

## IMPORTANT MESSAGE FOR STUDENTS

The specification of this assignment has been updated. It is crucial to make sure your answers match the latest version of this work before submitting your work for marking.

The changes include:

1. Question 2, Employees.department\_id is no longer of Foreign Key. The sections which are modified are clearly **highlighted** for easy reference.

Make sure that you consider this change in your answers to all the relevant sub-questions (i.e. 2.1 – 2.8). It may or may not require any changes to your answers, but it is important that you review all your answers and make sure that you understand the impact of this change.

This change is published on 5 August 2020.

**Database Concepts**  
**ISYS 1055**  
**Assignment 1**

Assessment Type	Individual assignment; no group work. Submit online via Canvas→Assignments→Assignment 1. Marks are awarded for meeting requirements as closely as possible. Clarifications/updates may be made via announcements/relevant discussion forums.
Due Date	Week 4, Tuesday 11 <sup>th</sup> August 2020, 11:59pm.
Marks	20

### 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 assignment you will apply the skills and concepts that you have learned about database systems in the course so far.

### 2. Assessment Criteria

This assessment will determine your ability to:

- Independently solve problems by using database concepts taught over the first several weeks of the course.
- Understand the concepts about database systems and the relational model.
- Write SQL statements to define relation schemas and instantiate relations with data.
- Meet deadlines.

Seek clarification from your instructor, when needed, [via discussion forums](#).

This assignment is worth 20 marks in total for two main questions (10+10=20), which accounts for 20% of the overall assessment for the course. The revised assessment components and weights for the course are:

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

### 3. Learning Outcomes

This assessment is relevant to the following Course Learning Outcomes:

- CLO 1: Describe various data modelling and database system technologies.
- CLO 2: Explain the main concepts for the relational data model.
- CLO 4: Apply basic SQL as a programming language to define database schemas and update database contents.

It also supports the following Graduate Learning Outcomes:

- Enabling Knowledge: You will gain skills as you 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→Assignment 1](#). Your submission must be a single .PDF file, with the filename being your student number (e.g., S1234567.pdf) containing all the answers to all the questions in this assignment. Please note the following.

1. Clearly number each answer according to the numbering in this assignment specification (e.g. Q1.1, Q1.2, etc.).
2. Start each main question (Q1, Q2) on a new page.
3. Use at least 11-point font size.
4. 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 .ZIP file includes the correct content.
5. Never leave submission to the last minute -- you may have difficulty uploading files.
6. You can submit multiple times – a new submission will override any earlier submissions. However, if your final submission is after the due time, late penalties will apply.
7. If unexpected circumstances affect your ability to complete the assignment, you can apply for special consideration. More information on special consideration is available at <https://www.rmit.edu.au/students/student-essentials/assessment-and-exams/assessment/special-consideration>. **Special consideration may result in alternative assessment in the format of a timed online test. Note that special consideration may result in alternative assessment in the form of a timed online test and/or an oral interview with the lecturer.**

After the due date, you will have 5 business days to submit your assignment as a late submission. Late submissions will incur a penalty of 10% per day. After these five days, Canvas will be closed and you will receive zero marks for this assignment.

#### **Assessment declaration**

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

<https://www.rmit.edu.au/students/student-essentials/assessment-and-exams/assessment/assessment-declaration>

#### 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

<https://www.rmit.edu.au/students/student-essentials/rights-and-responsibilities/academic-integrity>

## **6. Rubric and marking guidelines**

The detailed rubric and assessment criteria are available online via Canvas→Assignments→Assignment 1.

## **7. Assignment questions**

This assignment has two (2) questions and students are required to answer both questions.

### Question 1: The Beautiful House Case Study (10 marks)

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Beautiful House is a real-estate agency that has offices throughout Melbourne. The following are the requirements for managing data about staff, offices and properties for Beautiful House.

#### Offices

Beautiful House has branch offices throughout Melbourne. Each branch office is allocated several staff members, including a manager who manages the operations of the office. The data describing a branch office includes a unique branch number, address (street, suburb and postcode), telephone numbers (up to a maximum of three), and the name of the staff member who currently manages the office. Additional data about managers includes the date that the manager started the position at the current branch office and a monthly bonus payment based on performance.

#### Staff

Staff members with the role of supervisor are responsible for the day-to-day activities of a team of staff called agents (up to a maximum of 10 at any one time). Not all staff members are assigned to a supervisor. The data for each staff member includes a unique staff number, name, address, position, salary, name of supervisor (where applicable), and the details of the branch office where a staff member is working.

#### Properties

Each branch office offers a range of properties for rent. The data stored for each property includes a unique property number, address (street, suburb, postcode), type, number of rooms and weekly rent. The management of a property is assigned to an agent. An agent manages a maximum of 100 properties at any one time. When a property is available for rent, the property details will be displayed on the Beautiful House website and, when necessary, as advertisement on other websites.

A database system will be built to help manage data for Beautiful House. Answer the following questions. Each answer should be a SHORT passage of at most several lines.

**QUESTION 1.1** (2 marks): Discuss two main important advantages for using a DBMS to manage data for Beautiful House and explain the reasons for your choices based on the given scenario.

**QUESTION 1.2** (3 marks): **Name three classes of objects** that need to be represented in the database and details need to be stored in the database. Explain your answer.

**QUESTION 1.3** (3 marks): Give three relationships you think exist among the classes of objects in Question 1.2. Explain your answer.

**QUESTION 1.4** (2 marks): Assume a database system is built and in operation. Give two classes of users of the database system and list their two likely queries.

## Question 2: Employee Database (10 marks)

This section contains the schema and a database instance for the Employee database that stores employee data for an organisation. The data includes items such as personal info (e.g. name, phone, salary), departments of the organisation (e.g. name and location of each department, who the manager is), jobs (e.g. titles, salary range), and a history for past contracts with each employee. A database instance is shown in Figure 1 followed by the database schema.

Employees

employee_id	first_name	last_name	phone_number	hire_date	job_id	salary	department_id
50	Adam	Smith	1234	26/10/09	22	\$66,000	2
66	Tom	Moosa	1235	10/12/16	10	\$140,000	2
10	Jonny	Deans	1236	9/9/15	33	\$70,000	1
12	Adam	Jones	1247	8/8/19	10	\$138,000	1
18	Joseph	Ryan	1277	5/5/20	10	\$150,000	3

Departments

department_id	department_name	manager_id	location_id
1	IT Services	12	10
2	Accounting	66	20
3	Human Resource	18	30

Jobs

job_id	job_title	min_salary	max_salary
10	Dep Manager	\$120,000	\$150,000
22	Accountant	\$60,000	\$80,000
33	Programmer	\$60,000	\$80,000
45	Senior Programmer	\$70,000	\$120,000

Locations

location_id	street_address	postal_code	city	state_province	country_id
10	123 Collins St	3000	Melbourne	VIC	1
20	222 Bourke St	3000	Melbourne	VIC	1
30	555 Swanston St	3000	Melbourne	VIC	1

Countries

country_id	country_name
1	Australia
2	Vietnam
3	Spain

Job History

employee_id	start_date	end_date	job_id	department_id
10	1/1/01	10/4/02	33	1
10	11/4/02	20/8/02	33	1
12	1/1/98	5/10/03	33	1
12	6/10/03	6/10/04	33	1
12	7/10/04	7/8/09	33	1

Figure 1: Employee Database Instance

The database schema is shown below where attribute meaning is self-explanatory; “Job History” is simplified as “JobHistory”. Primary keys are underlined and foreign keys are annotated with a \*.

Note that Employees relation is updated and department\_id is no longer a foreign key.

Employees(employee\_id, first\_name, last\_name, phone\_number, hire\_date, job\_id, salary, department\_id)

Departments(department\_id, department\_name, manager\_id\*, location\_id\*)

Jobs(job\_id, job\_title, min\_salary, max\_salary)

Locations(location\_id, street\_address, postal\_code, city, state\_province, country\_id\*)

Countries(country\_id, country\_name)

JobHistory(employee\_id\*, start\_date, end\_date, job\_id\*, department\_id\*)

How Foreign Keys and Primary Keys Are Related

Note that this table is updated and the highlighted FK is removed.

Foreign Key	Primary Key
Job History.employee_id	Employees.employee_id
Departments.manager_id	Employees.employee_id
Job History.department_id	Departments.department_id
Job History.job_id	Jobs.job_id
Locations.country_id	Countries.country_id
Departments.location_id	Locations.location_id
Employees.department_id	Departments.department_id

Figure 2 Foreign keys

The following questions must be answered based on the given database schema and instance. Where explanation is required, each answer should be a SHORT passage of at most several lines. You are strongly advised to include your SQL scripts for building all tables in the database (schema and instance) as Appendix to show that your SQL statements for Questions 2.6—2.8 can run in Oracle. Note that in Figure 1 some values are represented in currency format for readability; they are indeed of INTEGER data type in Oracle SQL.

**QUESTION 2.1** (1 mark): Does the database schema ensure that there is a job associated with each employee? Explain your answer.

**Questions 2.2** (1 mark): Can an employee work for two departments at the same time? Can an employee take two jobs at the same time? Explain your answer.

**QUESTION 2.3** (1 mark): The Accounting department has recently changed its structure and now has branches at all locations of the business. The following SQL statements are intended to record this new change in the database instance. Will they work? Explain your answer.

```
INSERT INTO Departments VALUES(2, 'Accounting', 66, 10);  
INSERT INTO Departments VALUES(2, 'Accounting', 66, 30);
```

**QUESTION 2.4** (1 mark): Consider the request “find all the employment details (e.g. first name, last name, hire date) of department managers”. Can this request be completed using the given database schema? Explain your answer.

**QUESTION 2.5** (1 mark): Explain what the result of executing the following SQL statement on the database instance will be.

```
DELETE from JOBS WHERE job_id=33;
```

**QUESTION 2.6** (2 marks): Write an SQL statement to create the Department table including all the constraints, assuming all the tables that Department depends on already exist in the database. Your SQL statement must execute in Oracle.

**QUESTION 2.7** (2 marks): Write an SQL statement to create the JobHistory table including all the constraints, assuming all the tables that JobHistory depends on already exist in the database. Your SQL statement must run in Oracle.

**QUESTION 2.8** (1 mark): A new department is recently established with the name of Property Services. You are asked to update the given database instance so that it also includes the new department. The new department is located at 555 Swanston Street Melbourne VIC and its manager is yet to be assigned. Write an SQL statement to complete the request. Your SQL statement must run in Oracle.