Q1)

a) A → B does not hold (violated by tuples 1 and 2).
b) B → C does not hold (violated by tuples 1, 5, 4, and 6).
c) D → A holds.
d) AD → C holds.
e) AC → B does not hold (violated by tuples 1 and 2).
f) BC → A holds.

Q2)

a) R into R1(A,B,C) and R2(C,D,E)

Intersection: R1∩R2=C

Functional dependencies:

i) AB → C,
ii) AD → E,
iii) A→C,
iv) D→C,

The decomposition is **lossless** since C→A and C→D, and both A and D are in R1 and R2, respectively. Both R1 and R2's characteristics are functionally determined by the common attribute C in the intersection.

b) R into R1(A,C,D) and R2(B,D,E)

Intersection: R1∩R2=D

Functional dependencies:

i) AB → C,
ii) AD → E,
iii) C→A,
iv) C→D,

Based on the specified functional dependencies, D by itself is unable to functionally identify any other property in either R1 or R2. Since there is no functional dependence that permits us to recover the original relation R without losing any information, this decomposition may be **lossy**.

Q3) R(A, B, C, D, E), F = {A → B, A → D, E → D, BD → C}

a) A → C

We need to check if A can functionally identify C using the provided set F in order to deduce A→C. We may infer that A is able to predict B and D from A→B and A→D. As BD→C and A are known to be able to predict B and D, it stands to reason that A is likewise able to determine C. Consequently, A→C can be derived from F.

b) CE→B

We must investigate if B can be determined by C and E together in order to deduce CE→B. E→D suggests that E ascertains D. However, there aren't any functional linkages that would enable C and E to decide B together, either directly or indirectly. There is no functional dependency chain connecting CE and B, nor does C show up on the right side of any functional dependency. Thus, CE→B cannot be derived from F.