

## 2. Task 1 (2.5 marks)



Shall be fine

Create a drawing of a conceptual schema

Read and analyse the following specification of a sample database domain:

*A transportation company would like to create a database to record some of its operations.*

*The company owns and uses a number of buses to implement transportation services between the cities.*

*The company employs administration staff members, drivers, guides and mechanics. A common description of an employee consists of a unique employee number, first name last name and date of birth. Additionally, drivers are described by a unique driving licence number and category of a driving licence. Mechanics are also described by a list of qualifications acquired in the past together with a date when each qualification has been acquired.*

*The company supports a number of transportation services. Each service starts at a city, passes through a number of intermediate stops and ends in another or the same city. An origin location, a sequence of intermediate stops, and a destination location of service are described by unique addresses. An address consists of a city name, street name and building number.*

*Each intermediate stop has a unique number in a sequence of intermediate stops within a transportation service.*

*A transportation service is described by a planned departure time from an origin location, the planned arrival times and departure times at the intermediate stops and a planned arrival time at a destination location. A city of departure, planned departure time, and a city of destination uniquely identify each transportation service.*

*The transportation company assigns the drivers, guides and busses to the transportation services.*

*Shorter transportation services have one bus and one driver assigned. Longer transportation services have a single bus and multiple drivers assigned. Each driver is assigned to a section of a longer transportation service, A section starts at a location, and it includes a number of successive locations a transportation service passes through.*

*A description of a bus consists of a registration number, make, model, year of manufacture, fuel consumption and a total number of seats available.*

*The objective of this task is to construct a conceptual schema for the specification of a database domain listed above.*

*Artificial identification attributes, commonly known as "id" attributes are not allowed in your solution. Use only the information provided in the specification.*

*Use the UMLet tool to create a drawing of a conceptual schema in the notation of UML simplified class diagrams explained to you during the lecture classes in DPIT115. No other notation will be accepted. Remember to use the CSIT115-815Palette palette.*

*Add your name, student number and date to your diagrams.*

*Use the option File->Export as... to export your diagram as a file in BMP format. Do not delete exported files, you will submit them as one of the deliverables from your laboratory work.*

In this task, you will need to provide a detailed analysis of a conceptual schema like in the previous laboratory task using the template provided. The final conceptual schema needs to be expressed in UML simplified class diagram notation.

Show your work for each step of the process and use the template provided.

? How so

Deliverables

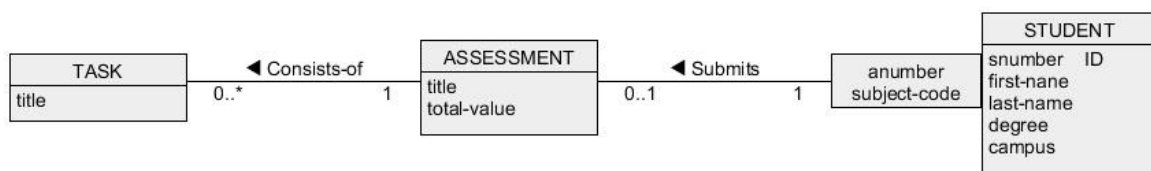
A file solution1.pdf with the final design of a conceptual schema.

Submission of a file with a different name and/or different extension and/or different type scores no marks.

### 3. Task 2 (1.5 marks)

Extend a conceptual schema

Consider the following conceptual schema. The schema represents a database domain where the students submit the assignments and assignments consist of tasks.



Your task is to extend the schema after the extension, it would be possible to store the following information in the database.

1. We would like to store in the database information about two different types of students: postgraduate students and undergraduate students. Postgraduate students are additionally described by the title of the research project. Undergraduate students are described by an optional title of their software project.
2. We would like to store in the database information about the titles and topics of all software projects and the groups of students who participate in each project. Assume that a title uniquely identifies each project.
3. We would like to add information about the total number of tasks included in each assignment and for each task, we would like to store information about a name of the file of each task and a sequence number of a task within an assignment. Do not forget about an identifier of a class TASK.

Add your name, student number and date to your diagrams.

Use UMLet and CSIT115-815Palette palette to extend the conceptual schema. The original schema is provided in a file task2.uxf.

After all, extensions save an extended conceptual schema in a file solution2.uxf.

Next, use the option File->Export as... to export your diagram into a file solution2.bmp in BMP format, once exported print it to a file named solution2.pdf. You will submit it as one of the deliverables from your laboratory work.

Deliverables

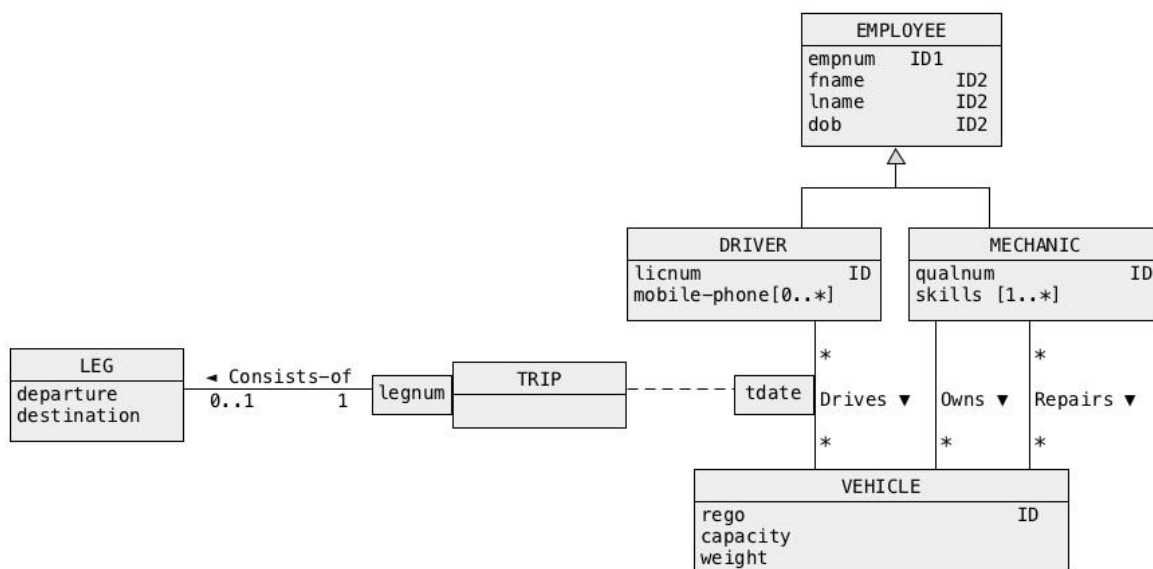
A file solution2.pdf with an extended conceptual schema.

Submission of a file with a different name and/or different extension and/or different type scores no marks.

#### 4. Task 3 (2 marks)

Perform logical database design

Consider a conceptual schema given below:



Assume that each driver has a different number of mobile phones or does not have a mobile phone at all. Also, assume that skills can be shared by mechanics.

Your task is to perform logical database design, i.e. to transform a conceptual schema given above into a collection of relational schemas.

Show your work for each step of the process and use the template provided.

For each relational schema created clearly list the names of attributes, primary key, candidate keys (if any), and foreign keys (if any). Assume, that the subset method must be used to implement a generalization (if any). A way how a conceptual schema can be transformed into a collection of relational schemas is explained in a presentation 06 Logical Design.

The relational schemas must be listed in a format presented in slides 44 and 45 in presentation 06 Logical Design. Listing of the relational schemas in the other format scores no marks.

Deliverables

A file solution3.pdf with a list of relational schemas, the primary key for each relational schema, candidate keys (if any) for each relational schema, foreign keys (if any) for each relational schema.

Submission of a file with a different name and/or different extension and/or different type scores no marks.

## 5. Task 4 (6 marks)

Theory questions

Using the template provided, review the lecture material and references tests and form answers to the following questions using your own words, diagrams and examples:

1. Discuss each of the following concepts in the context of the relational data model:
  1. relation
  2. attribute
  3. domain
  4. tuple
  5. intension and extension
  6. degree and cardinality
2. Discuss the difference between the candidate keys and primary keys?
3. Explain what is meant by a foreign key?
4. Database design is quite complex and important. Discuss the role played by users during the design process
5. Describe the purpose of normalizing data
6. Briefly describe the basic SQL DDL statements and explain their use

Deliverables

The file solution4.pdf with your answers to the questions, your name student number and the date, should be included on each page.

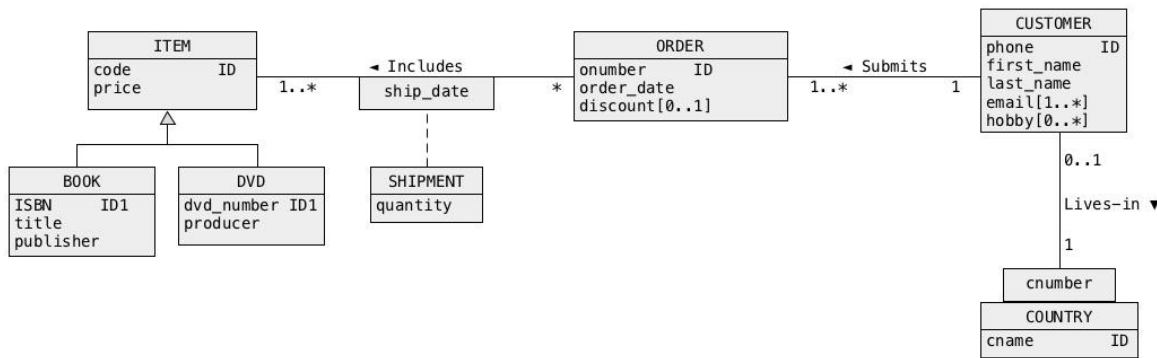
Submission of a file with a different name and/or different extension and/or different type will score no marks.

## 6. Task 5 (3 marks)

Transform a conceptual schema and create tables in MySQL

In this task, you must use a virtual machine with MySQL. All technical details on how to start and how to use a virtual machine have been explained and practised in Lab 1, task 2 and task 3.

Consider a conceptual schema given below:



1. Perform a step of logical database design and transform a conceptual schema given above into a collection of relational schemas. Use an association method for the implementation of generalization.

Show your work for each step of the process and use the template provided.

2. Next, use the relational schemas obtained in the previous step to create an SQL script solution5.sql with CREATE TABLE statements that implement the relational schemas.

Your CREATE TABLE statements must enforce the following types of columns in the relational tables.

- All columns that contain dates must be of type DATE.
  - All item codes must be a fixed-size sequence of 8 characters.
  - All order numbers are sequences of 10 digits.
  - All discounts applied are fractions in a range (0,1) with 1 position after the decimal point.
  - All prices are real numbers (floating-point numbers) in a range 0.00 to 99999.99 with 2 positions after the decimal point.
  - The types of all other columns in the relational tables are up to you. However, the types must make sense. For example, a city or country name of type integer will not get a lot of appreciation from a person evaluating your solution.
3. Note, that you MUST use only CREATE TABLE statements and no other statement of SQL. You can find a lot of information about the implementation of CREATE TABLE statements in a presentation 09 SQL - Data Definition Language (DDL) and in Cookbook, How to use data definition and basic data manipulation statements of SQL, Recipe 4.1 How to create and how to alter the relational tables? You can use either graphical user interface SQL Developer or command-line interface MySQL to implement your script. Show your work for each step of the process and use the template provided for step2 and submit the file as solution5.pdf.
  4. When your script is ready connect to the command line interface MySQL and drop all relational tables created so far.

Next, process the script solution5.sql implemented in the previous step. Processing of the script must create a report. The report from the processing of a script solution5.sql must be saved in a file solution5.rpt.

If the processing of the file returns errors, then you must eliminate the errors. Processing of your script must show NO ERRORS. A solution with errors is worth no marks.

It is recommended to create a script drop.sql that drops all relational tables created by processing

of a script solution5.sql and it is recommended to process a script drop.sql after each processing of solution5.sql. In such a way you can avoid unpleasant error messages like:

ERROR 1050 (42S01): Table '...' already exists

Please, remember that such a message counts as an error in processing the script and that a solution with errors is worth no marks.

To create a report, you must use a technique already practised in Lab 1. You can also find more information about creating reports from the processing of SQL scripts in Cookbook, Recipe 3.1 How to use "MySQL? Command based interface to MySQL database server? Step 4 How to save the results of SQL processing in a file?

Your report must contain a listing of all the SQL statements processed. To achieve that, you must logon to the MySQL client with `-v` (verbose) and `-c` (retain comments) options in the following way:

```
mysql -u csit115 -p -v -c
```

You can find more information on how to display SQL statements while a script is processed in Cookbook, Recipe 3.1 How to use "MySQL? Command based interface to MySQL database server? Step 3 How to process SQL script?

A report that does not contain a listing of the processed SQL statements will score no marks; make sure that you connect to MySQL client with an option `-v` And again, ... a report from the processing of your SQL script must contain NO ERRORS.

#### Deliverables

A file solution5.pdf showing the transformation of the UML into relational schemas.

A file solution5.rpt with a report from the processing of your SQL script solution5.sql.

The report must be created with the command line interface MySQL, the report MUST NOT include any errors, and the report must list all SQL statements processed.

Submission of a file with a different name and/or different extension and/or different type scores no marks.