Schema Refinement & Normal Forms HW

1. Consider a relation R with five attributes ABCDE. You are given the following dependencies: A → B, BC → E and ED → A
   a) List all the keys for R
      CD must be part of key
      CD*={C,D} so not a key, try adding another attribute
      ACD* ={A,C,D,B,E} so this is a key
      BCD* ={B,C,D,E,A} so this is a key
      ECD* ={E,C,D,A,B} so this is a key
   b) Is R in 3NF?
      YES for all given functional dependencies right hand side is part of a key
   c) Is R in BCNF?
      NO left hand side of the function dependencies are not a key or a super key

2. Consider a relation R with five attributes ABCDE. You are given the following dependencies: A → BC, BC → E and E → DA
   a) Is decomposition to ABC and CDE provides lossless-join decomposition
      the common attribute is C. It is lossless if C is a key for either of the tables.
      C → {A,B,C} is not correct   C→ {C,D,E} is not correct
      So it does not satisfy lossless join
   b) If not find a lossless-join decomposition for R
      ABC  //  ADE is a possible lossless decomposition
      A is the common attribute
      A → {A,B,C} is correct, A is a key for ABC table.
   c) Is decomposition to ABC and CDE provides dependency preserving decomposition?
      It provides dependency preserving if all the original functional dependencies are
      preserved in the decomposed tables. For this check the projections of the dependencies
      for the decomposed tables and try to generate original dependencies.

      projection for ABC is A→ BC
      projection for CDE is E→ D

      you cannot derive BC→E or E→ A from the projections so not dependency preserving.
   d) If not find a dependency preserving decomposition for R

      ABCE // DE is a possible dep. pres. decomposition

      projection for ABCE is A→ BC  BC→ E  E→ A
      projection for DE is E→ D

      All functional dependencies are derived from the projections.