

## **CSIT882 Database Management Systems**

### **Assignment 1**

Published on 1 March 2021

---

#### **Scope**

This assignment consists of the tasks related to conceptual modelling, logical design, and decomposition of relational schemas.

#### **Please read very carefully information listed below.**

This assignment contributes to 0% of the total evaluation in a subject CSIT882 and the only evaluation is either **satisfactory** or **not satisfactory** grade of the outcomes of the assignment.

The outcomes of the assignment work are due by **Saturday 27 March 2021, 7.00 pm (sharp)**.

A submission procedure is explained at the end of specification.

This assignment consists of 4 tasks and specification of each task starts from a new page. It is expected that one problem will be solved in a period of one week. It is recommended to pass through a Quiz first.

A submission marked by Moodle as `Late` is treated as a late submission no matter how many seconds it is late.

A policy regarding late submissions is included in the subject outline.

A submission of compressed files (zipped, gzipped, rared, tared, 7-zipped, lhzed, ... etc) is not allowed. The compressed files will not be evaluated.

All files left on Moodle in a state "`Draft (not submitted)`" will not be evaluated.

An implementation that does not compile due to one or more syntactical errors scores no marks.

It is expected that all tasks included within **Assignment 1** will be solved **individually without any cooperation** with the other students. If you have any doubts, questions, etc. please consult your lecturer or tutor during lab classes or office hours. Plagiarism will result in a **FAIL** grade being recorded for the assessment task.

---

### **Prologue**

In this Assignment you must use a notation of simplified UML class diagrams for conceptual modelling and UMLet 14.3 with CSIT882 Palette to draw the conceptual schemas.

It is explained in a video presentation available on Moodle in a section Software Resource and Installation Procedures how to install and how to use UMLet 14.3 with CSIT882 Palette.

### **Action 1**

Download and install UMLet 14.3 with CSIT882 Palette on your computer system.

### **Action 2**

Access Cookbook and implement a Recipe 2 How to use UMLet 14.3 for conceptual modelling. An entry point to Cookbook is located on Moodle in a section Software Resource and Installation Procedures.

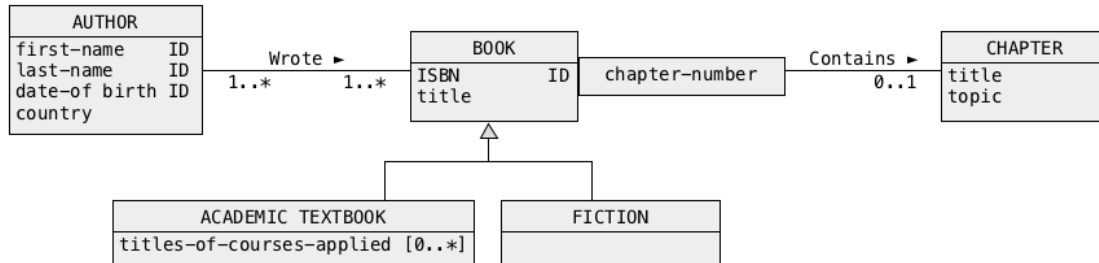
No report is expected from the implementations of actions listed above.

## Tasks

### **Task 1 (To be completed by the end of Week 1)**

An objective of Task 1 is interpretation of a conceptual schema expressed in a notation of simplified UML class diagrams.

Analyse the following conceptual schema.



Write a natural language specification of a sample a database domain (like for example, the specification written by your lecturer in a Tasks 2 of this Assignment) such that it contains all information included in a conceptual schema given above. Include into your specification all information that you can learn from a conceptual schema given above. Save your specification of a sample database domain in a file `solution1.pdf`.

### **Deliverables**

A file `solution1.pdf` with a specification of a sample database domain related to a conceptual schema given above.

---

用自然语言描述上图

## Task 2 (To be completed by the end of Week 2)

An objective of this task is to create a conceptual schema of a given sample database domain.

Read the following specification of a sample database domain.

*A real estate company would like to create a database with information about some of its activities, real estate properties on the market, owners and potential buyers.*

*The owners of real estate properties offer for sale two types of properties: standing alone houses and empty blocks of land. Both types of real estate properties are described by a unique full address that consists of city, street, house number or lot number. The standing alone houses are additionally described by the total number of bedrooms. The blocks of land are described by the total area.*

*The real estate properties are owned by the owners. An owner is described by the first name, last name and phone number. The owners are uniquely identified by a mobile phone number. The owners determine the "asked prices" of the properties offered for sale.*

*The potential buyers express their interests in buying the properties offered for sale. The buyers may express their interests in one or more real estate properties offered for sale. The buyers are described by the first name, last name and mobile phone number. The buyers are uniquely identified by a mobile phone number. Additionally, the buyers provide information about minimal and maximal price they are willing to pay for each one of the real estate properties they are interested in.*

*The real estate agency employs the real estate agents that communicate with the owners and buyers. A real estate agent is assigned to a number of owners and buyers. A real estate agent is described by a unique employee number, unique mobile phone number, first name, and last name.*

Your task is to create a conceptual schema of the sample database domain given above and to draw such schema in a notation of UML simplified classes of objects explained to you during the lecture classes in CSIT115. No other notation will be accepted !

To create a conceptual schema, use a methodology explained to you in a presentation 04 Conceptual Modeling. First, read through the specification listed above and find all classes of objects. Next, read through the specification again and find all attributes. Next, read through the specification again and find all associations, link attributes, and association classes. Next, read through the specification again and find identifiers and qualifications. Finally, read through the specification and find generalizations. Entire process described above must be included in the outcomes from the implementation of this task.

To create the fragments of conceptual schema obtained after each iteration use a diagram drawing tool UMLet.

Remember to use CSIT882Palette palette !

Technically, to follow a design methodology explained to you in a presentation 04 Conceptual Modeling you can include the fragments of database specification listed above into a Word document and then insert into the document the fragments of diagrams and the final diagram as bmp file obtained from File->Export as ... option of UMLet. A structure of the file should include the specification of a sample database domain with the fragments of text with the UML simplified class diagrams representing a solution expanded step by step. When ready convert Word document into pdf format and save it as a file `solution2.pdf`.

If you still do not understand how the problem should be solved please check the sample solution of similar tasks available on Moodle in a file `sample-solution.pdf`.

If you still do not understand how the problem should be solved then ask your subject coordinator during his office hours.

**Deliverables**

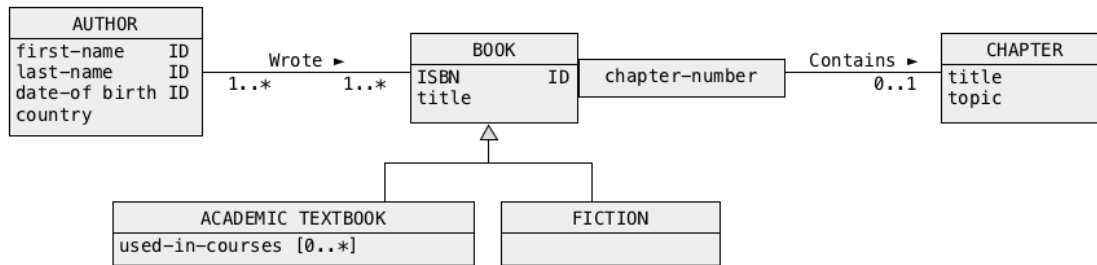
A file `solution2.pdf` with a description of a process of conceptual modelling together with the final design of a conceptual schema.

---

### Task 3 (To be completed by the end of Week 3)

An objective of this task is to transform a conceptual schema into a collection of relational schemas (logical design).

Analyse the following conceptual schema that represents a sample database domain where authors write books that consist of chapters. There are two types of books: academic textbooks and fiction. Academic textbook can be used in many courses and a course can use many textbooks.



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

Assume, that **superset method** must be used to transform a generalization hierarchy.

把每一步都写下来，转为关系模型

For each relational schema created clearly list the names of attributes, primary key, candidate keys (if any), and foreign keys (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 the slides 44 and 45 in a presentation 06 Logical Design.

### Deliverables

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

---

#### **Task 4 (To be completed by the end of Week 4)**

An objective of this task is to analyse the quality of a relational schema and in order to improve the quality decompose it into a collection of relational schemas (informal normalization of relational schemas).

Analyze the following relational schema.

```
EMPLOYEE(enumber, first-name, last-name, project-title,  
         budget, deadline, software-used)
```

A relational table `EMPLOYEE` contains information about the employees, projects the employees are working on and software systems used for the implementations of the projects. A project is implemented by more than one employee and each employee works on only one project. Employee number (`enumber`) uniquely identifies each employee and project title (`project-title`) uniquely identifies each project. The attributes `budget`, `deadline` and `software-used` describe the projects. Many software systems can be used for implementation of a project and a single software system can be used for implementation of many projects.

No new attributes can be added to the design !

Your task is to verify the quality of the relational design given above and to improve the quality through decomposition of relational schemas. The objectives of the decompositions include the elimination of redundancies on one side and minimalization of the total number of relational schemas on the other side.

**To verify the quality of relational schemas listed above use a method of row insertions explained in a presentation 07 Database Design Problems.**

List all decompositions and syntheses performed. Each time you propose a decomposition/synthesis of a relational schema, list the new relational schemas obtained after each decomposition.

The relational schemas must be listed in a format presented in the slides 44 and 45 in a presentation 06 Logical Design.

#### **Deliverables**

A file `solution4.pdf` with a list of all decompositions performed and a list of decomposed relational schemas with the primary keys for each relational schema, candidate keys (if any) for each relational schema, foreign keys (if any) for each relational schema.

---

## Submission

Note, that you have only one submission. So, make it absolutely sure that you submit the correct files with the correct contents and correct types. No other submission is possible !

Submit the files **solution1.pdf**, **solution2.pdf**, **solution3.pdf**, and **solution4.pdf** through Moodle in the following way:

- (1) Access Moodle at **<http://moodle.uowplatform.edu.au/>**
- (2) To login use a **Login** link located in the right upper corner the Web page or in the middle of the bottom of the Web page
- (3) When logged select a site **CSIT882 (S121)Data Management Systems**
- (4) Scroll down to a section **Assessment Tasks**
- (5) Click at a link **In this place you can submit the outcomes of Assignment 1**
- (6) Click at a button **Add Submission**
- (7) Move a file **solution1.pdf** into an area **You can drag and drop files here to add them**. You can also use a link **Add...**
- (8) Repeat step (7) for the files **solution2.pdf**, **solution3.pdf** and **solution4.pdf**.
- (9) Click at a button **Save changes**
- (10) Click at a button **Submit assignment**
- (11) Click at the checkbox with a text attached: **By checking this box, I confirm that this submission is my own work, ...** in order to confirm the authorship of your submission
- (12) Click at a button **Continue**

---

*End of specification*