

# Homework Due 2018-04-29 by 11:55 PM

## 1 General Instructions

Please read these instructions carefully for each assignment, though they generally do not vary much between the assignments.

1. You need to follow carefully the specific instructions for the assignment as written below.

It is advisable to print out this document and check off various points as they are addressed. It is easy to miss something when switching between the assignment and the solution on a single screen, especially on a laptop.

2. If you have questions concerning this homework email Jiaxuan Lu, <mailto:jl5006@nyu.edu> in the way specified in the course description.

3. Submit your homework in electronic form by uploading it to NYU Classes by the due date and time. Use only permitted software and format. E.g., if you are asked for a relational database specification using SQL Power Architect than that's what you must submit.

4. If you submit a scanned, handwritten assignment, it has to be written neatly, that is, it should be neatly divided into lines just as a typeset document, etc.

5. Show *all* your applicable work (other than for reading assignments, if any).

6. If you want to refer to a specific line in this document, refer to the small numbers in the left margin.

7. Your solution should be uploaded as a single `zip` file containing all the files that you need to produce. Assuming that your Net ID is `abc123` and you are submitting your solution to Homework due 2034-02-15, your zip file should be named `20340215abc123.zip`, of course you need to specify the correct date and the correct Net ID.

8. Do not email your submission to any of the assistants. If you run into problems uploading your solution and the time for the submission has passed, please email Zvi Kedem *in the way specified in the course description*, and if you have a solution, email the solution also.

9. Until the deadline that the system imposes you can resubmit your homework as many times as you like and you may want to submit it relatively frequently in case something happens to your partial work on your machine.

10. In addition, there is a one-hour automatic extension, which you can use without any penalty. But do not count on it as it is only there in case you have communication problems and did not succeed in uploading the solution because of them.

32 11. **Be sure to follow the academic integrity rules listed in the course description**  
33 **posted on NYU Classes.** The department and the GSAS treat academic integrity very  
34 seriously and I am required to report all possible violations.

## 35 2 Assignments

### 36 2.1 Description

37 Produce your solution as a PDF file but note **item 7 in section 1.** You may handwrite your solution  
38 but note **item 4 in section 1.**

39 The problems deal with normalization. We wanted comprehensive problems so that you can practice  
40 complex cases. But complex cases do not lend themselves into natural applications. So we did not  
41 look for them and just used letters and FDs that are good for exercising the algorithms. In practice,  
42 you are likely to find simpler cases than some of the problems below, though perhaps much bigger.

43 **For this homework it is particularly important**

- 44 • To show all your work and not to skip any steps as otherwise it is not possible to be sure that  
45 you understand what you are doing. For example, if you replace a set of FDs M by a set of  
46 FDs N, claiming that they are equivalent, you need to prove that as we did in class.
- 47 • To write the solution very neatly as requested above.

48 When you compute keys, use all the heuristics you like including the ones we used when we covered the  
49 PFDT example, but you must use all the heuristics we used when we covered the EmToPrHoSkLoRo  
50 example.

51 To show that a relation is not in BCNF you may want to consult slides 223–224 in Unit 7.

52 1. Given a relation schema ABCDEFGHI satisfying the following functional dependencies, find  
53 all the keys and show that the relation is not in BCNF.

- 54 •  $A \rightarrow I$
- 55 •  $AB \rightarrow C$
- 56 •  $AE \rightarrow GH$
- 57 •  $BE \rightarrow DF$
- 58 •  $H \rightarrow A$

59 2. Given a relation schema ABCDEFGH, show that the given functional dependencies form a  
60 minimal (also called canonical) cover.

- 61 •  $A \rightarrow B$
- 62 •  $ADE \rightarrow C$
- 63 •  $ADF \rightarrow G$
- 64 •  $CF \rightarrow GH$

- 65 3. Given a relation schema ABCD satisfying the following functional dependencies, and following  
66 *exactly* the procedure we covered in class find a minimal cover. (There are other procedures  
67 that work, but you have to follow the one we covered.) Generally, you also need to show that  
68 the set is indeed a minimal cover. But as this point was covered in **item 2** above, you do not  
69 need to do it here.
- 70 •  $A \rightarrow BC$
  - 71 •  $AB \rightarrow D$
  - 72 •  $B \rightarrow C$
- 73 4. Given a relation schema ABCDEFGHI satisfying the following functional dependencies, and  
74 following *exactly* the procedure we covered in class find a minimal cover. (There are other  
75 procedures that work, but you have to follow the one we covered.) Generally, you also need to  
76 show that the set is indeed a minimal cover. But as this was covered in **item 2** above, you do  
77 not need to do it here.
- 78 •  $A \rightarrow HI$
  - 79 •  $AB \rightarrow CD$
  - 80 •  $CD \rightarrow EF$
  - 81 •  $E \rightarrow F$
  - 82 •  $G \rightarrow AD$
  - 83 •  $H \rightarrow B$
  - 84 •  $I \rightarrow AG$
- 85 5. Given a relation schema ABCDEFGH and the following minimal cover, create a lossless-join,  
86 dependencies-preserving, 3NF decomposition.
- 87 •  $ABD \rightarrow G$
  - 88 •  $AG \rightarrow E$
  - 89 •  $BD \rightarrow C$
  - 90 •  $CF \rightarrow A$
  - 91 •  $G \rightarrow B$
- 92 6. Given a relation schema ABCDEFGH and the following minimal cover, create a lossless-join,  
93 dependencies-preserving, 3NF decomposition.
- 94 •  $A \rightarrow B$
  - 95 •  $B \rightarrow DE$
  - 96 •  $CF \rightarrow DE$
  - 97 •  $DG \rightarrow CF$

## 98 **2.2 What to submit**

99 Please submit a single zip file as described in **item 7** of **section 1**.

100 The archive should contain the PDF file of solutions.

101 The file name must be consistent with your zip file name. If your zip file named **20340215abc123.zip**,  
102 your pdf file must be named **20340215abc123.pdf**. In the the beginning of the pdf file put

- 103 1. Your name
- 104 2. Your N-number
- 105 3. Your Net ID