**CS630 HW6**

**Q1**

Here we are given a Relation R with four attributes ABCD and the following set of FDs:

F = {B*→*C, D*→*A}

We need first identify the keys for R and then need to determine if R is in BCNF, 3NF or none of them.

|  |  |
| --- | --- |
| X | X+ |
| A | A |
| B | B,C |
| C | C |
| D | D,A |
| AB | A,B,C |
| AC | A,C |
| AD | A,D |
| BC | B,C |
| BD | B,D,C,A |
| CD | C,D,A |
| ABC | A,B,C |
| ABD |  |
| ACD | A,C,D |
| BCD |  |

K = BD

F+ = {B*→*C, D*→*A, AB*→*C, BD*→*C, BD*→*A, CD*→*A}

|  |  |  |
| --- | --- | --- |
| FD | Is BCNF Violation? | Is 3NF Violation? |
| B*→*C | Yes | Yes |
| D*→*A | Yes | Yes |
| AB*→*C | Yes | Yes |
| BD*→*C | No | No |
| BD*→*A | No | No |
| CD*→*A | Yes | Yes |

The Relation R is not BCNF and also not 3NF

Now since it is not BCNF we have to decompose.

Case 1: B*→*C

F+= {B*→*C, D*→*A, AB*→*C, BD*→*C, BD*→*A, CD*→*A}

ABCD

ABD

BCNF

BC

B*→*C

Fx+= {B*→*C}

Fy+= {D*→*A, BD*→*A}

D*→*A

DA

BD

Fz+= {D*→*A}

|  |  |
| --- | --- |
| X | X+ |
| A | A |
| B | B |
| D | D,A |
| AB | A,B |
| AD | A,D |
| BD | A,B,D |

New K= BD

F+ = {D*→*A, BD*→*A}

|  |  |
| --- | --- |
| FD | Is BCNF Violation? |
| D*→*A | Yes |
| BD*→*A | No |

Decomposition: BC, DA, BD

**Q2**

Here we are given a Relation R with four attributes ABCD and the following set of FDs:

F = {AB*→*C, B*→*D}

We need first identify the keys for R and then need to determine if R is in BCNF, 3NF or none of them.

|  |  |
| --- | --- |
| X | X+ |
| A | A |
| B | B,D |
| C | C |
| D | D |
| AB | A,B,C,D |
| AC | A,C |
| AD | A,D |
| BC | B,C,D |
| BD | B,D |
| CD | C,D |
| ABC |  |
| ABD |  |
| ACD | A,C,D |
| BCD | B,C,D |

K = AB

F+ = {AB*→*C, B*→*D, AB*→*D, BC*→*D}

|  |  |  |
| --- | --- | --- |
| FD | Is BCNF Violation? | Is 3NF Violation? |
| AB*→*C | No | No |
| B*→*D | Yes | Yes |
| AB*→*D | No | No |
| BC*→*D | Yes | Yes |

So it is not BCNF and also not 3NF.

Now since it is not BCNF we have to decompose.

Case 1: B*→*D

F+={AB*→*C, B*→*D, AB*→*D, BC*→*D}

ABCD

B*→*D

ABC

BCNF

BD

Fy+={AB*→*C}

Fx+= {B*→*D}

|  |  |
| --- | --- |
| X | X+ |
| A | A |
| B | B |
| C | C |
| AB | A,B,C |
| AC | A,C |
| BC | B,C |

K = AB

F+ = {AB*→*C}

|  |  |
| --- | --- |
| FD | Is BCNF Violation? |
| AB*→*C | No |

Decomposition: BD, ABC

**Q3**

**Step 1:**

Sys

B

C

E

D

A

P, Y

P, Y

**Step 2:**

Sys

B

C

E

D

A

P, Y

P, Y

P, Y

**Step 3:**

Sys

B

C

E

D

A

P, Y

P, Y

P, Y

P, Y

**Step 4:**

Sys

B

C

E

D

A

P, Y

P, Y

P, Y

P, Y

P, Y

**Step 5:**

Sys

B

C

E

D

A

P, Y

P, Y

P, Y

P, Y

P, N

P, Y

**Step 6:**

Sys

B

C

E

D

A

P, Y

P, Y

P, Y

P, Y

P, Y

P, N

P, Y

**Step 7:**

Sys

B

C

E

D

A

P, Y

P, Y

P, Y

P, Y

P, Y

P, N

P, Y

So the new authorization will be

Sys

B

C

E

D

A

P, Y

P, Y

P, Y

P, N

Yes D can still exercise the privilege as there is a path to D from A through E and E is granting that privilege to D. No B cannot exercise any privilege as none of the other nodes grant any permission to B.