CS 353 Spring 2020
Homework 4
Due: 13 April, Monday till midnight
You will use the Moodle course page for submission of this assignment

Q.1 [18 pts, 2 pts each] Given the following instance of the relation R(A,B,C)

	A	B	C
Tuple 1	a1	b1	c1
Tuple 2	a1	b2	c2
Tuple 3	a2	b3	c1
Tuple 4	a2	b3	c2

Which of the following dependencies may hold in relation R? If a dependency cannot hold, indicate which tuples cause the violation.

(a) B → A (b) C → A (c) A → B (d) C → B (e) A→ C (f) B → C (g) BC → A
(h) AC → B (i) AB → C

Q.2 [8 pts, 4 pts each] Given the following relations with functional dependencies:
Relations: P(A, B, C, D) and Q(A, B, C, D)
Functional Dependencies:

- For P: A→BCD, B→ACD
- For Q: BC → AD, D→B

(a) Find all candidate keys in P
(b) Find all candidate keys in Q

Q.3 [20 pts] Given the following relation with functional dependencies:
Relation: S(A, B, C, D, E, F, G)
Functional Dependencies: F = {BCD → A, BC → E, A → F, F → G, C→D, A→G}
Decompose S into 3NF. The decomposition should be lossless-join and dependency preserving. Show all your work.

Q.4 [24 pts] Given the following relation with functional dependencies:
Relation: Q(A,B,C,D,E)
Functional Dependencies: AB → E and D → C

(a) [6 pts] Find all superkey(s) and candidate key(s)
(b) [18 pts] Decompose Q into BCNF. Show all your work.

Q.5 [18 pts, 6 pts each] Determine if the following decompositions are lossless-join or not. Show all your work.

(a) Given the relational schema S(A, B, C, D, E), and the functional dependency set:
{ A → C, BD → A, D → E }. S is decomposed into S1(B, C, D), S2(A, B, D) and S3(A, E)
(b) Given the relational schema S(A, B, C, D), and the functional dependency set:
{ A → BCD, B → C, CD → A }. S is decomposed into S1(A, B, C) and S2(B, C, D)
(c) Given the relational schema S(A, B, C, D), and the functional dependency set:
{ A → BCD, B → C, CD → A }. S is decomposed into S1(A, B, D) and S2(B, C)

Q.6 [12 pts] Given the relational schema S(A, B, C, D), and the functional dependency set:

{ A → BCD, B → C, CD → A }. Determine if the decomposition of S into S1(A, B, C) and S2(B, C, D) is dependency preserving or not. Show all your work.