CS 4611 – Spring 2017 – Laboratory 5
Assigned: 10/3/2017
Due: 10/5/2017 at 11:59 PM. Submit your file(s) to canvas.
Maximum Grade: 100 pts.

Objectives: The objectives of this lab are the following:

- **Get familiarized with the Armstrong axioms of functional dependencies, and learn how other rules follow logically from these axioms.**
- **Practice how to compute the closure of a set of attributes.**
- **Practice how to compute the closure of a set of functional dependencies.**
- **Learn how to distinguish if a relational schema is in BCNF form.**
- **Learn how to decompose a relation that is not in BCNF form into other relations that are in BCNF form.**

Activity 1: Use the Armstrong Axioms (reflexivity, augmentation, and transitivity) to prove the *union rule*. Your proof needs to be done step by step, and at each step you need to write down the logical assumptions that you are making. Follow the same format we saw in class.

Activity 2: Given a relation $R(A, B, C, D, E, F, G, I, J, K)$ with the following set *F* of functional dependencies:

$$A \rightarrow BC$$
$$AC \rightarrow D$$
$$IC \rightarrow FA$$
$$BA \rightarrow GD$$
$$G \rightarrow IJ$$
$$E \rightarrow K$$

Compute the *closure of the set of attributes* $\{I, C\}$ step-by-step, explaining why you add each attribute to the closure, and writing down how the closure grows at each step. Write a candidate key for *R* and justify why it is a candidate key and not a superkey.

Activity 3: Given the following set *F* of functional dependencies:

$$A \rightarrow B$$
$$B \rightarrow C$$

Compute F^+, the *closure of the set of functional dependencies F.*

Activity 4: Give an example (different from the ones we saw in class) of an E-R diagram such that when reduced to the E-R model (using the algorithm we saw) it gives rise to at least one table that is not in BCNF form. Then, for each table that is not in BCNF form, decompose it so that the resulting tables are in BCNF form.