School of Computing Technologies

ISYS3412 Practical Database Concepts/ISYS1055 Database Concepts
Assessment 3

	Assessment Type: Individual assignment. Submit online via Canvas→Assignments→Assessment 3. Marks are awarded for meeting requirements as closely as possible. Clarifications/updates may be made via announcements/relevant discussion forums.
	Due time: 23:59 17 May 2021, Monday Week 11.
	Weighting: **20 marks**

1. Overview

Database systems are a key technology for the storage, management, manipulation, and retrieval of structured data. They have an impact on the use of information technology in applications ranging from banking, to travel bookings, to online shopping. In this assessment you will apply the skills and concepts that you have learned about database systems in the course.

2. Assessment Criteria

This assessment will determine your ability to:

1. Independently design a database using the ER model.
2. Map a given ER model into a relational database schema.
3. Relational database schema normalisation.

Ask questions, when needed, via Canvas discussion forums.

This assignment is worth 20 points, which accounts for 20% of the overall assessment for the course:

Assessment 1	Assessment 2	Assessment 3	Assessment 4
10%	30%	20%	40%

3. Learning Outcomes

This assessment is relevant to the following Course Learning Outcomes:

- CLO 3: Identify issues with and compare, justify relational database design using the functional dependency concepts.
- CLO 6: Design a database schema using conceptual modelling mechanisms such as entity-relationship diagrams.

It also supports the following Graduate Learning Outcomes:

- Enabling Knowledge: Apply data modelling knowledge effectively in diverse contexts.
- Critical Analysis: Analyse and model requirements and constraints for the purpose of designing and implementing software artefacts and IT systems.
- Problem solving: Design and implement database solutions that accommodate specified requirements and constraints, based on analysis or modelling or requirements specification.

4. Submission format

Submit your assignment via Canvas→Assignments→Assessment 3. You are required to submit a pdf file. The file must be named after your student number -- for example, S1234.pdf.

- It is your responsibility to correctly submit your files. Please verify that your submission is correctly submitted by downloading what you have submitted to see if your file includes the correct content.
- Never leave submission to the last minute -- you may have difficulty uploading files. You can submit multiple times. However, if your last submission is after the due time, late penalties apply.

5. Academic integrity and plagiarism (standard warning)

Academic integrity is about honest presentation of your academic work. It means acknowledging the work of others while developing your own insights, knowledge and ideas. You should take extreme care that you have:

- Acknowledged words, data, diagrams, models, frameworks and/or ideas of others you have quoted (i.e., directly copied), summarised, paraphrased, discussed or mentioned in your assessment through the appropriate referencing methods,
- Provided a reference list of the publication details so your reader can locate the source if necessary. This includes material taken from Internet sites.

If you do not acknowledge the sources of your material, you may be accused of plagiarism because you have passed off the work and ideas of another person without appropriate referencing, as if they were your own. RMIT University treats plagiarism as a very serious offence constituting misconduct. Plagiarism covers a variety of inappropriate behaviours, including:

- Failure to properly document a source
- Copyright material from the internet or databases
- Collusion between students

For further information on our policies and procedures, please refer to the University website.

6. Assessment declaration

When you submit work electronically, you agree to the assessment declaration.

7. Rubric/assessment criteria for marking

Failure to submit files in the required format results in **a penalty of 10 marks**. Examples include the submission not in PDF, ER diagrams not using notations in the lecture slides.
Late submission results in a penalty of 2 marks for (up to) each 24 hours being late. Submissions more than 5*24 hours late results in zero marks.
If unexpected circumstances – for example unexpected short-term physical or mental ill-health -- affect your ability to complete the assignment, you may be eligible for assessment adjustment:

- Requests for extension of time for submission of up to 7 days can be made by emailing the course coordinator. Application form available at:

https://www.rmit.edu.au/students/student-essentials/assessment-and-results/extensions-of-time-for-submission-of-assessable-work

- Otherwise apply for special consideration via the University Special consideration: https://www.rmit.edu.au/students/student-essentials/assessment-and-exams/assessment/special-consideration.

Special Consideration that extends beyond the release of solutions (typically 2 weeks from the submission due date) will automatically result in an equivalent assessment in the form of an online test and interview on the same topics (time to be arranged by the course coordinator).

Marking rubric

Criteria	Marks		
Question 1.1 (3 marks) Each major error -1 pt and minor error -0.5 pts.	0-1pts Many (>=2) major errors; examples: wrong NF, missing/wrong explanation, missing/wrong annotation for PK or FK.	2 pts Either of below is met: * Some (<=1) major error. * Minor errors; examples: not completely correct explanation but shows understanding of the NF definition.	3 pts Mostly correct and possible (at most one) very minor error (e.g. wrong attribute name).
Question 1.2 (3 marks) Major error -1 pt and minor error -0.5 pts.	0-1 pts Either of below is met: * No or incorrect working is shown. * Many (>=2) major errors in the resultant relation schemas; examples: wrong, missing or redundant resultant relation schemas, or missing or wrong PK or FK annotations.	2 pts ALL of below is met: * Correct working is shown. * Some (<=1) major errors in the resultant relation schemas.	3 pts ALL of below is met: * Correct working is shown. * Mostly correct resultant relation schemas and possible (<=1) very minor error (e.g. wrong attribute name).
Question 2 (8 marks) Major error -1 pt and minor error -0.5 pts.	0-3 pts Either of below is met: * Missing, redundant, or wrong modelling for many (>=3) required concepts (entity sets or relationships). * Many (>=3) major errors. Examples: redundant entity sets/relationships. * Most (>=3) example queries can not be answered with the ER model. * Many (>=3) major errors; examples: missing PK, redundant entity sets/relationships.	4-6 Either of below is met: * Missing, redundant, or wrong modelling for some (<=2) required concepts. * Some (<=2) major errors. * Some (<=2) example queries can not be answered with the ER model. * Some (<=2) major errors.	7-8 pts ALL of below must be met: * All required concepts are modelled. * All example queries can be answered. * Possible minor errors (-0.5 pts); examples: missing non-key attribute, missing/wrong cardinality for relationships.
Question 3 (6 marks) Major error -1 pt and minor error -0.5 pts.	0-2 pts Either of below is met: * Missing, redundant, or wrong mapping for many (>=3) concepts (entity sets or relationships). * Many (>3) major errors; examples: missing/wrong primary/foreign key attributes or their annotation.	3-4 pts Either of below is met: * Missing, redundant, or wrong mapping for some (<=2) concepts. * Some (<=2) major errors.	5-6 pts ALL of below must be met: * Correct mapping for all concepts * No major errors. * Possible minor errors; examples: wrong spelling attribute names.

8. Assignment questions.

Question 1. Normalisation (6 points).

Consider the following relational database schema about employees from departments working on projects:

Employee(empNo, givename, surname, DOB, ~~gender,~~ deptNo, dept_name)
Department(deptNo, dept_name, location, manager)
WorkOn(empNo, projNo, proj_name, deptNo, hours)

Some notes on the semantics of attributes are as follows:

- Each employee has a unique employee number (empNo) and work for a department.
- Each department has a unique department number (deptNo), a manager and possibly several locations.
- Each project has a unique project number (projNo). A project also has an "owning" department.
- Employees work on projects for some hours.

FDs based on business rules are given as follows:

- empNo → givename, surname, DOB, deptNo, dept_name
- deptNo → dept_name, manager
- projNo → proj_name, deptNo, dept_name
- empNo, projNo → proj_name, deptNo, hours

Answer questions below:

1.1 (3 points) Identify and annotate the primary key (underline) and any foreign keys (asterisk) for each given relation. Give the highest normal form for each relation. Explain your answer using the given FDs. Note that relations must be written in the form as shown in the examples below:

Student(sno, name, address)
Course(cno, title)
Take(sno*, cno*, grade)

1.2 (3 points) Decompose any given relation not in BCNF or 3NF into relations in BCNF or 3NF. Your decomposition must keep all functional dependencies and must be lossless. Show your working for the decomposition. For each resultant relation, explain if it is in BCNF or 3NF and annotate the primary key (underline) and any foreign keys (asterisk).

Question 2. The ER Model (8 points).

The XB Records management has decided to build a database storing information about artists who perform for their albums. The company has hired you to design the database. Description of the database is as follows.

- Each artist has a unique ID, a name, and an address.
- A band has a name, year established and place of origin. A band has several artists. An artist usually is a member of only one band at a time.
- Each song has an ID and a title.
- Genres of songs are described by a unique name, some description. For example, “rock” is a genre with the description “rock music originated as ‘rock and roll’ in the United States”. A genre may have many songs.
- Each album recorded on the XB label has a title, a release date, a format (such as CD, MP3), and a unique album number. Each album has many tracks on it (up to 20 usually), and they are numbered sequentially. Each track of an album usually corresponds to a song.
- An album may be by an artist or a band (but not both).
- A song may appear on several albums. A song has one or more genres, and a genre may have many songs.

Examples for queries on the database:

- Look up the details of artists, bands, songs and albums.
- List the songs and their track number for the album “Thriller” (title).
- Give the number of songs for each genre.
- Find the albums by an artist named “ Bob Janes”.
- Give the name of the band for the album “The Last Waltz”.
- How many albums have the song “Almost is Never Enough”?

According to the data requirements and query requirements above, give the ER diagram for the database using the UML class diagram symbols (as used in the lecture notes and tutorials), making appropriate assumptions where necessary. You must represent entity types, relationships and their attributes, and all applicable constraints in your diagram. Explain any constraints that are not expressed in the diagram. Note that your ER diagram would be mapped to a relational database schema and implemented as tables using a DBMS. It may be helpful that you do this mapping and see if the queries can be answered using the mapped relations to help you refine the ER diagram.

Question 3. ER to Relational Schema Mapping (6 points).

Consider the ER diagram for a Software Testing database below using UML class diagram symbols. Map the diagram to a relational database schema. Indicate the primary key (underline) and any foreign keys (asterisk) for each relation. Note that a relational database schema comprises a set of relation schemas written in the form as shown in the examples below:

Student(sno, name, address)
Course(cno, title)
Take(sno*, cno*, grade)