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CZS4361

Assignment 2

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

① A → B ② E → A ③ CE → D

1.1 • Can only produce: A, B, and D but not C and E therefore C and E has to be in every key.

1key: {CE} ③→ {CDE} ②→ {ACDE} ①→ {ABCDE}

• Form the key and superkey.

{CE} → {C}+ {C} → {C}+ {E} ②→ {EA}

{CEA} also a key

Minimal Key: • Since all other keys requires {CE} in it plus some other variable, making it bigger than {CE}.

Thus, {CE} is a minimal key by default.

1.2 Minimal Basis:

① {A} → {A}+ ✓

② {E} → {E}+ ✓

③ {CE} ②→ {CEA} ✓

- check redundancy, ✓ = no other rules can be applied.

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

BCNF: {A} ①→ {AB} - Does not fit BCNF.

- Split base and check rule.

R1,1 {AB} ① already in BCNF

R1,2 {ACDE} ②③ LHS not a super key due to FD2 (E → A)

R2,1 {AE} ② already in BCNF

R2,2 {CDE} ③④ already in BCNF

∴ R1, {AB}
R2,1 {AE}
R2,2 {CDE}

1.4 $R(A, B, C, D, E)$

3NF: $R_1\{AB\}$ $R_2\{EA\}$ $R_3\{CED\}$

$R_1\{AB\}$ → not superkey

$R_2\{EA\}$ → not superkey

$R_3\{CED\}$ → contain key ∴ superkey ✓

∴ $\boxed{R_3\{CED\}}$

Problem 2) S(C, E, J, P, R, T)

① J→P ② T→E ③ J→C ④ JT→R ⑤ C→P

2.1 Can only produce: C, E, P, and R but not J and T therefore J and T has to be in every key.

Key: {JT} ① {JTP} ② {TPE} ③ {JTPEC} ④ {JTPECR}

⑤ is redudant.

• Form the key and super key.

{J, T} ∴ {JPCTE} also a key

{J} ① {JP} ③ {JPC} {T} ② {TE}

Minimal key • Since all other keys requires {JT} in its plus some other variable, making it bigger than {JT}. Thus, **{JT}** is a minimal key by default.

1.2 ① {J} → ③ {JC} → ⑤ {JCP} ✗ - check redudancy

② {T} → {T}+ ✓ {J} {CP} redudent on ⑤

③ {J} ① {JP} ✓

④ {JT} → ① {JTP} ③ {JTPC} ② {JTPCE} ✓

⑤ {C} → {C}+ ✓

Minimal basis •

- {T} → {T}+
- {J} → {JP}
- {JT} → {JTPCE}
- {C} → {C}+

1.3 S(C, E, J, P, R, T)

BCNF: {T} → {TE} - Does not fit BCNF

R1{TE} R2{T, C, J, P, R} - Split base and check rule,

already in BCNF ⑤ LHS not a super key due to FDs (C→P)

R21{CP} R22{CTJR} FDs (J→C)

R31{JC} R32{JRT}

already in BCNF

∴ | R1{TE} |
| R21{CP} |
| R31{JC} |
| R32{JRT} |

1.4 S(C, E, J, P, R, T)

3NF: R1{JP} R2{TE} R3{JC} R4{JTR} R5{CP}

↓ ↓ ↓ Contain key is superkey

not superkey ←

∴ | R4{JTR} |