Part 1

Relation Schema and Functional Dependencies:

Consider the relation schema A(P, Q, R, S, T, U) with the following sets of functional dependencies:

F1 = {PQ → R, QR → TS, PR → U}
F2 = {P → Q, R → P, PQ → ST, ST → U}
F3 = {PQR → S, QR → TP, QRT → U}

Questions:

A. For each set F1, F2, and F3:
Work out whether relation A with the respective set of functional dependencies is in BCNF and show how you reached the answer.

B. For each set F1, F2, and F3:
Find all candidate keys of A and show how you reached the answer.

C. For each set F1, F2, and F3:
Consider the following 3 decompositions of A into 2 sub-relations:
Decomposition 1:
　　　A1{P, Q, R, S},
　　　A2{S, T, U}
Decomposition 2:
　　　A1{P, Q, R},
　　　A2{S, T, U}
Decomposition 3:·
　　　A1{P, Q, R, T},
　　　A2{Q, R, S, U}
Are these decompositions lossless? Explain your answer.
Note: There are total of 9 sub-questions: 3 Decompositions for 3 functional dependency sets

Part 2

In this problem, you are required to translate the given entity relationship model that is provided to you, which is a solution to Assignment 1, into relations for the relational model and produce MySQL DDL statements to create corresponding tables.

Questions

A. Use the methods presented in class to translate the ER diagram into relations.
  ○ Translate the ER design, including entities and relationships, into a set of relations.
  ○ Describe the primary key, not NULL and inclusion dependency constraints needed for the relational schema to capture and enforce the semantics of the ER design.
  ○ Note: You can ignore the derived attributes in the assignment.

   Example:
   Relation:
       employee(<u>id</u>, depId, name, level, award)
   Not Null Attributes:
       All non-key attributes are not NULL.
   Inclusion constraints:
       employee(depId)⊆department(id)

B. Write SQL DDL statements for creating the tables corresponding to the relations you developed. Pick suitable data types for each attribute. Also include the appropriate referential integrity constraints and "NOT NULL" constraint while creating the tables. Execute your DDL statements on MySQL and make sure that all the statements execute without any error (we will be executing the DDL statements in the same order as in your submission).

   Example:
   CREATE TABLE Employee(
       id INTEGER NOT NULL,
       name VARCHAR(40) NOT NULL,
       depId VARCHAR(10) NOT NULL,
       award VARCHAR(40),
       PRIMARY KEY (id),
       FOREIGN KEY (depId) REFERENCES Department(depID)
   );