

Assignment 1, CSC-370, Daniel German

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Q1(3.2.2)

i)

FDs: $A \rightarrow D, B \rightarrow C, B \rightarrow D$

b)

$\{A\}$

c)

$\{A, B\}, \{A, C\}, \{A, D\}, \{A, B, C\}, \{A, B, D\}, \{A, C, D\}, \{A, B, C, D\}$

ii)

FDs: $AB \rightarrow C, BC \rightarrow D, CD \rightarrow A, AD \rightarrow B$

b)

$\{AB\}, \{BC\}, \{CD\}, \{AD\}$

c)

$\{ABCD\}, \{ABC\}, \{ABD\}, \{ACD\}, \{BCD\}$

iii)

FDs: $A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow A$

b)

$\{A\}, \{B\}, \{C\}, \{D\}$

c)

$\{AB\}, \{AC\}, \{AD\}, \{BC\}, \{BD\}, \{CD\}, \{ABC\}, \{ACD\}, \{ABD\}, \{BCD\}, \{ABCD\}$

Q2(3.2.4)

a)

$R(A, B, C)$

FDs: $A \rightarrow B, B \rightarrow C$

The closure of $\{B\}^+ = BC$, therefore given $A \rightarrow B$ does not imply $B \rightarrow A$

Example: A = Monkeys, B = Mammals, C = Animals.

- Monkeys imply mammals, and mammals imply animals but mammals do not imply monkeys.

b)

$R(A, B, C)$

FDs: $AB \rightarrow C, A \rightarrow C, C \rightarrow D, B \rightarrow C$

The closure of $\{B\}^+ = B$, therefore given $AB \rightarrow C$ and $A \rightarrow C$, does not imply $B \rightarrow C$

Example: A = SIN number, B = Last Name, C = First Name.

- A SIN number and a last name or just a SIN number will give me a first name, but a last name on its own does not imply a first name.

Q3(3.2.10)

a)

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

FDs in R : $AB \rightarrow DE, C \rightarrow E, D \rightarrow C, E \rightarrow A$

$\{A\}^+ = \{A\}$

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

$\{C\}^+ = \{C, E, A\}$ add $C \rightarrow A$ to R_1

$\{AB\}^+ = \{A, B, D, E\}$ add $AB \rightarrow C$ to R_1

$\{AC\}^+ = \{A, C, E\}$

$\{BC\}^+ = \{B, C, E\}$

$R_1 = \{C \rightarrow A, AB \rightarrow C\}$

b)

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

FDs in R : $A \rightarrow D, BD \rightarrow E, AC \rightarrow E, DE \rightarrow B$

$\{A\}^+ = \{A, D\}$

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

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

$\{AB\}^+ = \{A, B, D, E\}$

$\{AC\}^+ = \{A, C, E, D, B\}$ add $AC \rightarrow B$ to R_1

$\{BC\}^+ = \{B, C\}$

$R_1 = \{AC \rightarrow B\}$

c)

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

FDs in R : $AB \rightarrow D, AC \rightarrow E, BC \rightarrow D, D \rightarrow A, E \rightarrow B$

$\{A\}^+ = \{A\}$

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

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

$\{AB\}^+ = \{A, B, D\}$

$\{AC\}^+ = \{A, C, E, B\}$ add $AC \rightarrow B$ to R_1

$\{BC\}^+ = \{B, C, D, A\}$ add $BC \rightarrow A$ to R_1

$R_1 = \{AC \rightarrow B, BC \rightarrow A\}$

Q4(3.3.1)

a)

$R(A, B, C, D)$ with FDs $AB \rightarrow C, C \rightarrow D, D \rightarrow A$

$\{A\}^+ = \{A\}$

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

$\{C\}^+ = \{C, D, A\}$

$\{D\}^+ = \{D, A\}$

$\{AB\}^+ = \{A, B, C, D\}$ Candidate Key

$\{BC\}^+ = \{A, B, C, D\}$ Candidate Key

$\{BD\}^+ = \{A, B, C, D\}$ Candidate Key

$\{AC\}^+ = \{A, D, C\}$

$\{AD\}^+ = \{D, A\}$

$\{DC\}^+ = \{D, A, C\}$

i) The FD $C \rightarrow D$ is a violation because C is not a Super Key.

ii) $(ABC)(CD)$

b)

$R(A, B, C, D)$ with FDs $B \rightarrow C, B \rightarrow D$

$\{A\}^+ = \{A\}$

$\{B\}^+ = \{B, C, D\}$

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

$\{D\}^+ = \{D\}$

$\{AB\}^+ = \{A, B, C, D\}$ Candidate Key

$\{BC\}^+ = \{B, C, D\}$

$\{BD\}^+ = \{B, D, C\}$

$$\{AC\}^+ = \{A, C\}$$

$$\{AD\}^+ = \{A, D\}$$

$$\{DC\}^+ = \{D, C\}$$

i) The FD $B \rightarrow C$ is a violation because B is not a Super Key.

ii) $(BCD)(AB)$

c)

$R(A, B, C, D)$ with FDs $AB \rightarrow C, BC \rightarrow D, CD \rightarrow A, AD \rightarrow B$

$$\{A\}^+ = \{A\}$$

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

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

$$\{D\}^+ = \{D\}$$

$$\{AB\}^+ = \{A, B, C, D\} \text{ Candidate Key}$$

$$\{BC\}^+ = \{B, C, D, A\} \text{ Candidate Key}$$

$$\{BD\}^+ = \{B, D\}$$

$$\{AC\}^+ = \{A, C\}$$

$$\{AD\}^+ = \{A, D, B, C\} \text{ Candidate Key}$$

$$\{DC\}^+ = \{D, C, A, B\} \text{ Candidate Key}$$

i) There are no violations.

ii) $(ABCD)$