CSCI 5333 DBMS
Fall 2021
Homework #8

Normalization Theory

(1) Use Armstrong's axioms and rules to prove that

F = {B->A, AC->D, CD->F, F->E}

implies BC-> E

(2) Consider R(A, B, C, D, E) with

F = {A->B, BC->DE, AB->E, DE->C, AE->CD}

(a) What are A+, B+, C+, D+ and E+?

(b) What are the candidate keys? Why?

(c) Show all prime attributes and non-prime attributes?

(d) Give a canonical cover of F?

(e) What is the highest normal form (up to BCNF) of R? Why?

(f) If R is not in BCNF, can you provide a lossless FD preserving decompositions of R into BCNF relations?

(3) Consider R(A, B, C, D, E, F) with

F = {CD->B, BC->D, D->A, F->DE, FDE->AC, B->F}

(a) What are A+, B+, C+, D+, E+, F+?

(b) What are the candidate keys? Why?

(c) Show all prime attributes and non-prime attributes?

(d) Give a canonical cover of F?

(e) What is the highest normal form (up to BCNF) of R? Why?

(f) If R is not in BCNF, can you provide a lossless FD preserving decompositions of R into BCNF relations?

(4) What are the highest normal forms of the following relations (assume they are at least in 1NF.

(a) R(A,B,C,D) {A->C}

(b) R(A,B,C,D) {A->B, B->A, A->C, C->D, D->AB}

(c) R(A,B,C,D,E) {AB->CD, C->ABE}

(d) R(A,B,C,D,E) {ABC->D, E->D}

(e) R(A,B,C,D,E) {ABC->D, D->E}

(f) R(A,B,C,D,E) {ABCE->D, D->BE}

(5) Given R(A,B,C,D,E) {AB->C, A->D, BE->A, AD->CE}

It is decomposed into R1(A,B,C), R2(A,C,D,E) and R3(A,B,E).

Is the decomposition lossy? Prove your assertion.

(6) Short questions

(a) It is known that R(A,B,C,D,E) has exactly two candidate keysWhat are the maximum and minimum number of superkeys R may have?

(b) A relation R is in 3NF and is known to have exactly one candidate key. Can we deduce that R is also in BCNF? Prove your assertion.

(c) If the relation R(A,B,C,D,E) has *exactly* five superkeys. Can you deduce how many candidate keys R have? Why?

As usual, submit your homework through Blackboard using the file name <<Yourname>>_<<YourStudentNumber>>_h8.docx.