Part2

1. Consider a relation V with attributes LMNOPQRST and functional dependencies W
2. LPR+ = LPRQST, not a superkey, violates

LR+ = LRST, not a superkey, violates

M+ = MLO, not a superkey, violates

MR+ = MRN, not a superkey, violates

1. LPR+ = LPRQST, R1 = LPRQST, R2 = LMNOPR

R1 = LPRQST

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| L | P | Q | R | S | T | closure | FDs |
| 1 |  |  |  |  |  | L+ = L | Nothing |
|  | 1 |  |  |  |  | P+ = P | Nothing |
|  |  | 1 |  |  |  | Q+ = Q | Nothing |
|  |  |  | 1 |  |  | R+ = R | Nothing |
|  |  |  |  | 1 |  | S+= S | Nothing |
|  |  |  |  |  | 1 | T+ = T | Nothing |
| 1 | 1 |  | 1 |  |  | LPR+ = LPRQST | Superkey |
| 1 |  |  | 1 |  |  | LR+ = LRST | Violate |

R1 = LPRQST, LR+ = LRST, R3 = LRST, R4 = LPRQ

R3 = LRST

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| L | R | S | T | Closure | FDs |
| 1 | 1 |  |  | LR+ = LRST | Superkey  LR+ = ST |
|  |  |  | Nothing | Else | Relevnt |

R4 = LPRQ

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| L | P | R | Q | Closure | FDs |
| 1 | 1 | 1 |  | LPR+ = LPRQST | Superkey  LPR+ = Q |
|  |  |  | Nothing | Else | Relevant |

R2 = LMNOPR

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| L | M | N | O | P | R | Closure | FDs |
|  | 1 |  |  |  |  | M+ = MLO | Violates |

R2 = LMNOPR, M+ = MLO, R5 = MLO, R6 = MNPR

R5 = MLO

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| M | L | O | Closure | FDs |
| 1 |  |  | M+ = MLO | Superkey  M+ = LO |
|  |  | Nothing | Else | Relevant |

R6 = MNPR

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| M | N | P | R | Closure | FDs |
| 1 |  |  | 1 | MR+ = MRN | Violates |

R6 = MNPR, MR+ = MRN, R7 = MRN, R8 = MPR

R7 = MRN

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| M | R | N | Closure | FDs |
| 1 | 1 |  | MR+ = MRN | Superkey  MR+ = N |
|  |  | Nothing | Else | Relevant |

R8 = MPR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| M | P | R | Closure | FDs |
|  |  |  | Nothing | Relevant |

Final decomposition:

R3 = LRST, FD: LR+ = ST,

R4 = LPQR, FD: LPR+ = Q,

R5 = LMO, FD: M+ = LO,

R7 = MNR, FD: MR+ = N,

R8 = MPR, no FD.

1. Consider a relation P with attributes ABCDEFGH and functional dependencies T.

T = {AB→CD, ACDE→BF, B→ACD, CD→AF, CDE→FG, EB→D}

1. AB = C

AB = D

ACDE = B

ACDE = F

B = A

B = C

B = D

CD = A

CD = F

CDE = F

CDE = G

EB = D

AB = C: A+ = A, B+ = BACDF, reduced to B = C

AB = D: B+ = BACDF, reduced to B = D

ACDE = B: Nothing yield B, no reduction

ACDE = F: CD+ = CDAF, reduced to CD = F

B = A: singleton no reduction

B = C: singleton no reduction

B = D: singleton no reduction

CD = A: Nothing yield A, no reduction

CD = F: Nothing yield F, no reduction

CDE = F: CD+ = CDAF, reduced to CD = F

CDE = G: Nothing yield G, no reduction

EB = D: B+ = BACDF, reduced to B = D

New set:

ACDE = B

B = A

B = C

B = D

CD = F

CD = A

CDE = G

Without ACDE = B, ACED+ = ACDEFG, needed

Without B = A, B+ = BCDAF, removed

Without B = A, B = C, B+ = BD, needed

Without B = A, B = D, B+ = BC, needed

Without B = A, CD = F, CD+ = CDA, needed

Without B = A, CD = A, CD+ = CDF, needed

Without B = A, CDE = G, CDE+ = CDEAFB, needed

Final set:

ACDE = B

B = C

B = D

CD = A

CD = F

CDE = G



|  |  |  |  |
| --- | --- | --- | --- |
| Attribute | LHS | RHS | Conclusion |
| A | 1 | 1 | Check |
| B | 1 | 1 | Check |
| C | 1 | 1 | Check |
| D | 1 | 1 | Check |
| E | 1 | 0 | In all keys |
| F | 0 | 1 | Not in any key |
| G | 0 | 1 | Not in any key |
| H | 0 | 0 | In all keys |

CDEH+ = ABCDEFGH

BEH+ = ABCDEFGH

AEH+ = AEH, not superkey, not key

CEH+ = CEH, not superkey, not key

DEH+ = DEH, not superkey, not key

ACEH+ = ACEH, not superkey, not key

ADEH+ = ADEH, not superkey, not key

All other possibilities must include CDEH or BEH and therefore are not minimal.

Keys: CDEH, BEH

1. Minimal bases:

ACDE = B

B = C

B = D

CD = A

CD = F

CDE = G

Revised FDs:

ACDE = B

B = CD

CD = AF

CDE = G

Result set relations:

R1 {ACDEB}, R2{BCD}, R3{CDAF}, R4{CDEG}, discard R2 because it is in R1

Final set relations:

R1 {ACDEB}, R3{CDAF}, R4{CDEG}

1. Relation that violate BCNF: CD projects onto R1 and produces ACD and it is not a superkey

Since there exist relation that violates BCNF, these schema allows redundancy.