



School of Computing and Information Systems

INFO90002

Database Systems and Information Modelling

Practice Exam 1

Semester 2 2021

Reading Time: 15 minutes

Writing Time: 120 minutes (2 Hours)

**This exam has 10 pages including this page
ATTEMPT ALL QUESTIONS IN ANY ORDER**

Authorised Materials:

While you are undertaking this assessment, you are permitted to

- make use of any textbook, lecture slides (including soft copies)
- MySQL Workbench is supported for E.R. modelling questions
- Draw IO (diagrams.net) for Chen conceptual models or any suitable modelling equivalent
- Any lecture notes, books, laptop, PC
- You are free to use the course materials and your laptop/PC in this exam.

While you are undertaking this assessment, you MUST NOT

- make use of any messaging or communication technology
- record, screenshot, stream, upload or in any known format duplicate this document
- record, screenshot, stream, upload or in any known format duplicate your solutions
- make use of any world wide web or internet based resources such as wikipedia, github, stackoverflow, google, Weichat or any known search engine / messaging services
- act in a manner that could be regarded as providing assistance to a student who is undertaking this assessment or in the future will be undertaking this assessment
- seek assistance from any other student who is undertaking this assessment or in the future will be undertaking this assessment

Instructions to Students

- The total for this exam is 100 marks
- Attempt **all** 9 questions which are of unequal marks value
- Be sure to number your answers to ensure your questions is marked
- Questions can be answered in any order
- **PLEASE DO NOT USE RED font colour or pens.**
- You may revisit/edit your exam answers throughout
- You must not communicate with other students whilst taking this exam, e.g. using messaging, chat rooms or email

The work you submit **must be based on your own knowledge and skills** and without the assistance of any other person. You must not copy directly the text from any material without attribution.

Paper to be stored in the Baillieu Library

Submission Instructions:

This Practice Exam No 1 must be submitted as a single PDF file in the Assessment Tab of the Learning Management System. Be sure to use the PRACTICE EXAM No 1 link.

Unless Academic Adjustment Plans are in place any assignment submitted after the due date and time will receive 0 marks.

Email submissions will not be accepted. Email submissions will not be assessed.

Q1. ER Modelling (20 marks)

Q1. Criterion Classics is an on-demand streaming service that streams old television shows (e.g. 'Skippy') and movies ('Lawrence of Arabia'), including black-and-white movies ('Casablanca') and television shows ('I dream of Lucy'). Each Criterion Classics account can have multiple profiles associated with it – for example, a family account could have one profile for the parents and one profile for each child. Profiles of type 'Child' can only view titles classified as 'U' (Universal) and 'G' (General). Each profile is stored with an avatar or digital image. About each account we store a name ('Mary Lawson') the monthly subscription price, the number of concurrent screens allowed and the day of the month (18th) the account is charged and the name of the subscription plan (Basic, Standard, Premium).

Each movie is an individual title. TV shows can have one or more seasons and up to 24 episodes in a season. Each title of a TV show (e.g. "Breaking Bad") will also have episodes title (e.g. "Ozymandias") as well as season number (5) and episode number (14) as well as its running time 47:35 (minutes and seconds) and classification ('MA').

Criterion Classics stores the length of each title/episode in minutes and seconds, as well as the elapsed time a particular profile stopped watching the title/episode. This is so users can 'continue watching' where they left off if they have to stop watching for any reason. If a user watches the title to the end, the abandon time is equal to the title/episode length time.

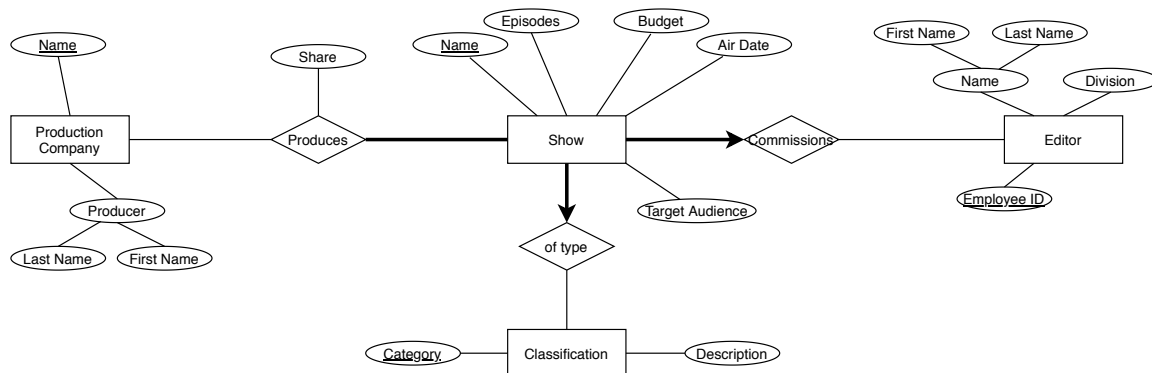
By collecting and storing this information, Criterion Classics can make recommendations to other users based on profile data analysis. Criterion Classics makes recommendations about rating appropriate titles to all profiles. Criterion needs to store the name of the title, the date it was suggested to a profile and the number of times (total count) a particular title has been recommended to a user. Using this information and the viewing information of a profile it can determine if its suggested viewing algorithm is working.

Q1. You are asked to model a **conceptual** Model of the Criterion Classics case study in **Chen** notation. State any assumptions you have made.

Q2. SQL DDL (10 marks)

The British Broadcasting Corporation (BBC) has a number of commissioning editors (e.g. Martin Davidson) who have cast a number of landmark shows ("Life on Earth", "A History of Britain") from independent production companies such as names like Hartswood films (Sherlock, Coupling) with producer Sue Vertue. Sometimes more than one production company is involved in the production of a series. Every Show is given a name "Sherlock" a number of episodes (between 6 and 24) a budget (up to several hundred thousand pounds) and an estimated air date for the first episode. The Producers must also nominate who is the target audience (Audiences are graded by age and income demographic) and classify the show (e.g. Documentary, Drama, Comedy, Light Entertainment, Game Show, Reality, News and Current Affairs, Special Event).

Q2. Write the SQL DDL for the following Chen conceptual model. There is no need to specify not null. You can use whichever data types you think are appropriate for a MySQL relational database



Q3. SQL (20 marks)

This case study is for the SQL model to help contextualise the Physical ER model

Lunch Rider

LunchRider is a new startup in the food delivery business. LunchRider allows people to order lunches from local food vendors and have them delivered by a delivery rider on a bike. When a customer opens the LunchRider app, it first presents a list of local vendors such as cafes, restaurants and snack bars. The customer clicks on a vendor. Then the app shows the meals available from that vendor.

The customer chooses which meals they want from that vendor: for example "2 chili burgers meals" and "1 mango smoothie". The phone sends this order to the LunchRider server, along with the customer's phone GPS coordinates - the meals will be delivered to this location. Customers can click to "like" a meal and the total number of likes (across all customers) is displayed beside each meal. When a customer's order is received, LunchRider broadcasts a work offer to riders who are near the customer. Riders see the offer pop up on their app and can press "accept" or "no thanks".

The chosen rider goes to the vendor, picks up the meals, and delivers them to the customer's location. We record at what time the rider delivers the order. Payment is automatically deducted from the customer's credit card and bank transactions are handled by the bank. LunchRiders provide their name, mobile phone number, and date of birth. Whenever a rider is on duty, the rider's app sends the GPS coordinates about once per minute, allowing us to keep track of each rider's location.

If someone wants to order a meal, they need to first register as a customer, giving their name, email address, mobile phone number and current credit card. Over time a customer may register more than one credit card. Vendors must register the name and address of their business, including GPS coordinates and a contact email address, and provide the name, price, description (max 1,000 characters) and photo of each meal that they want to sell.

After delivery, the app allows the customer to rate the rider's service, choosing from 1 star (worst), 2, 3, 4 or 5 stars (best). The app also allows the customer to add the rider to their "favourite" list. LunchRider uses this information to help choose riders for future work offers.

All locations are recorded as a pair of numbers representing latitude and longitude. Latitudes are between -90 and 90 degrees (south pole to north pole) while longitudes are between -180 and 180 degrees (west or east of the prime meridian). LunchRider uses a precision of 4 decimal places, which is about 11 metres at the equator (smaller in Melbourne). For example, the Doug McDonnell building at The University of Melbourne is at latitude -37.7989, longitude 144.9627.

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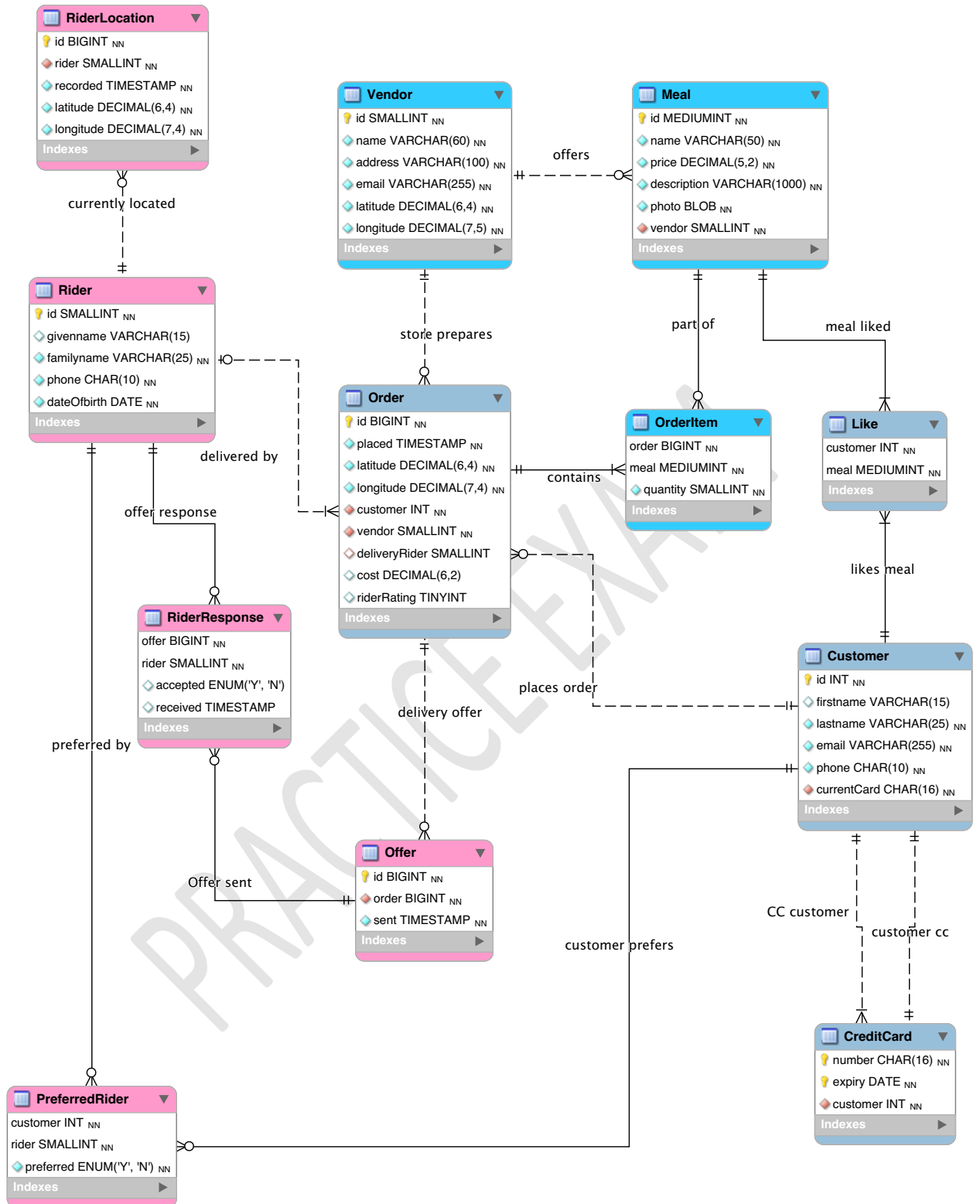


Figure 2: The Lunch Rider Entity Relationship Model

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Questions 4A-4E require you to write one single SQL statement per question. Do not use views, temporary tables or inline views. Format code for ease of reading. Ensure user-friendly output by renaming columns where appropriate. Values of column fields are in italics e.g. *Tom Hardy*

For Example:

Q. List the name and salary of *Jane Grey*

```
SELECT firstname, lastname, salary
FROM employee
WHERE firstname = 'Jane' and lastname = 'Grey';
```

Q3A. Write the SQL for the following query:

List all Vendor names who offer a meal where the price is greater than \$60.00 and less than \$80.00

(1 marks)

Q3B. List the names of riders born in 1997 have accepted an offer in August 2020?

(3 marks)

Q3C. How many customers have ordered and liked the '*Betty Deluxe Burger Meal*' meal ordered from the Melbourne store with coordinates latitude -37.8156 and longitude 144.9636 ?

(4 marks)

Q3D. List the names of riders who are also customers of the Lunch Rider app (assume the rider uses the same phone number as they would as a customer)

(4 marks)

Q3E. List the vendor names who have never had any ordered meal liked by any customer

(3 marks)

Q3F. Name the riders who have received a rating of 4 or above from more than 500 different customers

(5 marks)

Q4. Normalisation (20 marks)

The table below is part of the medical records for a Veterinarian Clinic

PRACTICE (Animal_ID, Animal, Animal type, OWNER_ID, Owner, Phone, Consult, PROC_ID, PROC_DESC)

Animal ID	Animal	Animal Type	Owner_ID	Owner	Phone	Consult	ProcID	Description
317	Ralph	Dog	10	Julie Sumner	0409 673-888	13-Oct-13	101	Annual Checkup
317	Ralph	Dog	10	Julie Sumner	0409 673-888	27-Apr-13	115	Teeth Clean
317	Ralph	Dog	10	Julie Sumner	0409 673-888	14-Oct-14	119	3 month Checkup
398	Zeno	Canary	23	Tony Rijks	0408 322-444	21-Jul-14	105	Parasite treatment
398	Zeno	Canary	23	Tony Rijks	0408 322-444	14-Oct-13	119	3 month Checkup
441	Panda	Short haired cat	47	Helene Hanff	0419 121-212	24-Apr-14	715	Initial Consultation
441	Panda	Short haired cat	47	Helene Hanff	0419 121-212	27-Apr-13	115	Teeth Clean
518	Zeno	Canary	23	Tony Rijks	0408 322-444	1-Mar-15	001	6 month Checkup

The combination of ANIMAL_ID and PROC_ID is the candidate key for the relation. The following functional dependencies hold:

- Animal_ID → ANIMAL, ANIMAL Type, OWNER_ID
- OWNER_ID → OWNER, PHONE
- PROCID → DESCRIPTION
- ANIMAL_ID, PROC_ID → Consult

Q4. Please normalise the data to third normal form (3NF). At each stage give an example of an anomaly. Show each stage of normalisation (i.e. 1NF, 2NF, 3NF).

Key: **BOLD** primary key *ITALIC* foreign key **BOLD + ITALIC** primary foreign key

Q5. NoSQL**(4 marks)**

Q5. There are trade-offs between the principles of ACID and BASE. Discuss the trade-off between availability and consistency for relational and NoSQL databases. Illustrate your answer using either the example of Facebook or the example of Twitter.

(4 marks)**Q6. Applications****(4 marks)**

Q6. There are problems with giving end users an SQL interface to access a database. Describe **two** (2) distinct problems, and for each, how providing application software to users solves the problem.

(4 marks)**Q7. Distributed Databases****(4 marks)**

Q7. Describe how synchronous updates work and the advantages and disadvantages of this approach.

(4 marks)**Q8. Data Warehouses****(14 Marks)**

Sennheiser Australia wants to track information about the selling of audio equipment (microphones, headphones, turntables) via physical retail stores located throughout Australia. You need to design a data warehouse to report information about sales of audio equipment over time. You need to store the retail store (store ID, Manager's first name, Manager's last name, phone number, address, state), and product (product-id, name, description, category, retail price, wholesale price). The sales managers want to find the number of items sold (e.g. turntables), the revenue and profit. The information needs to be accessible by the retail store, its state, product name (e.g. "Sen-300-II") and for different times (week, month, quarter, half year and year).

Q9A. Draw a *star schema* to support the design of this data warehouse, showing the attributes in each table. Be sure to denote PK, FK and PFK.

(8 marks)

Q9B. Briefly explain what OLTP and OLAP databases are and demonstrate the difference between these two types of databases.

(6 marks)

Q9. Ethics & Security (4 marks)

Q9. What are the advantages and disadvantages of a logical backup when compared with a physical backup of a database?

(4 marks)

**END OF EXAM
GOOD LUCK!**

PRACTICE EXAM