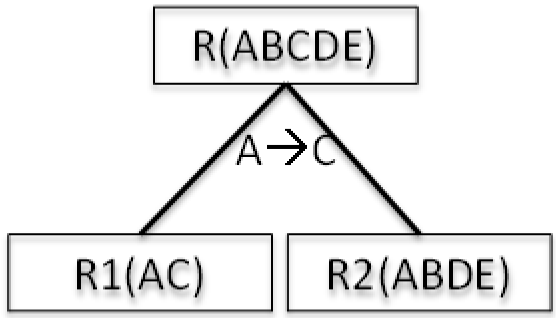
Question 1 – You may get different solutions depending on the order you normalised the FDS

a)

AB^+=ABCDE (AB is the candidate key)



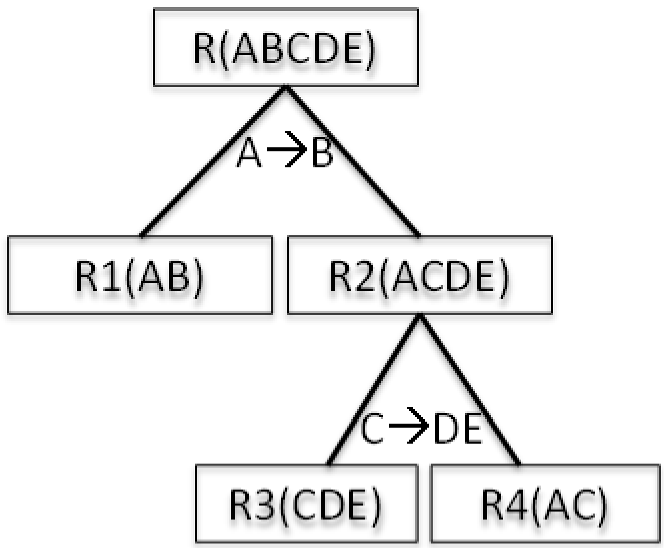
Final answer:

R1 [A, C] FD 1: A→C

R2 [A, B, D, E] FD2: {A, B} → {D, E}

b)

AC^+=ABCDE (AC is the candidate key)



Final answer:

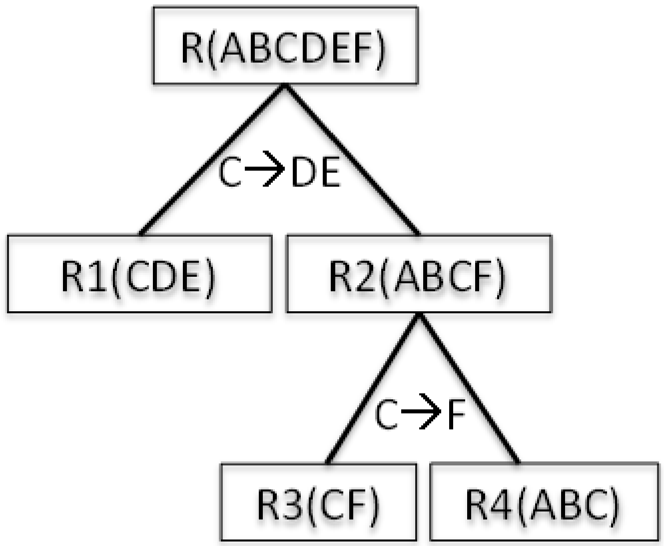
R1[A, B] FD1: A→B

R3[C, D, E]   FD2: $C \rightarrow \{D, E\}$

R4[A, C]   No non-trivial FD

c)

A^+=ABCDEF (A is the candidate key)



Functional dependency E→F is lost

<u>Final answer:</u>

R1[C, D, E]   FD2: $C \rightarrow \{D, E\}$

R3[C, F] $C \rightarrow F$ [Implicit FD]

R4[A, B, C]   FD1: $A \rightarrow \{B, C\}$

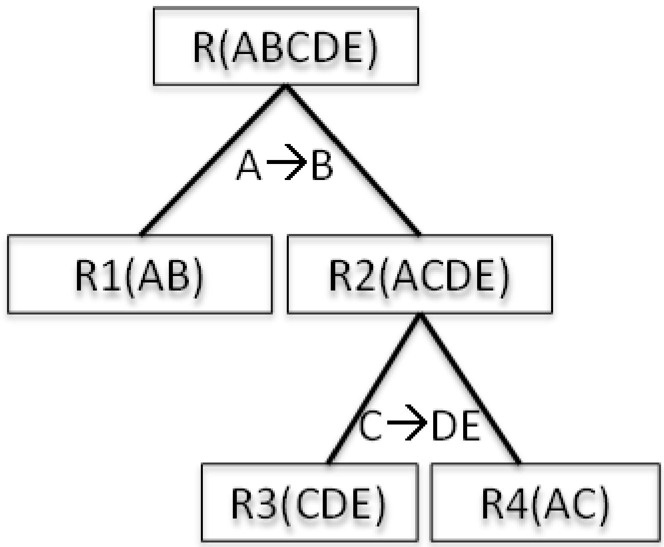
d)

AC^+=ABCDE

ADE^+=ADECB

BC^+=BCADE

AC, ADE, BC are all candidate keys



Functional dependencies {A, D, E} → C and {B, C} → A are lost

<u>Final answer:</u>

R1[A, B]	FD1: A→B
R3[C, D, E]	FD2: C→ {D, E}
R4[A, C]	No non-trivial FD

Notice that this is the same solution as **b)**, think why this is the case despite **d)** having double the number of initials FDs. What is lost?

Question 2

a)

FDs in Standard Form

$A \rightarrow D$

$A \rightarrow E$

$D \rightarrow A$

$B \rightarrow C$

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

$\{B, C\} \rightarrow D$

$\{E, A\} \rightarrow D$

Minimize LHS

$A \rightarrow D$

$A \rightarrow E$

$D \rightarrow A$

$B \rightarrow C$

$B \rightarrow A$

$B \rightarrow D$

$A \rightarrow D$

Delete Redundancy (Final Result)

$A \rightarrow D$

$A \rightarrow E$

$D \rightarrow A$

$B \rightarrow C$

$B \rightarrow A$

b)

<u>FDs in Standard Form</u>

A → B

A → C

A → D

A → E

A → F

{B, C} → A

{D, E} → B

C → D

<u>Minimize LHS</u>

No Changed Possible

<u>Delete Redundancy</u>

We can delete A → D and A → B as they are redundant

<u>Final Result</u>

A → C

A → E

A → F

{B, C} → A

{D, E} → B

C → D

Question 3 – You may get different solutions depending on the order you normalised the FDs.

a)

FDs after Minimal Cover is determined:

FD 1: {A, B} → C

FD 2: C → D

FD 3: C → E

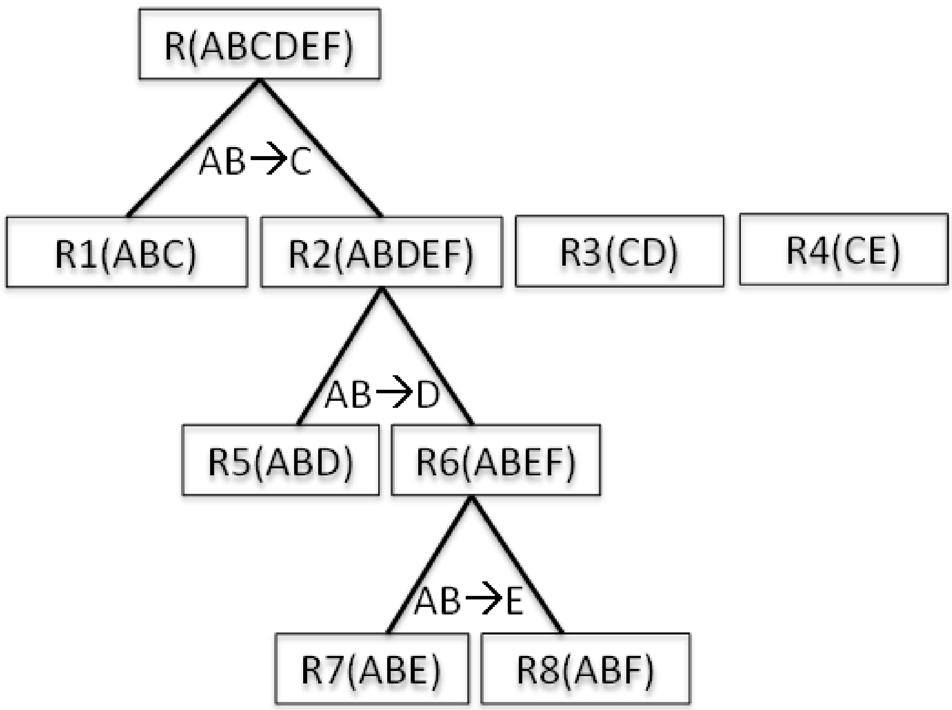
Through transitive rule we can derive 2 implicit FDs

FD4: {A, B} → D

FD5: {A, B} → E

ABF^{+}=ABFCDE (ABF is the candidate key)

Prime attributes: A, B, F



<u>Final answer:</u>

R1[A, B, C]	FD 1: {A, B} → C	
R3[C, D]	FD 2: C → D	[To preserve the FD]
R4[C, E]	FD 2: C → E	[To preserve the FD]

R5[A, B, D]	FD 4: {A, B} → D	[Implicit FD]
R7[A, B, E]	FD 5: {A, B} → E	[Implicit FD]
R8[A, B, F]	No non-trivial FD	

b)

FDs after Minimal Cover is determined:

FD 1: {A, B} → C

FD 2: {C, D} → E

FD 3: D → F

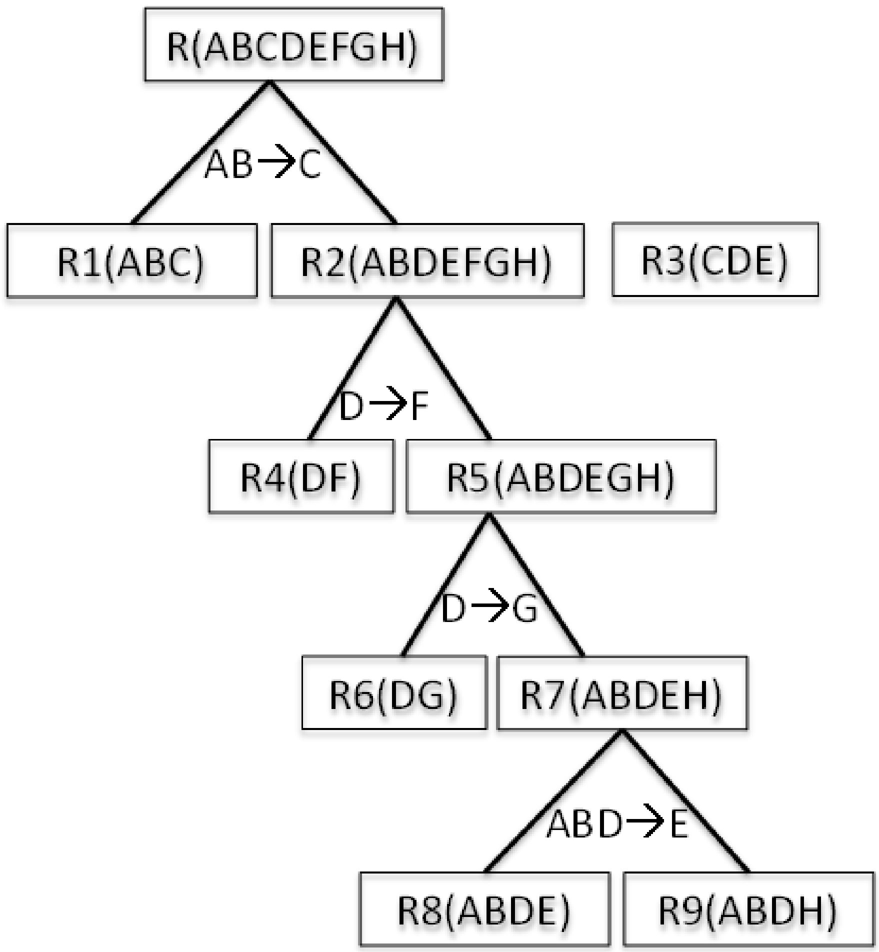
FD 4: D → G

Using the pseudotransitive rule we can derive one implicit FD

FD5: {A, B, D} → E

$ABDH^+$=ABDHCEFG (ABDH is the candidate key)

Prime attributes: A, B, D, H



<u>Final answer:</u>

R1[A, B, C]	FD 1: {A, B} → C	
R3[C, D, E]	FD 2: {C, D} → E	[To preserve the FD]
R4[D, F]	FD 3: D → F	
R6[D, G]	FD 4: D → G	
R8[A, B, D, E]	FD 5: {A, B, D} → E	[Implicit FD]
R9[A, B, D, H]	No non-trivial FD	