

Brandon Patten

### Assignment 3: Functional Dependency and Schema Refinement

1. R(A, B, C, D, E)

$$FD = \{AB \rightarrow C, CD \rightarrow E, C \rightarrow A, C \rightarrow D, D \rightarrow B\}$$

| L    | M | R |
|------|---|---|
| ABCD | E |   |

$$AB^+ = ABCDE \checkmark$$

$$CD^+ = CDE \times$$

$$C^+ = CADBE \checkmark \quad \text{• prevents other CUs w/ C. in}$$

$$D^+ = DBCAE \checkmark \quad \text{them because they would not}$$

$$A^+ = ACDBE \checkmark \quad \text{be minimal.}$$

$$B^+ = B$$

$$AD^+ = ADBCE \checkmark$$

$$AC^+ = ACDEB \checkmark \quad \text{not minimal}$$

$$BC^+ = BCDAE \checkmark$$

$$BD^+ = BD$$

Candidate keys: AB, AD, CD, BC, C

2.  $R(A, B, C, D, E, F)$

$FD = \{AB \rightarrow C, AD \rightarrow B, C \rightarrow B, F \rightarrow AD, F \rightarrow E\}$

$F \rightarrow E, F \rightarrow AD \therefore F \rightarrow ADE$  (UNION)

$F \rightarrow AD, AD \rightarrow B \therefore F \rightarrow B$  (TRANSITIVITY)

$F \rightarrow B, F \rightarrow ADE \therefore F \rightarrow ABDE$  (UNION)

$AB \supseteq \therefore F \rightarrow AB$  (REFLEXIVITY)

$F \rightarrow AB, AB \rightarrow C \therefore F \rightarrow C$  (TRANSITIVITY)

$F \rightarrow C, F \rightarrow ABDE \therefore F \rightarrow ABCDE$  (UNION)

$F \rightarrow ABCDE, F \rightarrow F \therefore F \rightarrow ABCDEF$  (UNION)

$\therefore F$  is a Superkey of  $R$

3. StudentInfo(StudNo, StudName, Major, Advisor,  
CourseNo, Ctitle, InstrucName,  
InstrucLocn, Grade)

FD1: StudNo → StudName

FD2: CourseNo → Ctitle

FD3: InstrucName → InstrucLocn

FD4: StudNo, CourseNo, Major → Grade

FD5: StudNo, Major → Advisor

FD6: Advisor → Major

FD7: CourseNo → InstrucName

Student(StudNo, StudName)

StudMajor(StudNo, Major, Advisor)

StudCourse(StudNo, Major, CourseNo, Ctitle,  
InstrucName, InstrucLocn, Grade)

Step 1. Minimize RHTS

- FD7, splits up CourseNo → Ctitle,  
do not satisfy BCNF: InstrucName

StudMajor, FD6: Advisor → Major: Advisor not a key if from FD2

StudCourse, FD3: InstrucName → InstrucLocn: InstrucName not a key

|| : FD7: CourseNo → InstrucName: CourseNo || ||

|| : FD2: CourseNo → Ctitle: " " " "



Step 2. BCNF decom.

FD6: ✓(studNo, Advisor) ✓(Advisor, Major)

FD5: (studNo, Major, CourseNo, CrHr, InstName, Grade)  
✓(InstName, InstLocn)

FD2: (studNo, Major, CourseNo, InstName, Grade)  
(CourseNo, CrHr)

FD7: (studNo, Major, CourseNo, Grade) ↑ MERGE ↓  
(CourseNo, CrHr, InstName)

- Student (studNo, studName)

Course (CourseNo, CrHr, InstName)

InstName (InstName, InstLocn)

StudCourse (studNo, major, CourseNo, Grade)

StudMajor (studNo, Major, Advisor)

Advisor (Advisor, Major)

I pledge my honor that I have abided by the  
Stevens Honor System.

Ruth Patten