# Database Systems, CSCI 4380-01
# Homework # 2
# Due Monday September 21, 2020 at 11:59:59 PM

**Homework Statement.** This homework is worth 5% of your total grade. If you choose to skip it, Midterm #1 will be worth 5% more. Remember, practice is extremely important to do well in this class. I recommend that not only you solve this homework, but also work on homeworks from past semesters. Link to those is already provided in Teams, which I am repeating here:

`http://cs.rpi.edu/~sibel/DBS_Past_Materials/`

This homework aims to test normalization theory.

**Question 1.** You are given the following relation:

`EventInformation(eventname, edate, starttime, duration, URL, description, host, panelistname, panelistemail, participantid, participantname, participantemail, participantaddress, ticketprice)`

This is a relation containing information about different events. Each event can have multiple names, panelists and participants. There can be multiple events on a given date, but only one event can occur on a given `edate` and `starttime`. For such an event, there is a unique `duration, URL, description` and `host`.

Two panelists from different events can have the same `panelistname` or `panelistemail`, but for panelist in a specific event, `panelistname` is unique and given their `panelistname` for an event, their `panelistemail` is fixed. (This means that however unlikely, two participants in the same event may share an email but not name).

`participantname`, `participantemail`, `participantaddress` are not guaranteed to be unique in the database, but `participantid` is unique for the whole relation. Given a unique `participantid`, their `participantname`, `participantemail` and `participantaddress` is fixed. The `ticketprice` value is unique for a unique participant and an event as different people can be charged different amounts for the same event (in the same way Amazon charges different people different amounts for the same product!).

List all relevant functional dependencies for this relation based on the above description.

Based on your functional dependencies, check if this relation is in BCNF or in 3NF. Show your work.

**Question 2.** You are given the following set of functional dependencies for relation $R(A, B, C, D, E, F, G)$.

$$\mathcal{F} = \{AC \rightarrow D, AC \rightarrow E, BE \rightarrow F, AFG \rightarrow B\}$$

Is the decomposition of $R$ into $R1(A, B, C, F, G)$ and $R2(A, B, C, D, E)$ a dependency preserving decomposition?

To do this, find the projection of these functional dependencies to decomposed relations $R1$ and $R2$ below as $\mathcal{F}_1$ and $\mathcal{F}_2$. Show some details of your work.

The find if the union of these functional dependencies and check if they are equivalent to the original set $F$.

**Question 3.** You are given the following set of functional dependencies for relation $R(A, B, C, D, E, F, G)$:

$$\mathcal{F} = \{AC \rightarrow BD, BC \rightarrow E, BE \rightarrow DF, AG \rightarrow EB\}$$

$R1(A, C, B, D)$
$R2(A, B, C, E, G)$
$R3(B, E, F)$
$R4(A, G, E)$

Is the following decomposition lossless? Show your work with Chase decomposition algorithm.

**Question 4.** You are given the following set of functional dependencies for relation $R(A, B, C, D, E, F, G, H)$:

$$\mathcal{F} = \{AD \rightarrow CE, C \rightarrow D, BEF \rightarrow G, AG \rightarrow C\}$$

(a) Find keys, check if it is in 3NF or not.

(b) If it is not in 3NF, use 3NF decomposition to find relations in 3NF.

(c) For each decomposed relation, the find the functional dependencies that are projected into the relation. Check if it is in BCNF or not.

**Question 5.** Convert the following set of functional dependencies to minimal basis. Show only the main steps:

$$\mathcal{F} = \{AC \rightarrow BD, BC \rightarrow BE, ABC \rightarrow E\}$$

**Question 6.** You are given the following relation and the set of functional dependencies. In this model, clubs can have multiple offiers but a person can be the offier of only one club.

Use BCNF decomposition to find a set of relations that are in BCNF.

```
Clubs(clubname, datefounded, url, contactemail, memberid, membername, officername,
officerposition)
```

We will shorten the attributes for simplicity to:

```
Clubs(cname, df, url, email, mid, mname, oname, oposition)
```

```
cname → df url email
cname mid → mname
oname → oposition
oname → cname
```

**SUBMISSION INSTRUCTIONS.** Submit a PDF document or a Text document for this homework using Submitty. No other format and no hand written homeworks please. No late submissions will be allowed.

If the Submitty for homework submissions is not immediately available, we will announce it on Teams when it becomes available.