Assignment 3.

Question4.

FD : A 🡪 BC R={A,B, C,D,E,F}

C 🡪 D

DE 🡪 F

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **A** | **B** | **C** | **D** | **E** | **F** |
| **R1** | α | α |  |  | α |  |
| **R2** | α |  | α | α |  |  |
| **R3** |  |  | α |  | α | α |

Since of the FD : A🡪 and the values in R1 and R2 are the same, we can changed the values of B and C in the two sets.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **A** | **B** | **C** | **D** | **E** | **F** |
| **R1** | α | α | α |  | α |  |
| **R2** | α | α | α | α |  |  |
| **R3** |  |  | α |  | α | α |

Now, since of the FD: C🡪 D and the values in are all the same for the column C, we can change the value of the R1, D and the value of R3, D for an alpha. Resulting in:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **A** | **B** | **C** | **D** | **E** | **F** |
| **R1** | α | α | α | α | α |  |
| **R2** | α | α | α | α |  |  |
| **R3** |  |  | α | α | α | α |

Next, using the last functional dependency, DE🡪 F, we see that in R1 and R3, we have the RHS as D and E and the LHS differs (column F). We can therefore change the value of the missing F in R1 for an alpha. Resulting in:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **A** | **B** | **C** | **D** | **E** | **F** |
| **R1** | α | α | α | α | α | α |
| **R2** | α | α | α | α |  |  |
| **R3** |  |  | α | α | α | α |

Since all of the elements of the R1 are alpha, we can say that this is a lossless decomposition.

The FDs that hold in the R3 are:

C 🡪 D

DE 🡪 F

Since we can see that all of the elements of the FD contain an alpha in the last table of part a).

To check if they are dependency preserving.

FD : A 🡪 BC R1 : {A, B, E}

C 🡪 D R2 : {A, C, D}

DE 🡪 F R3 : {C, E, F}

We can see that the FD : A🡪 BC does not fit inside any of the 3 sub-relations. Hence, the decomposition is not dependency preserving.

First finding the candidate keys of the FDs, for all of the three schemes.

R1 : {A, B, E}

R2 : {A, C, D}

R3 : {C, E, F}

The candidate keys for R1 are:

AE since none of the FDs determine A and E, but B is determined by A.

Since all of the LHS FDs does not include AE, it is not in BCNF.

The candidate keys for R2 are:

A, since A determines C and C determines D.

From the first 2 FDs, we can recreate the FDs:

Since the FD C🡪 D does not have the primary key on the LHS, it is not a in BCNF.

The candidate keys for R3 are:

CDE, since C is only determined by A, and F is determined by DE.

Since all of the LHS FDs does not include CDE, it is not in BCNF.

**Question 5.**

Given the Relation Scheme 🡪 R: {A1,A2,A3,A4 ,A5}

And the FDs: A3 →A4 A4 →A5 A5 → A1

The decomposition into:

R1 = {A1, A2}, R2 = {A2, A3}, R3 = {A3, A4}, R4 = {A4, A5}, R5 = {A5, A1}

We can then draw the following table according to the decomposition scheme:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **A1** | **A2** | **A3** | **A4** | **A5** |
| **R1** | α | α |  |  |  |
| **R2** |  | α | α |  |  |
| **R3** |  |  | α | α |  |
| **R4** |  |  |  | α | α |
| **R5** | α |  |  |  | α |

Taking into account the first FD: A3 →A4, we see that the rows R2 and R3 have A3 as a factor but different A4, we can then change the A4 of R2 for an alpha. Resulting in:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **A1** | **A2** | **A3** | **A4** | **A5** |
| **R1** | α | α |  |  |  |
| **R2** |  | α | α | α |  |
| **R3** |  |  | α | α |  |
| **R4** |  |  |  | α | α |
| **R5** | α |  |  |  | α |

Taking into account the second FD: A4 →A5, we see that the rows R2, R3 and R4 have A4 as a factor but different A5, we can then change the A5 of R2 and R3 for an alpha. Resulting in:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **A1** | **A2** | **A3** | **A4** | **A5** |
| **R1** | α | α |  |  |  |
| **R2** |  | α | α | α | α |
| **R3** |  |  | α | α | α |
| **R4** |  |  |  | α | α |
| **R5** | α |  |  |  | α |

Taking into account the third FD: A5 →A1, we see that the rows R2, R3 and R4 and R5 have commonly A5 as a factor but different A1, we can then change the A5 of R2 and R3 and R4 for an alpha. Resulting in:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **A1** | **A2** | **A3** | **A4** | **A5** |
| **R1** | α | α |  |  |  |
| **R2** | α | α | α | α | α |
| **R3** | α |  | α | α | α |
| **R4** | α |  |  | α | α |
| **R5** | α |  |  |  | α |

Since the R2 have all the factor as alphas, we can say that this decomposition is lossless.