Class Worksheet

1. Consider the following algorithm for determining whether a \((U, F)\) pair is in 3NF:

Find a (minimal) key Z of R
For each nontrivial FD \(X \rightarrow Y\) in F {
   If X is not a superkey then {
      For each A in \(Y \setminus X\) {
         If A is not in Z then return false
      }
   }
}
Return true

a. If the algorithm returns true, is R necessarily in the 3NF? explain.

b. If the algorithm returns false, is R necessarily not in 3NF? explain.

c. Suggest a minor change to the algorithm that will make it correct. Explain whether the algorithm after the change is necessarily running at a polynomial time of R and F.
2. Given the schema \((\{A, B, C, D\}, \{A \rightarrow B, B \rightarrow C, D \rightarrow A\})\), show executions of the algorithm for testing whether the following decompositions are lossless:

a. \(\{AB, BC, CD\}\)

b. \(\{AB, BC, AD\}\)