

Please read 7.8 and 17.4 of the textbook and then answer the following, trying not to look at your notes or at the textbook. Quiz #6, on Wednesday 15th November, will consist exclusively of questions taken from the Part I of this homework.

Part I — Short Questions

Question 1

Consider the relation $R(A_1, A_2, A_3, A_4, A_5)$ and the functional dependencies $\{A_1, A_2 \rightarrow A_3, A_2 \rightarrow A_4, A_3 \rightarrow A_5\}$. Answer the following:

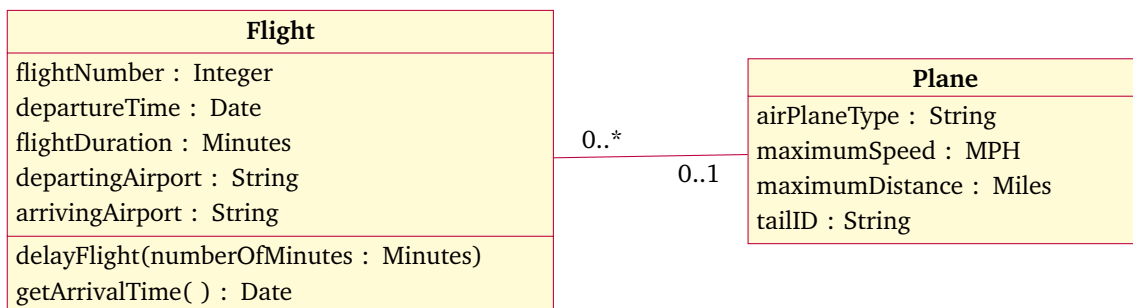
- A_1 by itself is not a primary key, but what is the only key that contains A_1 ?
- List the non-prime attributes.
- This relation is not in 2NF: what transformation can you operate to obtain a 2NF?
- The relations you obtained at the previous step are likely not to be in 3NF. Can you normalize them? If yes, how?

Question 2

Name two reasons why one would want to use a U.M.L. diagram over an Entity-Relationship diagram to represent a conceptual schema.

Question 3

Consider the following diagram:



Give the number of attributes for both classes, and suggest two operations for the class that doesn't have any. Discuss the multiplicities: why did the designer pick those values?

Question 4

What are the two different categories of U.M.L. diagram?

Question 5

Can a C++ developer working on Linux and a Java developer working on MacOS use the same deployment diagram as a basis to write their programs?

Question 6

What kind of diagram should we use if we want to ...

- describe the functional behavior of the system as seen by the user?
- capture the flow of messages in my software?
- represent the workflow of actions of an user?

Question 7

Briefly explain the difference between an aggregation and a composition association.

Question 8

How is generalization (or inheritance) represented in a U.M.L. class diagram? Why is such a concept useful?

Question 9

What is a record? What does it usually represent?

Question 10

What does it mean to say that a datatype is of variable length? Give an example of such a datatype.

Question 11

When does a file have variable-length records?

Question 12

When is it useful to have separate characters in your record?

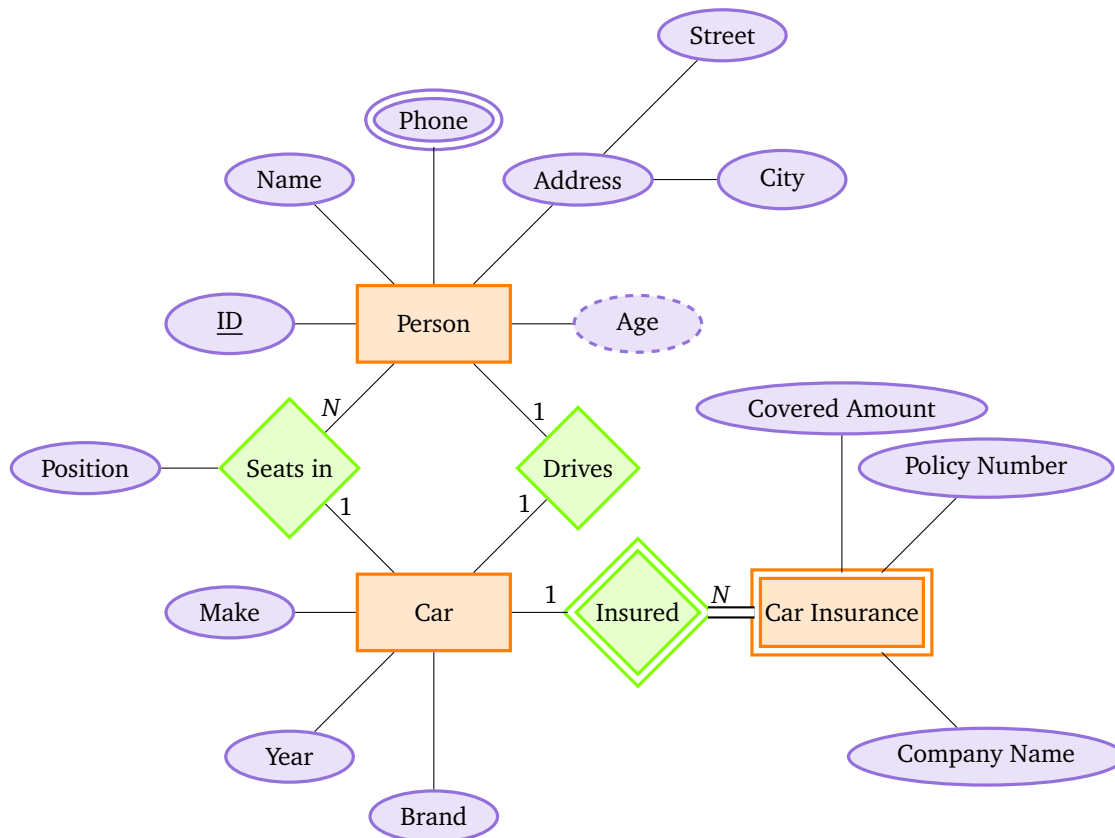


Part II — Problem

This part will help you in assessing your level of understanding of this lecture, prepare you for the rest of your cursus, and give you an idea of the kind of problem you will be asked to solve during the exams. I'll assume that you will have successfully completed those problems by the time Homework #7 is released (Wednesday 15th November), so don't wait and let me know if you had difficulties solving them.

Problem 1

Consider the following E.R.schema for the CAR_INFO database:



Note that a car can have at most one driver, N passengers, N insurances, and that car insurance exists only if it is “tied up” to a car (i.e., they are weak entities, and their identifying relationship is called “Insured”).

- Find the key attribute for “Car”, and the partial key for “Car Insurance”. If you can't think of any, add a dummy attribute and makes it be the key.
- With the help of Section 9.1.1 of your textbook, map that E.-R. diagram to a relational database schema.
- Convert the E.-R. diagram to a U.M.L. class diagram. Comparing Figure 7.16 and Figure 7.2 from your textbook should guide you.

Problem 2

In this exercise, we will install and explore the basic functionalities of MySQL Workbench, which is a cross-platform, open-source, and free graphical interface for database design.

- Install MySQL Workbench: Use your package manager if you're running Linux, or download the binaries from <https://dev.mysql.com/downloads/workbench/>.
- Once installed, execute the software. Under the panel “MySQL Connections”, you should see your local installation listed as “Local instance 3306”. Click on the top-right corner of that box, and then on “Edit

Connections”. Alternatively, click on “Database”, on “Manage Connections”, and then on “Local instance 3306”.

- (c) Check that all the parameters are correct. Normally, you only have to change the name of the user to “testuser”, and leave the rest as it is. Click on “Test the connection”, and enter your password (which should be “password”) when prompted. If you receive a warning about “Incompatible/nonstandard server version or connection protocol detected”, click on “Continue anyway”.
- (d) Now, click on the box “Local instance 3306”, and enter your password. A new tab appears, you can see the list of schemas in the bottom part of the left panel.
- (e) Click on “Database”, and then on “Reverse Engineering” (or hit `ctrl + r`), click on “next”, enter your password, and click on “next”. You should see the list of the schemas stored in your database. Select one, click on “next”, and then click on “execute”, “next”, and “close”.
- (f) You’re back on the previous view, but you should now see “E.E.R.diagram” on the top of the middle panel. Click on “E.E.R.diagram” twice, scroll down if needed, and you should see the E.E.R.diagram.
- (g) This diagram isn’t exactly a E.-R. diagram, and it’s not a U.M.L. diagram either. Yet, you should still be able to understand parts of it, and should try to modify it. Make some relations mandatory, change their name, add an attribute, change the name of another, insert a couple of elements in an entity, add a row in a table, etc. Make sure you understand the meaning of the lines between the entities.
- (h) Once you’re done, try to “Forward Engineer” by hitting “Ctrl” + “G”. Click on “next” twice, enter your password, click on “next” once more, and you should see the SQL code needed to produce the table you just designed using the graphical tool.

Problem 3

This problem requires you to have successfully completed Problem 1 and Problem 2.

Using the relational database schema that you obtained in question b of Problem 2, write the SQL implementation of that database. Then, using MySQL Workbench, use the “Reverse Engineering” function to obtain a E.E.R. diagram of your database, and compare it with the U.M.L. diagram you draw in question c of Problem 2. Apart from the difference inherent to the nature of the diagram (i.e., U.M.L. Vs E.E.R.), how are they the same? How do they differ? Is the automated tool as efficient and accurate as you?

