUST** put your name and student ID in the upper right hand corner of the first page. **FAILURE TO FOLLOW ALL DIRECTIONS COULD RESULT IN YOUR ASSIGNMENT NOT BEING GRADED!**

- 1) For this problem you will consider following relation and set of FDs:

$R(A,B,C,D,E)$

$AC \rightarrow E$

$AE \rightarrow D$

$B \rightarrow C$

$BE \rightarrow A$

- What are the keys of R?
- Show that the set of FDs is a minimal basis; if it is not a minimal basis, find a minimal basis for the FDs.
- What are all of the BCNF violations that follow from the FDs? (Don't just consider the listed FDs, but all that follow).
- Decompose R into BCNF. For each relation, list the keys, and make sure the set of FDs for each is a minimal basis.
- What are all of the 3NF violations that follow from the FDs? (Don't just consider the listed FDs, but all that follow).
- Decompose R into 3NF. For each relation, list the keys, and make sure the set of FDs for each is a minimal basis.
- What are all of the 4NF MVD violations that follow from the FDs?
- Decompose R into 4NF. For each relation, list the keys, FDs and MVD.
- If you project the relation R onto $S(A,B,C)$ what nontrivial FDs and MVDs hold in S?

- 2) For this problem you will consider the following relations and FDs:

Courses(C,T,H,R,S,G)

$C \rightarrow T$

$HR \rightarrow C$

$HT \rightarrow R$

$HS \rightarrow R$

$CS \rightarrow G$

Where C, T, H, R, S, and G are the course, teacher, hour, room, student, and grade respectively. With a proposed decomposition of:

$R_1(C, T, H)$

$R_2(C, H, R, G)$

$R_3(C, H, S)$

- a) Use the chase test to prove/disprove that holds $CH \rightarrow R$ in Courses.
 - b) Use the chase test to prove/disprove that holds $CHR \rightarrow G$ in Courses.
 - c) Use the chase test to prove/disprove the proposed decomposition has a lossless join.
 - d) Decompose Courses into 3NF.
 - e) Which of your relations in 3NF are not in BCNF?
 - f) Which of your relations in 3NF are not in 4NF?
- 3) Design a genealogy database with one entity set: People. The information to record about people includes their birth name, date of birth, date of death (if deceased), sex, gender, person's mother, person's father, and any children.