Question 1 – Prove the following using only the three core Armstrong's Axioms

Union: If $X \rightarrow Y$ and $X \rightarrow Z$, then $X \rightarrow \{Y, Z\}$

Decomposition: If $X \rightarrow \{Y, Z\}$, then $X \rightarrow Y$ and $X \rightarrow Z$

Pseudo-transitivity: If $X \rightarrow Y$ and $\{Y, Z\} \rightarrow A$, then $\{X, Z\} \rightarrow A$

Question 2 – For the following data, identify which of the options are *potential* Functional Dependencies

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 → B**
b) **B → A**
c) **A → C**
d) **B → C**
e) **C → D**
f) **C → E**
g) **D → E**
h) **{A, B} → C**
i) **{B, C} → E**
j) **{B, C, D} → E**

Question 3 – Fill in the following table using the stated Functional Dependencies

FD 1: A → B

FD 2: B → C

FD 3: {C, D} → E

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

Question 4 - Find all candidate keys for the given relations and functional dependencies.

a) R [A, B, C, D, E, F, G, H, I]

{A,B} → {C,D}

{A} → {E}

{B} → {F,H}

{C} → {G}

{D} → {B}

{G} → {C}

{H} → {I}

Candidate Key(s): _____

b) R [A, B, C, D, E]

{A} → {B,C}

{C,D} → {E}

{A,C} → {E}

{B} → {D}

{E} → {A,B}

Candidate Key(s): _____

c) R [A, B, C, D]

{A, B} → {C, D}

{C} → {A, B, D}

{D} → {C}

Candidate Key(s): _____

d) R [A, B, C, D, E, F, G, H, I, J]

{A, B} → {C}

{A} → {D, E}

{B} → {F}

{F} → {G, H}

{D} → {I, J}

Candidate Key(s): _____

e) R [A, B, C, D, E, F, G, H, I, J]

{A, B} → {C}

{B, D} → {E, F}

{A, D} → {G, H}

{A} → {I}

{H} → {J}

{J} → {A, B, D}

Candidate Key(s): _____

Question 5 – Answer the following questions based on the following data and give an explanation of your answer

FD 1: A → C

FD 2: B → {D, E}

A	**B**	**C**	**D**	**E**
2	2	1	5	6
2	3	1	5	4
3	4	5	3	2
3	5	5	1	3

a) Give an example of an insertion anomaly:

b) Give an example of a deletion anomaly:

c) Give an example of a modification anomaly: