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

1. $A^+ = \{A\}$ x

$B^+ = \{B\}$ x

$C^+ =$ $C \to \{C\}$

$C \to \{A\}$ $C \to \{CAD\}$ $C \to \{CADB\}$ $C \to \{ABCDE\}$

$C \to \{D\}$ $D \to \{B\}$ $CD \to \{E\}$ $C^+ = \{ABCDE\}$

$D^+ = \{D\}$

$AB^+ =$ $AB \to \{AB\}$ $AB \to \{ABC\}$ $AB \to \{ABCD\}$ $AB \to \{ABCDE\}$

$AB \to \{C\}$ $C \to \{D\}$ $D \to \{B\}$ $AB^+ = \{ABCDE\}$

$C \to \{A\}$ $CD \to \{E\}$

$AD^+ =$ $AD \to \{AD\}$ $AD \to \{ABD\}$ $AD \to \{ABCD\}$ $AD \to \{ABCDE\}$

$D \to \{B\}$ $AB \to \{C\}$ $CD \to \{E\}$ $AD^+ = \{ABCDE\}$

$BD^+ = \{BD\}$

Since C^+ is candidate key, any superset (AC^+, BC^+, CD^+, CE^+) would be superkey.

Same applies for AB and AD.

Candidate Keys include : { C, AB, AD }

2. $F \to \{AD\}$, $F \to \{A\}$ and $F \to \{D\}$ [Decomposition]

$F \to \{B\}$ by $F \to \{AD\}$ and $AD \to \{B\}$ [Transitivity]

$F \to \{AB\}$ by $F \to \{A\}$ and $F \to \{B\}$ [Union]

$F \to \{C\}$ by $F \to \{AB\}$ and $AB \to \{C\}$ [Transitivity]

$F \to \{E\}$ by Functional dependencies listed.

Therefore, $F^+ = \{ABCDEF\}$ and now F is a superkey of R from "Armstrong's Axioms".

3. Student (StudNo, StudName)

StudNo -> Studname

StudNo$^+$ = { StudNo, StudName }

Satisfy 3NF? (For X -> Y, X or Y has to be super)

StudNo -> StudName ✓

Satisfy BCNF? (For X -> Y, X is superkey)

StudNo -> StudName ✓

Satisfy, therefore, Student (StudNo, StudName) in BCNF.

StudMajor (StudNo, Major, Advisor)

StudNo$^+$ = { StudNo, StudName }

Major$^+$ = { major }

Advisor$^+$ = { advisor, major }

StudNo Major$^+$ = { StudNo, Major, Advisor } [candidate key]

Satisfy 3NF? (For X -> y, x or y is SK?)

StudNo Major -> Advisor ✓

Advisor -> Major ✓

Satisfy BCNF? (For X -> Y, x is SK)

StudNo Major -> Advisor ✓

Advisor -> Major No ✗ since the advisor isn't ckey

✓ StudNo, Major -> Advisor StudNO, Major, Advisor

✗ Advisor -> Major / Advisor -> Major \

✓ { <u>StudNo</u>, Advisor } { <u>Advisor</u>, Major } ✓

BCNF decomposition: StudMajor 1 (<u>StudNo</u>, Advisor)

StudMajor 2 (<u>Advisor</u>, Major)

3 StudCourse (StudNo, Major, CourseNo, CrHr, InstrucName, InstrucLocn, Grade) 3

A B C D E F G

StudNo CourseNo Major is the candidate key.

Satisfy 3NF?

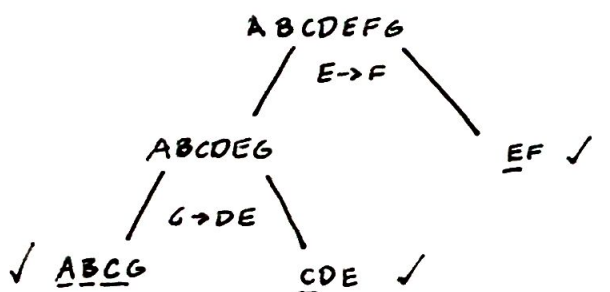
C -> DE No ACB -> G Yes ✓

E -> F No

Satisfy BCNF?

C -> DE No ACB -> G Yes ✓

E -> F No



BCNF Decomposition: ABCG, CDE, EF

Final BCNF Decomposition: Student (StudNo, StudName)

StudMajor1 (StudNo, Advisor)

StudMajor2 (Advisor, Major)

StudCourse1 (StudNo, Major, CourseNo, Grade)

StudCourse2 (CourseNo, CrHr, InstrucName)

StudCourse3 (InstrucName, InstrucLocn)