

1a. $R1 \cap R2$

ID	B
0	B0

1b. $R1 \times R2$

ID	A	B	ID.2	B.2	D	E
0	A0	B0	0	B0	D0	E0
0	A0	B0	2	B99	D2	E2
0	A0	B0	3	B3	D3	E3
1	A1	B1	0	B0	D0	E0
1	A1	B1	2	B99	D2	E2
1	A1	B1	3	B3	D3	E3
2	A2	B2	0	B0	D0	E0
2	A2	B2	2	B99	D2	E2
2	A2	B2	3	B3	D3	E3

1c.

$R1 \bowtie R2$

ID	A	B	D	E
0	A0	B0	D0	E0

1d.

$R1 \bowtie R2$

ID	A	B	D	E
0	A0	B0	D0	E0
1	A1	B1	null	null
2	A2	B2	null	null

1e. $R1 \bowtie R2$

ID	A	B	D	E
0	A0	B0	D0	E0
2	null	B99	D2	E2
3	null	B3	D3	E3

1f. $R1 \bowtie R2$

ID	A	B	ID	B	D	E
0	A0	B0	0	B0	D0	E0
1	A1	B1	null	null	null	null
2	A2	B2	null	null	null	null
null	null	null	2	B99	D2	E2
null	null	null	3	B3	D3	E3

2a. $\pi_{\text{Pizza}}(\sigma_{\text{Gender} = \text{female} \wedge \text{Age} > 20}(\text{Person} \bowtie \text{Eats}))$

2b. $\pi_{\text{Name}}(\sigma_{\text{Gender} = \text{female}}(\text{Person} \bowtie \text{Eats}) \bowtie \sigma_{\text{Pizzeria} = \text{"Straw Hat"}}(\text{Serves}))$

2c. $\pi_{\text{Pizzerias}}(\sigma_{\text{price} < 10}(\text{Serves}) \bowtie \sigma_{\text{Name} = \text{"Amy"} \vee \text{"Fay"}}(\text{Person} \bowtie \text{Eats}))$

2d. $\pi_{\text{Pizzerias}}(\sigma_{\text{price} < 10}(\text{Serves})) \bowtie \sigma_{\text{Name} = \text{"Amy"} \wedge \text{"Fay"}}(\text{Person} \bowtie \text{Eats})$

2e. $\pi_{\text{name}}(\sigma_{\text{pizzeria} = \text{"dominoes"}} \text{Eats} \bowtie \text{Serves} - \sigma_{\text{pizzeria} = \text{"dominoes"}} \text{Frequents})$

2f. $p(\text{youngerAge}, \pi_{\text{age}}(\sigma_{\text{Pizza} = \text{"Mushrooms"}} \text{Eats} \bowtie \text{Person}) - \pi_{\text{youngerAge} < \text{age}}(\sigma_{\text{Pizza} = \text{"Mushrooms"}} \text{Eats} \bowtie \text{Person}))$

2g. $\pi_{\text{Pizzerias}}(\sigma_{\text{age} > 30} \text{Frequents} \bowtie \text{Person})$

3a. $\{BG\}^+ = B, G, A, C, D, E, F$

3b. Candidate Key is $\{B, G\}$

3c. $R\{AB \rightarrow CD$

$C \rightarrow EF$

$G \rightarrow AF\}$

3d.

3d) $R = \{AB \rightarrow CD$
 $C \rightarrow EF$
 $G \rightarrow AF\}$

$R_1 (ABCD)$
 $AB \rightarrow CD$
 $CK = A, B$

$R_2 (ABEFG)$
 $G \rightarrow FA$
 $AB \rightarrow CD \xrightarrow{C \rightarrow EF} AB \rightarrow EF = AB \rightarrow EF$
 $CK = G, B$

$R_3 (GAF)$
 $G \rightarrow AF$
 $CK = G$

$R_4 (B, E)$
 $B \rightarrow E$
 $CK = B$

4a. $\{D\}^+ = D, A, B, C, E$

4b. CK is DF, AF, BF

4c. $R\{A \rightarrow BCD$

$BC \rightarrow DE$

$B \rightarrow A\}$

4d.

4d $R\{A \rightarrow BCD$
 $BC \rightarrow DE$
 $B \rightarrow A\}$

$R_1(A, F)$ $R_2(BCDEF)$

$A \rightarrow F$

CK: B $R_3(D-F)$ $R_4(BCDE)$

$D \rightarrow A$ $BC \rightarrow DE$

$A \rightarrow F$ CK: BC

CK: D

5a. $\{E\}^+$

5b. $A \rightarrow BCDF$

$E \rightarrow A$

$B \rightarrow D$

$BD \rightarrow CF$

$DF \rightarrow G$

SC $R = \{$

- $A \rightarrow BCDF$
- $E \rightarrow A$
- $B \rightarrow D$
- $BD \rightarrow CF$
- $DF \rightarrow G$

$R_1 (E, A)$
 $E \rightarrow A$
 ck: E

$R_2 (A, BCDF)$
 $A \rightarrow BCDF$
 $BD \rightarrow CF$

$R_3 (A, BCDF)$
 $A \rightarrow BCDF$
 ck: A

$R_4 (BCDF, G)$
 $BD \rightarrow CF$
 $DF \rightarrow G$

$R_5 (BD, CF)$
 $BD \rightarrow CF$
 ck: BD

(DF, G)
 $DF \rightarrow G$
 ck: DF

5c.