Home Work #6

Start your assignment with the following text provided you can honestly agree with it.

- *I certify that every answer in this assignment is the result of my own work; that I have neither obtained my answers from the Internet nor from any one else; and I have not shared my answers or attempts at answers with anyone else.*

1. Consider the relational schema:

$$R(A, B, C, D, E)$$

with the FDs $\{ADE \rightarrow C, BC \rightarrow DE, BE \rightarrow A\}$

a) Find the key(s) of R.
Start with appropriate guesses (explain how you guessed). Then use the closure algorithm to prove that your guess is a superkey and that it is a key.

b) Does R satisfy
   i. 2NF?
   ii. 3NF?
   iii. BCNF?

You must check the conditions stipulated by the corresponding formal definitions. Do not make unsupported assertions. If there is a violation, state exactly where and why. If there is no violation, explain how you came to that conclusion. Treat each normal form independently: if you find a violation for one normal form, do not use it to eliminate checking the next one!
Hint: Make use of part (a)

2. Either prove using ONLY the Reflexive, Augmentation and Transitive inference rules for FD's or disprove (using relation instances) the following:
   a) $\{X \rightarrow Y, X \rightarrow W, WY \rightarrow Z\} \vDash \{X \rightarrow Z\}$
   b) $\{X \rightarrow Z, Y \rightarrow Z\} \vDash \{X \rightarrow Y\}$

Structure your answer.

a) In a proof, justify each step. Number each step and use those numbers for justifications. For example,
   1 A → B (given)
   2 B → C (given)
   3 A → C (Transitive Rule, 1, 2)
   4 ...

b) To disprove, provide a relation instance (keep it small); clearly indicate which f.d.s they conform to and why and also which tuple(s) provide counter-examples for which F.D. and why. For example, to disprove $\{A \rightarrow B\} \vDash \{B \rightarrow A\}$, you can offer the following.
   Proof: False based on the following counterexample:

A	B
a_1	b_1
a_2	b_2

   It obeys $A \rightarrow B$ trivially since no two tuples agree on A. But it violates $B \rightarrow A$ since the tuples 1 and 2 agree on B but have different values for A.