

Question 1:Union:

$X \rightarrow Y$ (Initial)

$X \rightarrow \{X, X\}$ (Reflexivity)

$\{X, X\} \rightarrow \{X, Y\}$ (Augmentation using $X \rightarrow Y$ with the inclusion of X)

$\{X, Y\} \rightarrow \{Z, Y\}$ (Augmentation using $X \rightarrow Z$ with the inclusion of Y)

$X \rightarrow \{Y, Z\}$ (Transitivity based on what we have just shown)

Decomposition:

$X \rightarrow \{Y, Z\}$ (Initial)

$\{Y, Z\} \rightarrow Y$ (Reflexivity)

$\{Y, Z\} \rightarrow Z$ (Reflexivity)

$X \rightarrow Y$ (Transitivity)

$X \rightarrow Z$ (Transitivity)

Pseudo-Transitivity:

$X \rightarrow Y$ (Initial)

$\{X, Z\} \rightarrow \{Y, Z\}$ (Augmentation of $X \rightarrow Y$ and Z)

$\{Y, Z\} \rightarrow A$ (Given FD)

Question 2: Possible FDs are coloured in green

A	B	C	D	E
1	X	1	M	1
2	Y	1	M	1
3	Y	4	N	3
4	W	2	L	5
5	W	2	M	1
6	T	5	O	2

a) $A \rightarrow B$

b) $B \rightarrow A$

c) $A \rightarrow C$

d) $B \rightarrow C$

e) $C \rightarrow D$

f) $C \rightarrow E$

g) $D \rightarrow E$

h) $\{A, B\} \rightarrow C$

i) $\{B, C\} \rightarrow E$

j) $\{B, C, D\} \rightarrow E$

Question 3:

A	B	C	D	E
1	2	1	6	2
1	2	1	4	3
2	4	2	7	4
3	2	1	4	3

Question 4:

- a) Candidate key(s): {A, B} , {A, D}
- b) Candidate key(s): {B, C}, {C, D}, A, E
- c) Candidate key(s): C, {A, B}, D
- d) Candidate key(s): {A, B}
- e) Candidate key(s): {A, B, D}, H, J

Question 5:

- a) Insert anything into B, C, D and E without also inserting a value into A
- b) Deleting the tuple with B = 4 as we lose information for the functional dependency $(B \rightarrow \{D, E\})$, specifically $(4 \rightarrow \{3, 2\})$
- c) Updating {2, 2, 1, 5, 6} to {2, 3, 1, 5, 6} creates the inconsistency of $(B \rightarrow \{D, E\})$, creates the inconsistency $(3 \rightarrow \{5, 6\})$ and $(3 \rightarrow \{5, 4\})$