> **Note: This is an individual assignment. While it is expected that students will discuss their ideas with one another, students need to be aware of their responsibilities in ensuring that they do not deliberately or inadvertently plagiarize the work of others.**

Assignment Part 1 – Conceptual Database Modelling

Due date: Friday, 17 April 2020 5pm

Assessment Weight: 15%

Rationale

This assignment has been designed to assess students' ability to model a database, by constructing an entity-relationship diagram for a particular business scenario. This assignment addresses the following learning objectives for this subject:

- Develop a database model using the entity-relationship model
- Apply the techniques of normalisation

Requirements (Tasks)

1) You are to write a brief discussion of your solution, i.e. how you approached the modeling problem and any issues you may have encountered (maximum of ½ page)

2) You are to write all applicable **business rules** necessary to establish entities, relationships, optionalities, connectivities, cardinalities and constraints. If a many–to-many relationship is involved, state the business rules regarding the bridging entities after breaking down the many-to-many relationship. An example business rules format can be found in **Appendix A** of this document.

3) Based on these business rules*, draw a fully labeled and implementable **Entity-Relationship Diagram (ERD)**. Include all entities, relationships, optionalities, connectivities, cardinalities and constraints. You must use Crow's foot notation and MS Visio (or other software) to create the ERD. *A Hand-drawn ERD will NOT be accepted*. A sample ERD can be found in **Appendix A** of this document. (Note: The ERD created using the drawing tool (e.g. Visio) will need to be saved as an image file and then be included in your document file to be submitted)

4) A **summary** to describe the major justifications, assumptions and limitations related to your database design. For example:

- Assumption/justifications for optionalitiy, connectivities, constraints data type and data domain; and
- Special cases or data integrity issues that cannot be handled.

*NOTE: Designing the database is an iterative process; you may find yourself going back and forth between Tasks 2 and 3 to revise the design. Make sure that your final submission shows consistent design in the business rules (Task 2) and ERD (Task 3).

Submission

- You need to submit a single document file (MS Word or PDF format) to LearnJCU. The document should include all the answers for Task 1-4. Please name the file as **LastnameFirstnameA1.doc** or **LastnameFirstnameA1.pdf**.

- Timestamp shown on LearnJCU assignment submission will be used to determine if the assignment is late or not. Refer to the subject guide for the policy for late submission.

Business Description (Scenario)

ABC Education (ABCE) is a private company which owns a number of language/vocational branch colleges in Sydney, Newcastle, Brisbane, Gold Coast, Townsville and Cairns. Each college offers a wide range of English language courses as well as vocational courses from Certificate level up to Advanced Diplomas in a variety of disciplines. In order to meet different local specific conditions or demands each branch college may offer different range of courses.

Each college is managed by a college manager who was hired and allocated by ABCE Head Office. As college managers they have authority to manage all college-related business matters including student enrolment managements, human-resource management, financial/accounting matters, maintenance of college buildings, etc..

Each college manager is expected to send a report to the ABCE Head office in Brisbane periodically or whenever requested. This report summarizes the total revenues in fees collected, student enrolment summary, total expenses in maintenance and staff salary, staff details, courses offered etc.. Currently managers fill out a document form and mail it back to head office because the computer system is established for each college but is not integrated for the whole ABCE Company. Many college managers have complained that preparing this report is a very difficult and time consuming process. Also, the managers at the head-office also have expressed concerns about the accuracy and verifiability of the reports.

To reduce these concerns and to improve the ease and efficiency with which the college managers and employees conduct their daily business, the company is proposing to development a centralized database that can be used by the managers to track the daily business of their colleges and to prepare their reports. You have been asked to design a database that satisfies many user requirements provided by ABCE. General business description and various user requirements are summarized here:

Each College is organized by department (English Language, Information Technology, Business, and so on). There are two types of staff member working for the college; administrative staff and faculty (academic) member. Each academic member is assigned to a single department but most administrative staff work for overall college level (not for specific department level). All employees in College are working in an office allocated and some offices are shared by multiple people in the college. Every staff employed by a college of ABCE is identified as a unique ABCE staff number and ABCE allows a staff to be re-located from college to college if the staff wish and/or re-staffing is needed accordingly. The staff number is never changed even in this case.

Most departments offer more than one course; for example, the Information Technology department might offer courses in Computing/Networking, Interactive Game Design, and Business Informatics. Each course, however, is offered by only one department. Students can enroll more than one course at the same time, but most students are enrolled for only one. Each student is assigned a faculty member as an advisor for his or her study;

students who do more than one courses are assigned a faculty advisor for each course. One academic member should not be an advisor for more than 30 students at the same time.

A code that has two characters (IT for Information Technology, EL for English Language, BU for Business, and so on) identifies each department. A department runs a number of subjects and each subject is identified by the combination of the department code and a three-digit number. The number of credits offered by a particular subject does not vary; that is, all students who pass the same subject receive the same amount of credit. Different subjects may offer different credits. Every subject has at least one text book required and up to 3 supplementary texts. The department secretary needs to make a list of all subjects run in the department and textbooks required for each subject to make an order to the bookshop.

A seven-character code identifies the study-period (some colleges run semesters but others run trimesters) in which a subject is taught in a specific year (for example, SPT12020 represents the trimester 1 of 2020). ABCE's each college sets all necessary schedules for each study period including the date the study period begins and ends, the date final exams begins and end, and the last withdrawal date.

For a given study period, a department can run multiple classes of a same subject and allocates a different time slot for each class. Each class can be taught by a different faculty (academic member) in the department. The details of every class for all available subjects (subject code/title, class code/name, weekly time schedule, venue, the number of credits generated by the subject, teacher name, maximum enrolment permitted to the class, and the prerequisites for the subject) are provided to students before each semester commences and students use them to indicate the classes in which they want to enroll. If a student fails the subject in a semester (or trimester), the student may take the subject again later (in another semester or trimester).

Before making the enrolment process for a semester or trimester, every student has to submit a registration request form to request classes for the upcoming semester (or trimester). Students indicate the classes for which they want to register by entering each class's code. For each of these classes, students may also enter a code for an alternative class in case the first requested class is full. After all students have been assigned to classes, the system produces a student schedule form, which is mailed to students so that they know the classes in which they have been enrolled. This form shows the schedule for an individual student for the indicated semester.

After all students have completed the enrollment process for a given semester (or trimester), each faculty member receives a class list for each class he/she will be teaching. In addition to list the students (student number and name) in each class and general details of the class (department name, subject name, class code/name, semester, credits, weekly class time, days and venue), the class list provides space to record the grade each students earns in the subject. At the end of the semester (or trimester), the faculty member enters the students' grades in this list and sends a copy of the list to the records office, where the grades are entered into the database.

After a staff of the records office posts the grades (by entering them into the database), the admin staff should be able to generate a report card for each student using the DBMS directly or using the end-user application. The report card shows the list of subjects the students took during the semester. For each subject taken, the following details are reported; subject name, department name of the subject, subject title, grade, credits earned and grade points. The report also shows the summary of the current semester totals and cumulative totals including credits earned, GPA, Total Points, and so on. The report card also contains the student's permanent address and a local (alternative) address (if different). Then the report cards are mailed to the addresses printed on the report card. The grades earned by a student become part of his/her permanent record and will appear on the student's transcript.

Students can request to get his/her "Full Academic Records" at any time (before or after

completing his/her college course). This report lists complete information about a student; including his/her course(s) undertaken, department, academic advisor(s), all grades/credits received to date.

In some situations, employees at ABCE (head office or any college) may require reports to manage information about faculty members. This report lists all faculty members by college / department and contains each faculty member's ID number, name, address, office location, phone number, current rank (Associate Lecturer, Lecturer, Senior lecturer, Associate Professor, or Professor), and starting date of employment. It also lists the number, name, local / permanent addresses of each faculty member's advisees. It also shows the employment history of specific faculty members.

Employees at ABCE also may need to generate a report about a specific subject, a specific department or a specific college. A subject report (for each subject) lists the code and name of the department that is offering the subject, the subject number, the description of the subject, the number of credits awarded, and the department and subject number for each prerequisite subject. Similarly, a department report (for each department) lists details of a department including name, location, a head of department (one faculty member is selected as a head of department), name/office/phone number of each academic member of the department, the location of the department office, phone number, etc. A college report lists relevant information in a similar way.

ABCE has a supply of computers (PCs or labtops) or other equipments that it hires out to faculty members or students for a fee which varies from item to item. Most staff or students use their own PCs or laptops but not all faculty members or students have their own machine. The secretary in the hire office needs to generate reports to show for each machine owned by the College, the item number, description, purchase date and price and, if it is on hire, the name of the faculty member or the student who is currently hiring it. A department may need to request a report showing the list of faculty members or students in the department who hires any college equipment and the details of the equipment hired by them.

APPENDIX A SAMPLE BUSINESS RULES & ERD

Business Rules

Entity: SCHOOL
Each SCHOOL has at least ten or many STUDENTs.
Each SCHOOL has one or many SUBJECT.

Entity: STUDENT
Each STUDENT can take many SUBJECTs.
  Each STUDENT has one or many ENROLMENT record.
  Each ENROLMENT record is related to one STUDENT.
Each STUDENT is associated with one SCHOOL.
A STUDENT is resident of one CITY.

Entity: SUBJECT
Each SUBJECT is offered by one SCHOOL.
Each SUBJECT has zero or many STUDENTs.
  Each SUBJECT has zero or many ENROLMENT records.
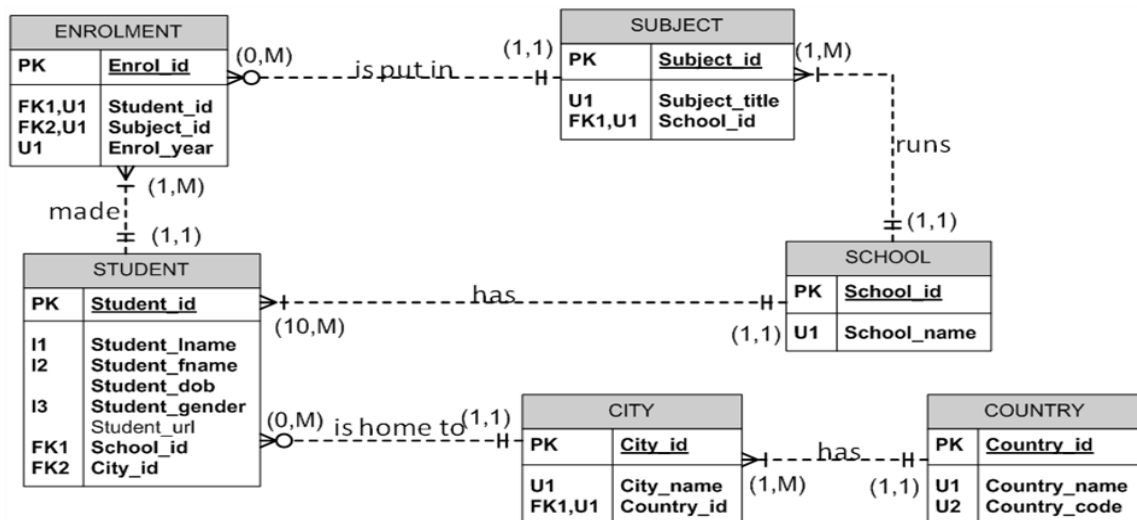 **Each ENROLMENT record is related to one SUBJECT.**

Entity: CITY
Each CITY has zero or many STUDENT lived in it.
Each CITY is in one COUNTRY.

Entity: COUNTRY
Each COUNTRY has one or many CITY.

(Note about the example ERD provided above:

  - Presentation of an ERD may be a bit different depending on what software tool you use. For example of using MySQL Workbench, the notation of PK or FK is presented using a colored symbols instead of actual written notations like 'PK' or 'FK'.
  - You are not required to determine the data type for each attribute at this ERD stage. Even though you present data types in your ERD, your assignment marker will not examine if it is correctly specified or not.
  - You are not required to specify extra information like FK1, FK2, U1, I1, I2 etc. Just ignore the notation from the example ERD given above. You are required to specify PK and FK clearly. Alternatively, you can notate PK and FK using underline ___ or square bracket [ ] respectively.
  - You are not required to specify obvious cardinalities like (0,M), (1,1), (1,M) etc. You are required to specify specific cardinalites which are not presented using crow's foot notation like (1,3), (4,10), (10,M) etc.

Note:

If you want to present the supertype-subtype relationships using an extended-ERD (EERD), you will need to draw the necessary EERD notations using facilities provided by the drawing tool software you use. Alternatively, you can present the superbype-subtype relationships using multiple 1:1 relationships and describe the special relationships in your document.

Assignment – Part 1 Database Modelling: Marking Criteria

	Criteria	Exemplary	Good	Satisfactory	Limited	Very Limited
Solution Outline	**A brief discussion of your solution outlining the approach taken.**	**(9, 10)** The solution is accurate, logical and desirable. The discussion of solution is appropriate and approaches for the solution chosen is properly detailed.	**(7, 8)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(5, 6)** The solution is discussed and the solution chosen is described, but is insufficient in accurateness, logic, depth, etc.	**(2, 3, 4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** Not attempted or the discussion of the solution attempted is mostly incorrect or not relevant
Database Modelling	**Entities (presented in Business Rules and ERD)**	**(9, 10)** All required entities (based on the business scenario given) are included both in Business Rules and in ERD. All entities are in 3NF	**(7, 8)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(5, 6)** All entities included are in 3NF but some required entities are missing either in Business Rules or in ERD OR Most required entities are included but some entities are not in 3NF (need to further normalized)	**(2, 3, 4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** Most required entities are missing and most included entities are not in 3NF
	Attributes (Fields) (presented in ERD)	**(9, 10)** Attributes in each entity are relevant to desired information and correctly designed. All required attributes are included. Attributes are named correctly and logically	**(7, 8)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(5, 6)** Some of required attributes are missing but most of included attributes are named appropriately OR Most of required attributes are included but named inappropriately	**(2, 3, 4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** Most of required attributes are missing or incorrectly designed (not relevant, or included in a wrong entity etc.)
	Connectivities (presented in Business Rules and ERD)	**(9, 10)** All relationships are correctly designed and presented both in Business Rules and in ERD.	**(7, 8)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(5, 6)** Most but not all (more than 50%) relationships are correctly designed and presented in Business Rules and ERD	**(2, 3, 4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** Most of required relationships between entities are missing or incorrectly designed.
	Cardinalities & Optionalities (presented in Business Rules and ERD)	**(9, 10)** All cardinalities and optionalities are appropriately designed and presented both in Business Rules and in ERD.	**(7, 8)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(5, 6)** Most but not all (more than 50%) cardinalities and optionalities are correctly designed and presented in Business Rules and ERD	**(2, 3, 4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** Most of required cardinalities and optionalities are missing or incorrectly designed.
	Relationship Names (presented in ERD)	**(5)** All relationships presented in ERD are appropriately named and well corresponded to Business Rules	**(4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(3)** Most but not all (more than 50%) relationships are named appropriately	**(2)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** Most relationship names are missing

		(5) / (9,10)	(4) / (7,8)	(3) / (5,6)	(2) / (2,3,4)	(0,1)
	Relationship Strength (presented in ERD)	**(5)** All relationship strength (weak or strong) is appropriately designed and correctly presented in ERD (dotted line or solid line)	**(4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(3)** Most but not all (more than 50%) relationships are presented correctly corresponding with its strength	**(2)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** Most relationship strengths are not presented appropriately
	Primary keys	**(9, 10)** All primary keys are correctly identified and unique	**(7, 8)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(5, 6)** Most but not all (more than 50%) primary keys are correctly identified and unique	**(2, 3, 4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** Most primary keys are not properly identified or unique
	Foreign keys	**(9, 10)** All necessary foreign keys are correctly identified	**(7, 8)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(5, 6)** Most but not all (more than 50%) necessary foreign keys are correctly identified	**(2, 3, 4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** Most foreign keys are not correctly identified
Presentation	**ERD**	**(5)** All components included in ERD are neatly and clearly presented without unnecessary complexity	**(4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(3)** Some parts in ERD are not clear or easily visible due to inappropriate display of components	**(2)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** ERD is not included or attempted but mostly inappropriate
	Business Rules	**(5)** All Business Rules listed are well expressed without unnecessary padding	**(4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(3)** Most but not all Business Rules are made and listed to meet requirements of the business scenario given.	**(2)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** Business Rules are not included or attempted but mostly inappropriate
Assumptions and Justifications		**(9, 10)** All necessary assumptions and justifications are appropriately made and listed. All assumptions are correctly incorporated in ERD	**(7, 8)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(5, 6)** Most but not all assumptions are made appropriately or correctly incorporated in ERD	**(2, 3, 4)** Exhibits aspects of exemplary (left) and satisfactory (right)	**(0, 1)** Assumptions are not listed or attempted but mostly incorrect or incorporated in ERD