CS 353 Fall 2024
Homework 5
Due: November 27, Wednesday till midnight
You will use the Moodle course page for submission of this assignment

Q.1 [10 pts, 5 pts each] Given the relation schema R(A, B, C, D, E) with the set of functional dependencies F = {A → B, B →D}. Determine if the decomposition of R into R1 and R2 is lossless for each of the following cases.

(a) R1(A, B, C, D), R2(B, E)

(b) R1(A, B, D), R2(A, C, E)

Q.2 [15 pts, 3 pts each] Given the relation schema R(A, B, C, D, E, F, G), determine if the following functional dependencies hold by the set of functional dependencies
F = {BD → A, BC → E, A → F, B → G, C→D, A → B}.

(a) B → A

(b) A → D

(c) AD → FG

(d) AC → D

(e) BC → F

Q.3 [15 pts] Given the relation schema R(A, B, C, D, E) with the set of functional dependencies F = {A → C, B → D, CD → E, E → A}.

Using **only Armstrong's axioms** show that BE → CD also holds on R.

Q.4 [15 pts] Given the relation schema R(A, B, C), determine if the following two functional dependency sets on R are equivalent:

F1 = {A → C, B → A}, F2 = {A → B, B → A, B → C}

Q.5 [20 pts] Given the relation schema R(A, B, C, D, E, G) and a set of functional dependencies F = {A → B, AC → D, C → E, E → G} that hold on R.

Determine if R is in BCNF. If not, give a lossless decomposition of R into BCNF.

Q.6 [25 pts] Given the relation schema R(A, B, C, D) with the functional dependency set F = {A → C, BCD → A, C → D, B → C, B → D}.

(a) [10 pts] Find a canonical cover Fc of F. Show all your work.

(b) [15 pts] Check if R is in 3NF. If not, decompose it into 3NF relations using the lossless and dependency preserving decomposition algorithm.