# CS 281 - Fall 2020

## Homework #3

*Please include your answers in a separate document with your name, surname, section and ID included. You may type your answers on the computer, or you may write them on paper to prepare a pdf document using an app such as Cam Scanner. In the end, you should upload a single pdf file on Moodle.*

**Q1. (20 points)**

Given the following table for a relation:

| A | B | C | D | E | F |
|---|---|---|---|---|---|
| Ankara | x00 | 163 | 1 | 10 | 1 |
| İzmir | x04 | 563 | 2 | 10 | 1 |
| İstanbul | x08 | 267 | 3 | 20 | 2 |
| İstanbul | x04 | 543 | 4 | 20 | 3 |
| Bursa | x00 | 896 | 5 | 10 | 5 |
| Erzurum | x08 | 467 | 6 | 10 | 6 |

Which of the following functional dependencies hold? Justify your answers.

I. B → C
II. AB → C
III. D → BC
IV. AE → F
V. EF → B

**Q2. (20 points)**

Find candidate key(s) for the following relations based on given functional dependencies.

I. R(A,B,C,D) F = {A → B, BC → AD}
II. R(A,B,C,D,E) F = {E → CB, D → AE, A → CB}
III. R(X,Y,Z,T) F = {T → X, Z → YT, XY → Z}
IV. R(X,Y,Z,T) F = {T → YZ, Y → XZ, XT → Y}
V. R(A,B,C,D,E) F = {AB → CD, D → A, BC → DE, C → DE}

**Q3. (20 points)**

Given the relation R(X,Y,Z,U,V,T) and F={X → YZV, YZ → UT, T → XY, V → U}

Is this relation in 3NF? If it is not in 3NF, decompose it into smaller relations so that it satisfies 3NF. In case you decompose it, is the decomposition lossless? Is it dependency preserving? Justify your answers.

**Q4. (20 points)**

Given the relation R(A,B,C,D,E) and F={A → CE, C → BD, DE → AB}

Is this relation in BCNF? If it is not in BCNF, decompose it into smaller relations so that it satisfies BCNF. In case you decompose it, is the decomposition lossless? Is it dependency preserving? Justify your answers.

**Q5. (20 points)**

Find the minimal cover for the following set of functional dependencies. Show your work in each step.

R(A,B,C,D,E)

F = {A → BC, B → CE, D → E, DE → BC, E → A}