Middle East Technical University

IS 503
Database Concepts and Applications
Assignment 3
Deadline: May 5th, 23:59

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1) Consider the following relation and the set of functional dependencies (FDs):

$$R = (A, B, C, D, E, F, G)$$

$$F+ =$$
$$\{ A \rightarrow B,$$
$$BC \rightarrow D,$$
$$E \rightarrow AF,$$
$$BF \rightarrow A,$$
$$CG \rightarrow D,$$
$$CG \rightarrow B,$$
$$FG \rightarrow C,$$
$$AFG \rightarrow B,$$
$$G \rightarrow EF,$$
$$CD \rightarrow B,$$
$$BCF \rightarrow A,$$
$$AE \rightarrow G \}$$

a. Find the minimal cover of the FD set. Justify your solution.(5 pts)

b. Find the candidate key(s) of R.(5 pts)

2) Consider the following relation and the set of functional dependencies (FDs):

$$R = (A, B, C, D, E, G)$$

$$F+ =$$
$$\{ AB \rightarrow C,$$
$$C \rightarrow A,$$
$$BC \rightarrow D,$$
$$ACD \rightarrow B,$$
$$D \rightarrow E,$$
$$D \rightarrow G,$$
$$BE \rightarrow C,$$
$$CG \rightarrow B,$$
$$CG \rightarrow D,$$
$$CE \rightarrow A,$$
$$CE \rightarrow G \}$$

a) Find the minimal cover of the FD set. Justify your solution. (6 pts)

b) Find the minimal key/keys of R. (10 pts)

c) If R is not in BCNF, decompose it into a set of relations that satisfy BCNF.(10 pts)

3) Consider the following relation and its minimal cover:

$$R = (A, B, C, D, E, F, G, H, I, J)$$

$$F+ =$$
$$\{ D \rightarrow I,$$
$$E \rightarrow G,$$
$$E \rightarrow J,$$
$$H \rightarrow B,$$
$$H \rightarrow C,$$
$$AC \rightarrow E,$$
$$CI \rightarrow D,$$
$$CI \rightarrow E,$$
$$GJ \rightarrow A,$$
$$GJ \rightarrow F \}$$

a. Find the candidate key(s) of R (6 pts).

b. Identify the best normal form that R satisfies (10 pts). Justify your answer.

c. For each of the following decompositions, comment whether they are dependency-preserving (8*3 pts) and give a lossless join (8*3 pts). Justify your answers:

i. R1(ACEFGJ), R2(BCDHI), R3(CEGIJ)
ii. R1(CDEI), R2(ACEFGJ), R3(BCGH)
iii. R1(BDH), R2(AEFGJ), R3(CDEHI)