CP5804 Database Systems - Assessment #1

Assessment 1 – Database (conceptual) modelling

Due date: 8:00 PM (AEST) End of Week 5, 12 April 2020

Assessment weight: 30%

Note:

Though this assessment submission due is end of Week 5, you are strongly recommended to start working for this assessment as early as possible. As most relevant topics for this assessment are covered in the first weeks of the course, you can start this assessment any time after Week 2. (It is why this assessment is named as '**Assessment 1**')

Rationale

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

- develop a database model using the entity relationship model.

Requirements

You are given three business scenarios (Scenarios #1, #2, and #3) and are required to draw an ERD for each scenario. Note that the complexity level of scenarios varies. Scenario #1 requires a simple model (consisting of three entities only) while ERDs for the last two scenarios may be at higher level of complication.

You must use crow's foot notation and may use any proper drawing tool (e.g., MySQL Workbench, MS Visio or other software supporting crow's foot notations) to draw your ERDs. ***A hand-drawn ERD will NOT be accepted***.

Note: The ERD created using any drawing software will need to be saved (or screen-captured) as an image file and then included in your document file to be submitted

The completed ERD must be fully labelled and implementable by presenting all necessary components including entities, relationships, connectivities, cardinalities, optionalities and constraints. Each entity should contain basic but necessary attributes including primary keys (PKs), foreign keys (FKs) and other attributes. You do not need to add non-essential attributes from your own imagination to an entity. To decide on some optionalities, you may need to make your own assumptions if there is some information you cannot glean from the given text scenario. Your list of assumptions must accompany the ERD.

To help your understanding about the requirements of this assignment, a sample ERD solution for a given sample scenario is provided below.

Sample Task and Sample Solution

- **Task (sample)**

  Imagine you are asked to create a conceptual database model by drawing an

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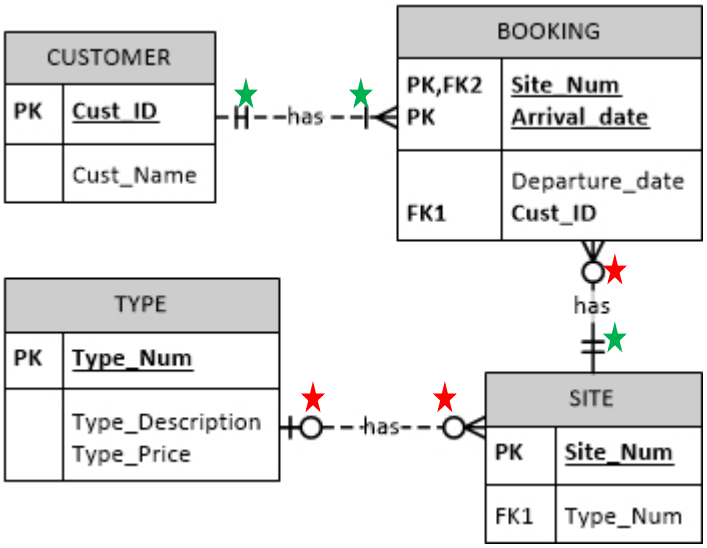
ERD for a business scenario as follows:

A caravan park has several types of accommodation: On-site vans ($30), Standard cabins ($33), En-suite cabins ($45) and Deluxe cabins ($49). For each type of accommodation, there are several sites available in the caravan park. For example, sites 2, 3 and 11 are all Standard cabins.

When a customer first arrives or makes a booking, they are assigned a customer code. They are asked their name and expected departure date and are booked into a site.

- **Solution ERD (for the sample task)**

The sample solution ERD and all assumptions made for this model are as follows:



Note: The red and green star symbols are not part of the ERD, but are used here to indicate points about which an assumption has been made. The optionality side (green star symbol) was decided based on the information provided in the business scenario. For the decision on the red star symbol sections, we needed to create our own assumptions. Three assumptions made for this sample solution are described below.

Assumptions:

1) **A site can have zero or more booking records.**
   There can exist brand new sites that have never been booked before. In these cases, the site record is stored in the SITE entity but no corresponding booking record exists in the BOOKING entity.
2) **A site can only be included in one or no type.**
   Some sites can exist without being recorded as any type of accommodation. The site's record is stored in the SITE entity but no corresponding TYPE record may exist.
3) **An accommodation type can have zero or more corresponding sites.**
   Some accommodation types are recorded with a description and price in the database (TYPE entity), but the caravan park may not have any sites allocated to that type.

To reach a solution, the following steps must be followed:

1. Identify all necessary entities.

   By reading through the scenario, you will find essential entities to be included in your model: CUSTOMER, TYPE and SITE

2. Consider relationships between any pair of entities.

   If you find a relationship between two entities, those two entities must be connected via the relationship line and proper name (generally 'has') in the ERD. You also have to consider the relationship's cardinality (generally 1:1, 1:M or M:N or a specific number of occurrences should be considered; e.g., 1:M (but minimum 3, maximum 10)).

   For example, for the given scenario, you found that a relationship must exist between CUSTOMER and SITE considering that a customer may have booked (and stayed) one or many times. Here, do not forget that a relationship is always bi-directional. This means that you should consider both the relationship CUSTOMER to SITE, determined as 1:M, and the other direction of the relationship, from SITE to CUSTOMER. Consider how many customers can be related to one site. Obviously, one site may have been booked by many customers; thus the one-directional relationship from SITE to CUSTOMER should also be 1:M. As a result, a combined bi-directional relationship between SITE and CUSTOMER would be M:N.

   In the same way, you can determine the relationship between TYPE and SITE as 1:M considering that an accommodation type can have many corresponding sites and one site must be allocated as one accommodation type only.

   For 1:M relationships, you do not need to consider further. For M:N relationships, however, you need to implement the M:N relationship on your ERD by creating two separate 1:M relationships, which forces creation of a new intermediate bridge (composite) entity. For this bridging purpose, a new entity BOOKING is created. Consequently, the relationship between CUSTOMER and BOOKING is set as 1:M, as is the relationship between SITE and BOOKING.

3. Identify attributes for each entity (including a bridge entity if created in the previous step).

   Set PK first and then set other necessary attributes by referring to the scenario outlined. Also, add FKs to entities appropriately to ensure entities are integrated correctly.

4. Consider optionality for each side of the relationship.

   Once a relationship has been determined in terms of cardinality (1:1, 1:M or M:N), it is time to determine the optionality for each side of the relationship.

   For example, the relationship between CUSTOMER and BOOKING is connected by 1:M relationship. There are two optionalities to be determined: one for the CUSTOMER side and the other for the BOOKING side. For the CUSTOMER side, you need to consider two possibilities: 1) a booking record may have no corresponding customer (the customer value can be 'null' for one booking record), or 2) a booking record must have the corresponding customer value filled in (the customer value should not be 'null' in every booking records). The decision should be made on the basis of the business scenario provided. Does the scenario clearly indicate that a booking record must be created only when the customer is identified? If yes, the optionality of the CUSTOMER side should be 'mandatory' and annotated as 'I' on the ERD. Alternatively, can a booking record be stored without customer details? If yes, you should put 'o' to denote the optional participation of the relationship.

   If you are not sure, you will need to make your own assumptions for each decision about optionality. The assumptions must be clearly described.

5. Check and present weak/strong relationships.

   Finally, check if the relationship line is correctly presented (dotted line or solid line). For this sample solution, the relationship between BOOKING and SITE is presented as a solid line (strong relationship because the PK of SITE is used as a part of the PK of BOOKING).

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Business Description (Scenario #1) – weight 5%

For a regional fishing festival held annually, we need a database to store information on the fisher's identity (id) (a unique id given when entering the festival event), which includes first name, surname, age and number of fish caught. Also stored is the fish type code (C = carp, M = Murray cod, T = tench, R = redfin), fish type (carp, etc.), weight, length when caught and type of lure used. Finally, the throw-back weight must be recorded. A carp of any weight must be kept but any Murray cod below 2 kg and any redfin below 300 g must be thrown back.

We must assume that a fisher can only catch one fish at a time. Also, an individual fish cannot be identified, so we cannot know whether a fish has been caught more than once.

Business Description (Scenario #2) – weight 5%

The Airport Authority in a small nation requires a database to store information about airlines, pilots and planes.

There is only one airport but several airlines use it. For each airline the identification code, full name and phone number of its local office is required.

Several types of plane use the airport and for each type the fuel capacity and maximum range is to be recorded.

Each pilot works for only one airline. For each pilot, their name, date of birth, address, the types of plane they can fly and their pilot's licence number is to be recorded.

Further information must be recorded to enable the production of a report listing the following details for each plane that uses the airport:

- plane identification code
- plane type
- date of manufacture
- owning airline.

Business Description (Scenario #3) – weight 20%

Joanne Myers, the owner of a bookstore chain named JM Books, has decided to store her data in a database and computerize its operations. You have been asked to design a database that satisfies many user requirements provided by JM Books. General business description and various user requirements are summarized here:

JM Books runs the chain of bookstores and keeps information about branches, publishers, authors, and books. Each branch has a number that uniquely identifies the branch and the authorized users of the database should be able to track the branch's name, location, and number of employees who currently works for the specific branch. Each publisher has a code that uniquely identifies the publisher and the publisher's name and city can be tracked. JM Books also records each author's information like id, last and first names. Any authorized user of JM Books database should be able to track book data including a unique code identifying the book, title, publisher, type of book (e.g. SF, ART, FIC, etc.), price, and whether the book is a paperback or not. The database also keeps "Inventory" records which indicate the number of copies of a particular book that are currently on hand at a particular branch of JM Books.

JM Books sells textbooks to the local colleges or universities thus the database should maintain information about courses (subjects), textbooks, and instructors. Each course (subject) adopts a textbook as either a prescribed one or supplementary one.

Each branch of JM Books is supervised by a branch manager. It is expected that JM Books database will be used to generate reports for various HR (Human Resource) related jobs.

For example, an authorized user should be able to generate a report to show the current employee records of a specific branch, a report to show the employee history of a branch including all records of previous managers and other employees, or a report to compare how much total salary has been paid for each branch in a specific year.

JM Books employees wear a uniform and use a personal tablet computer, both of which are supplied to each employee when they join to work, and which they return when they leave. Each uniform and computer has a number for stock-take purposes. The authorized user of the database should generate a report showing, for each uniform, the uniform's number, its size (small, medium, large etc) and the name of the employee it has been supplied to. In a similar way, the user should be able to generate a second report that shows for each computer: the computer number, type, model, other specifications and the name of the employee it has been hired by.

Joanne Myers also wants the inventory at her book stores to include movies (in DVD) so that the DVD rental service can be also done at her stores for people who want to watch movies in a more traditional way. To give a basic guide about movies to the customer who wants to rent DVDs, the database needs to keep information on movies (number, title, critics' rating, the MPAA rating (G, PG, PG-13, or R), actors (number, name, the year born, the year of death (if deceased)), and directors (similar information as actors) in a database.

The DVD rental program run by JM Books refers to each of its customers as "members" and each member in the club is assigned a member number. It also stores the members' names and addresses and the date joined the club. The DVD rental program periodically promotions during which members can earn bonus units that they can later apply to the cost of renting DVDs.

When the club purchases a new DVD, the DVD is assigned with its number and the database should keep other information like the corresponding number of the movie on the DVD, the date the DVD was purchased, the number of branch to which the DVD is assigned. The authorized users of the database should be able to generate a report about a DVD to show the number of times it has been rented, the number of the member who is currently renting it and the history of the rental of the DVD (the date of each rental, the date it was returned, the member who rented the DVD). Assume that a DVD could potentially be rented more than once on the same day.

Submission

- You must submit a single document file (MS Word or PDF format) to LearnJCU. The document should include all ERDs and lists of assumptions. You must clearly indicate which ERD and assumptions are for which scenario.
- You are required to submit with the assignment a cover sheet (individual); refer to LearnJCU page for the form.
- A timestamp shown on LearnJCU assignment submission will be used to determine whether an assignment was submitted on time; refer to the subject guide for the policy on late submissions.

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Assignment #1 Database modelling: marking criteria (for each scenario)

	Criteria	Exemplary	Competent	Marginal	Unacceptable
Database Modelling	Entities (presented in ERD)	**10** All required entities (based on the business scenario given) are included in ERD.	**5-9** Most required entities are included but not perfectly designed.	**2-4** Many required entities are missing.	**0-1** Not attempted (0) or all or most entities included are not relevant or are incorrect.
	Attributes (fields) (presented in ERD)	**10** Attributes in each entity are relevant to desired information and correctly designed. All required attributes are included. Attributes are named correctly and logically.	**5-9** Some required attributes are missing or named inappropriately.	**2-4** Many required attributes are missing or named inappropriately.	**0-1** Most required attributes are missing or incorrectly designed (e.g., included in the wrong entity).
	Connectivities (presented in ERD)	**10** All relationships are correctly designed and presented in ERD.	**5-9** Most but not all (>50%) relationships are correctly designed and presented in ERD.	**2-4** Some (<50%) relationships are correctly designed and presented in ERD.	**0-1** Most required relationships between entities are missing or incorrectly designed.
	Cardinalities & optionalities (presented in ERD)	**10** All cardinalities and optionalities are appropriately designed and presented in ERD.	**5-9** Most but not all (>50%) cardinalities and optionalities are correctly designed and presented in ERD.	**2-4** Some (<50%) cardinalities and optionalities are correctly designed and presented in ERD.	**0-1** Most required cardinalities and optionalities are missing or incorrectly designed.
	Relationship names (presented in ERD)	**10** All relationships presented in ERD are appropriately named.	**5-9** Most but not all (>50%) relationships are named appropriately.	**2-4** Some (<50%) relationships are appropriately named.	**0-1** Most relationship names are missing.
	Relationship strength (presented in ERD)	**10** All relationship strength (weak or strong) is appropriately designed and correctly presented in ERD (dotted line or solid line).	**5-9** Most but not all (>50%) relationships are presented correctly corresponding with strength.	**2-4** Some (<50%) relationships are presented correctly corresponding with strength.	**0-1** Most relationship strengths are not presented appropriately.
	PKs	**10** All PKs are correctly identified and unique.	**5-9** Most but not PKs are correctly identified and unique.	**2-4** Some PKs are correctly identified and unique.	**0-1** Most PKs are not properly identified or unique.
	FKs	**10** All necessary FKs are correctly identified.	**5-9** Most but not all necessary FKs are correctly identified.	**2-4** Some FKs are correctly identified.	**0-1** Most FKs are not correctly identified.
Presentation	ERD	**10** All components included in ERD are neatly and clearly presented without unnecessary complexity.	**5-9** Some parts of ERD are not clear or easily visible due to inappropriate display of components.	**1-4** Most parts of ERD are not clear or neatly presented.	**0** ERD is not included.
Assumptions		**10** All necessary assumptions are appropriately made and listed. All assumptions are correctly incorporated in ERD.	**5-9** Most but not all assumptions are made appropriately or correctly incorporated in ERD.	**1-4** Some assumptions are made but not correctly incorporated in ERD.	**0** Assumptions are not made or listed at all.

Your Assignment #1 mark (out of 30) = Scenario #1 x 0.05 + Scenario #2 x 0.05 + Scenario #3 x 0.2