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CIS4321
Assignment 2
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Problem 1

1.) $R(A,B,C,D,E)$

1. $A \rightarrow B$
2. $E \rightarrow A$
3. $CE \rightarrow D$

(I) $\{C,E\} \xrightarrow{3} \{C,D,E\} \xrightarrow{2} \{A,C,D,E\} \xrightarrow{1} \{A,B,C,D,E\}$

$\{C,E\}_+ = \{A,B,C,D,E\}$

(II) ~~$\{E\}$~~ $\xrightarrow{2} \{A,E\} \xrightarrow{1} \{A,B,E\}$

~~$\{\}$~~ $\rightarrow \{C\}$

$\{C,E\}$ is a superkey by (I) and is minimal by (II), and is therefore a key.

2.) $R(A, B, C, D, E)$

1. $A \rightarrow B$
2. $E \rightarrow A$
3. $CE \rightarrow D$

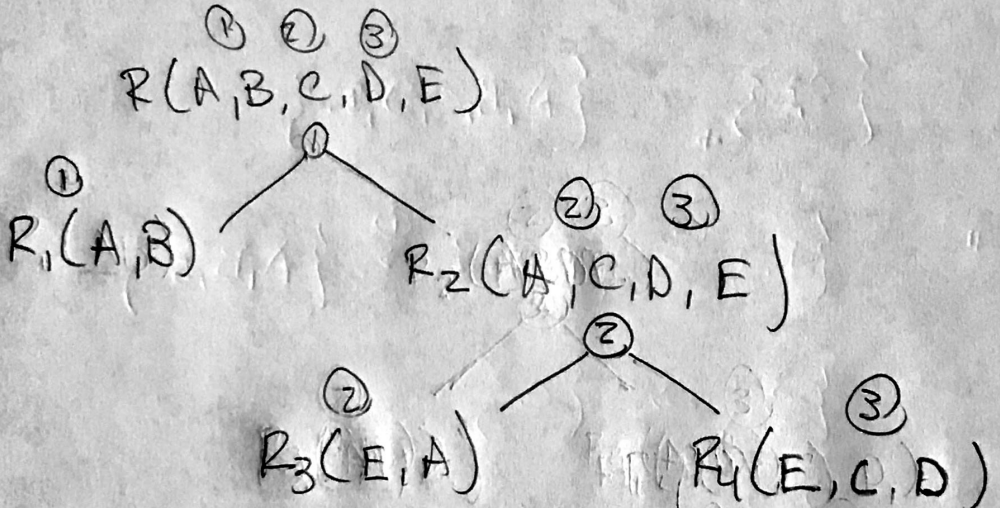
$\{A\} \rightarrow \{A\}$ ✓

$\{E\} \rightarrow \{E\}$ ✓

$\{CE\} \xrightarrow{②} \{ACE\} \xrightarrow{①} \{ABCE\}$ ✓

This is a minimal basis, as no dependencies are redundant.

3.)



$R_1(A, B)$

$R_3(A, E)$

$R_4(C, D, E)$

4.)

I. Find Minimal Basis

1. $A \rightarrow B$
2. $E \rightarrow A$
3. $CE \rightarrow D$

This basis is minimal and was proven in part 2.

II.

$R_1(A, B)$
$R_2(A, E)$
$R_3(C, D, E)$

III

$\{A, B\} \rightarrow \{A, B\}$ ×

$\{A, E\} \xrightarrow{2} \{A, B, E\}$ ×

$\{C, D, E\} \xrightarrow{3} \{A, C, D, E\} \xrightarrow{1} \{A, B, C, D, E\}$ ✓

$R_1(A, B)$
$R_2(A, E)$
$R_3(C, D, E)$

Problem 2

1) $S(C, E, J, P, R, T)$

1. $J \rightarrow P$
2. $T \rightarrow E$
3. $J \rightarrow C$
4. $JT \rightarrow R$
5. $C \rightarrow P$

(I) $\{JT\} \xrightarrow{4} \{JRT\} \xrightarrow{1} \{JPRT\} \xrightarrow{2} \{EJPRT\}$
$\xrightarrow{3} \{CEJPRT\}$ ✓

(II) $\{J\} \xrightarrow{3} \{CJ\} \xrightarrow{3} \{CJP\}$ ✓
$\{T\} \xrightarrow{2} \{ET\}$ ✓

By (I), $\{JT\}$ is a superkey. By (II), $\{JT\}$ is minimal. Therefore, it is a key.

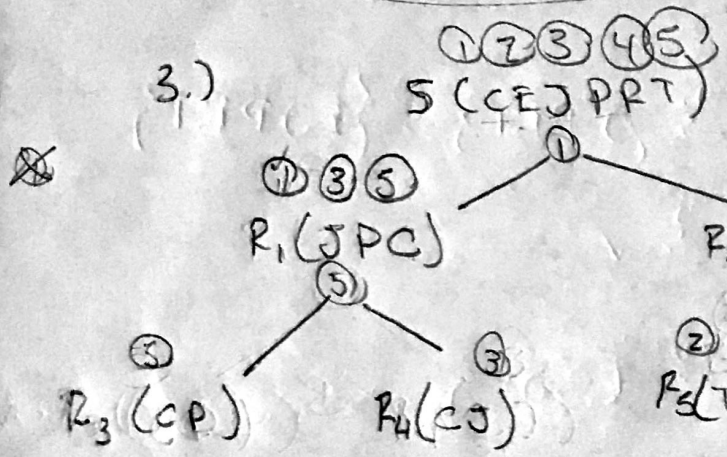
2.) $S(C, E, J, P, R, T)$

1. $J \to P$	$\{J\} \xrightarrow{3} \{J, C\} \xrightarrow{5} \{CJP\}$ ✓
2. $T \to E$	$\{T\} \to \{T\}$ ✓
3. $J \to C$	$\{J\} \xrightarrow{1} \{JP\}$ ✓
4. $JT \to R$	$\{JT\} \xrightarrow{3} \{CJT\} \xrightarrow{1} \{CJPT\} \xrightarrow{2} \{CEJPT\}$ ✓
5 $C \to P$	$\{C\} \to \{C\}$ ✓

Basis is minimal, as no dependencies are redundant.

1. $\{J\} \xrightarrow{1} \{JP\} \xrightarrow{3} \{JPC\}$ ×
5. $\{C\} \xrightarrow{5} \{CP\}$
2. $\{T\} \xrightarrow{2} \{TE\}$

3.)



Functional dependencies could not be preserved (#1) in the BCNF decomposition.

$R_3(CP)$
$R4(CJ)$
$R5(TE)$
$R6(TRJ)$

4.) I. Minimum basis was found in part 2.

II.

$R_1(JP)$

$R_2(ITE)$

$R_3(JC)$

$R_4(JTR)$

$R_5(CP)$

III.

We know {JT} is a key, as proved in Part #1. Thus, {JTR} must be a superkey and we don't have to add any additional relations. The above relations are final for this 3NF decomposition.