**Problem Set 1: 3NF**

1. **Consider a relation *R*with five attributes *ABCDE*. Dependencies of R are: *A → B*, *BC → E*, and *ED → A*?  Is *R*in 3NF?**

No, the relation is not in 3NF. From the given dependencies, we get BCD as candidate key. But BC →E is partial dependency which violates the constraint of 2NF. Hence, R is not in 3NF.

1. **Apply 3rd Normalization for the above 2nd problem?**

The second normal from does not have any transitive dependencies. It is also in third normal form.

Student = {Student ID, Last Name, First Name}

Student ID → Last Name, First Name

Student\_Course = {Student ID, Course ID, Grade}

Student ID, Course ID → Grade

Course = {Course ID, Course Section, Course name, Professor ID}

Course ID → Course Section, Course Name, Professor ID

Professor = {Professor ID, Professor Last Name, Professor First Name, Bldg, Office#}

Professor ID → Professor Last Name, Professor First Name, Bldg, Office#

1. **Apply 3rd Normalization for the above 3rd problem?**

The second normal from does not have any transitive dependencies. It is also in third normal form.

1. **Apply 3rd Normalization for the above 4th problem?**

The second normal from does not have any transitive dependencies. It is also in third normal form.

**Problem Set 2: BCNF**

1. **Consider the relation schema *R (A, B, C)*, which has the FD *B → C*. If *A*is a candidate key for *R*, is it possible for *R*to be in BCNF? If so, under what conditions? If not, explain why not.**

A is candidate key for relation R. The functional dependency B → C is a non prime attribute determining another non prime attribute. This violates 3NF constraint. Hence, it is not possible for the relation to be in BCNF.

1. **Apply BCNF for the above 2nd problem?**

In all the four relations, we have super keys determining the other attributes in all FDs. Hence, the 3NF is also in BCNF.

1. **Apply BCNF for the above 3rd problem?**

In all the relations, the super keys are determining the other attributes in all FDs. Hence, the 3NF is also in BCNF.

1. **Apply BCNF for the above 4th problem?**

In all the relations, we have super keys determining the other attributes in all FDs. Hence, the 3NF is also in BCNF.