THE UNIVERSITY OF
MELBOURNE

School of Computing and Information Systems

INFO90002

Database Systems and Information Modelling

END OF SEMESTER EXAM

Part 1: Modelling, SQL, Relational Algebra & Normalisation

Semester 2 2020

Exam Release Time: 9.00 am Tuesday November 24th 220 AEDT

Submission Due Date: 9.00am Thursday November 26th 2020 AEDT

SUBMISSION via the LMS https://lms.unimelb.edu.au before the due date and time

This Part (Part 1) has 9 pages including this page

Authorised Materials:

While you are undertaking this assessment, you are permitted to

- MySQL Workbench is supported for E.R. modelling questions
- Any lecture notes, books, laptop, PC
- You are free to use the course materials and your laptop/PC in this assessment.

While you are undertaking this assessment, you MUST NOT

- make use of any messaging or communication technology
- make use of any world wide web or internet based resources such as wikipedia, stackoverflow, google or any other search engine 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, has undertaken this assessment, or in the future will be undertaking this assessment
- plagiarise
- All work must be a synthesis of material studied in INFO90002
- You must not quote any work verbatim, this includes slide notes, websites, other student's notes and materials - including students from previous semesters of INFO90002

Instructions to Students

- There are two parts to this exam paper Part 1 and Part 2
- The total for this exam is 140 marks
- Part 1 must be submitted via the LMS before 9.00am Thursday November 26th 2020 AEST
- Part 1 (This section) is worth 70 marks
- Attempt **all** questions in all parts, which are of unequal marks value
- **PLEASE <u>DO NOT USE RED font</u> colour or pens.**
- You should not communicate with other students whilst taking this exam, e.g. using messaging, social media, 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 directly copy and paste material** that is not your own work.

Submission Instructions:

Exam A Part 1 must be submitted as a single PDF file in the Assessment Tab of the Learning Management System. Be sure to use the EXAM A Part 1 link.

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

Question 1: Modelling from a case study (30 marks)

A system to support "Experience Sampling" research

We are building a software system to support Experience Sampling experiments. In these experiments, a group of human participants fill in the same survey (set of questions), several times per day over multiple days. (Questions typically ask about what the person is doing or feeling.) Participants have an app on their phones that retrieves the questions from the database, displays the questions, accepts answers from the user, and sends the answers to the database to be stored. All relevant data, including details about researchers and participants, experiments and surveys, questions and answers are stored in the database.

To set up a new experiment, a researcher specifies a start and end date, the set of questions and the order to display them in, and the number of times per day they should be sent to participants. The researcher then recruits participants and stores their details in the system.

When the start day arrives, the system will begin to send surveys to participants. Each survey is the full set of questions specified by the researcher for that experiment. We need to keep track of each survey that is sent out, including when it was sent and to whom. When a participant responds to a survey, we need to store the answers, remembering when the answers arrived, and which answers came from which participant. (Note that participants don't necessarily respond to each survey.) Figure 1 shows a survey consisting of 3 questions, displayed on a participant's phone.

Questions can ask for three possible types of answer: short-text, numerical (integers zero or above), and multiple-choice. For short-text questions, the researcher specifies the maximum number of characters allowed, while for numerical questions, they specify the maximum number. For multiple-choice questions, they specify the list of possible answers. (The longest short-text our system allows is 1,000 characters, while the biggest maximum number we allow is 10,000.)

Multiple researchers will use our system, each of whom can set up as many experiments as they want. Over time we will build

Alice, please answer this survey

1. What are you doing right now?

(max 30 chars)

2. How many coffees have you had today?

(max 8)

3. Rate your current mood:
- good
- ok
- bad

Figure 1: A survey consisting of one short-text question, one numerical question, and one multiple-choice question.

up a bank of questions (and for the multiple-choice questions, answers), and we want to allow these to be re-used in multiple experiments. It's possible that a given participant might take part in more than one experiment. Researchers and participants need to store a username and email address in the system. We allow researchers to give a name to each experiment, such as "Bob's Masters project". During the life of our system we anticipate having around 1,000 researchers who will run an average of 10 experiments each, with around 100 participants per experiment. Experiments contain on average 5 questions and run for 30 days.

Q1. You are asked to model a **physical** Model of the Experience Sampling app in Crows Foot Notation for a MySQL v8.0 Relational Database **using MySQL Workbench**. State any assumptions you have made.

(30 marks)

Question 2. SQL – DDL   (10 marks)

Darling Murry is an <u>online only superstore</u>. It offers, technology, computers, phones, furniture, grocery items, household goods, whitegoods, phones, computers, baby goods and sporting goods. The following Chen conceptual model represents part of the <u>Darling Murry customer product review system</u>.
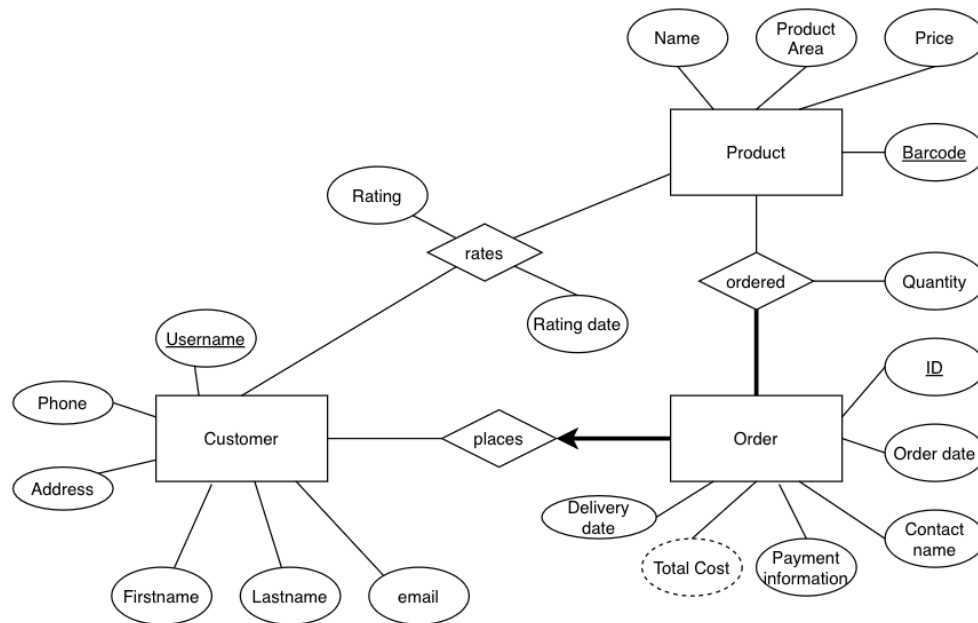
Figure 1 Conceptual Model of the Murray Darling Product Rating system

Q2. Write the SQL <u>DDL</u> for the above Chen conceptual model. <u>Do not specify null/not null</u>. You can use <u>whichever data types</u> you think are appropriate for a MySQL v8.0 database

(10 marks)

Question 3. SQL & Relational Algebra   (15 Marks)

Melbourne Touch Rugby Summer Competition

"Touch" rugby is a five-person game that is played in the off season (usually late Spring to late early Autumn). It is a fast and lively game where instead of tackling other players to the ground – they only have to touch or 'tag' the player for there to be a restart in play.

There are 8 touch rugby clubs that compete in the Melbourne Touch Rugby Summer comptition. There are currently four competitions: mens, womens, seniors – for men over the age of 35 years, and a mixed division for teams made up of men and women. A mixed team must have a minimum of three female players in every game. A team must have a minimum of four players available to play the game. If one team is unable to field a side (minimum of four players) at the game start time they forfeit the game and suffer a walkover, and do not record any value for their score. The other team scores 28 points.

The competitions have been running for several seasons, with the details of every game and participating teams and players carefully recorded.
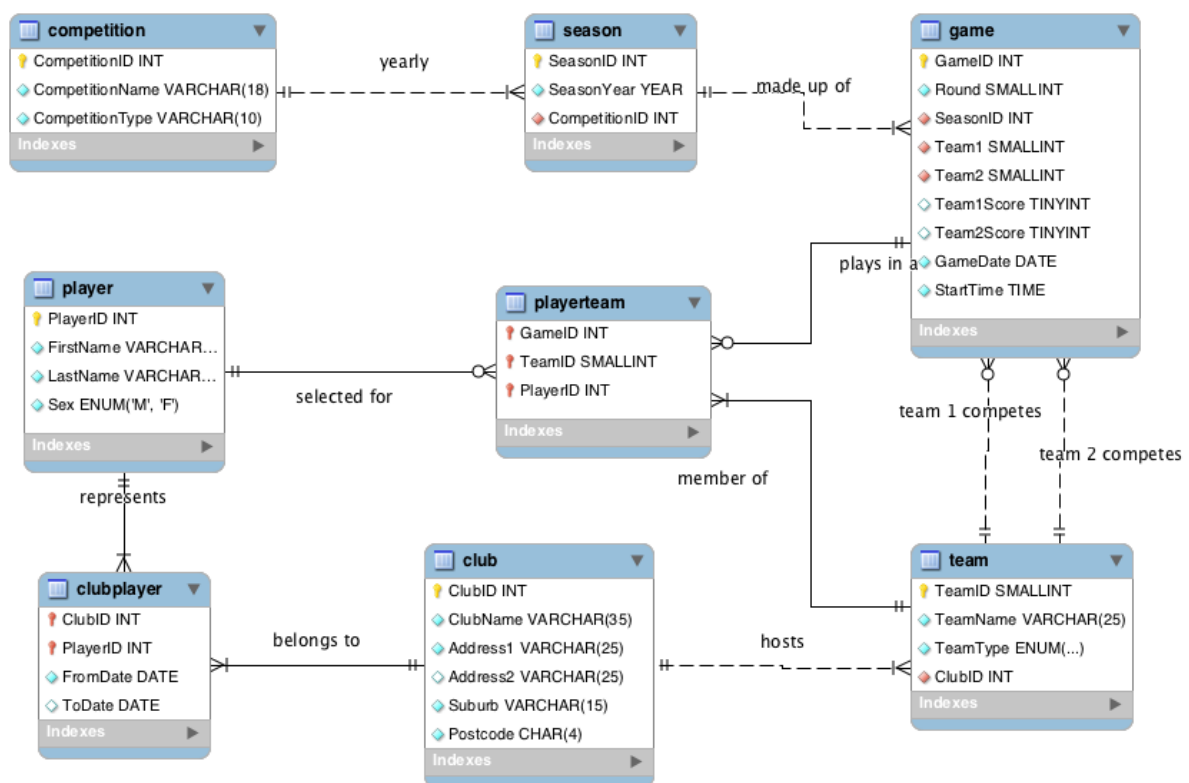

Figure 2. The Melbourne Touch Rugby schema

Questions 3A– 3D require you to write **one single SQL statement per question**. <u>Do not use **views**</u>, **<u>temporary tables</u>** or **<u>inline views</u>** or any **<u>schema on read</u>** solution. **Format code** for **ease of reading**. Ensure <u>user-friendly output by renaming columns where appropriate</u>. Display the <u>first ten rows</u> and the <u>total number of rows</u> returned.

For Example:

Q. *List the first name, last name and salary of Alice Munro*

```
SELECT firstname, lastname, salary
FROM   employee
WHERE firstname = 'Alice' AND lastname = 'Munro';
```

firstname	lastname	salary
▶ Alice	Munro	125000.00

1 row returned

Q3A. List the game date, team name and all players who were selected for a team that eventually had to forfeit (walkover) in 2018?

(3 marks)

Q3B. How many points did the *Melbourne University Rugby Club* team score in each year of the *Dewar Shield* competition? List the team name, and cumulative score for each year. Order the result from the highest cumulative score to lowest.

(3 marks)

Q3C. *Elizabeth Blackburn* has played for three different clubs. How many games did she play for each club? List the club name and number of games.

(3 marks)

Q3D. List the teams and scores for all games played on 4th October 2015 at 10.00 a.m.

Your result should be in tabular form :

Team A	32	Team B	27
Team C	15	Team D	23
Team E	23	Team F	6
Team G	0	Team H	10

(3 marks)

Q3E. Write the **<u>SQL</u>** and <u>two (2) versions</u> of **Relational Algebra** for the following query:

List all team names of the *Geelong Rugby Club*

(1+ 1 + 1 = 3 marks)

Question 4. Normalisation   (15 Marks)

The following is an example of the class timetable for a Pilates studio with a number of venues.

date	venue	class	day	time	address	weeks	trainer	certification	capacity
28-Oct-20	Pilates Studio	Pilates Advanced	Wednesday	6:15	343 A Lygon	8 weeks	Georgia	CPAA	12
29-Oct-20	Flemming Park	Strength	Thursday	18:00	Flemming	8 weeks	Jason	PPOA	24
29-Oct-20	Pilates Studio	Pilates Mat	Thursday	18:00	343 A Lygon	6 weeks	Melissa	NZAP	12
30-Oct-20	Reformer Studio	Pilates Advanced	Friday	6:15	354 Lygon	8 weeks	Georgia	CPAA	18
31-Oct-20	Strength Studio	Strength Circuit	Saturday	7:00	132 Victoria	8 weeks	Emily	PIA	15
31-Oct-20	Pilates Studio	Pilates Conditioning	Saturday	12:00	343 A Lygon	6 weeks	Stephanie	PIA	12
02-Nov-20	Flemming Park	Reformer	Monday	12:00	Flemming	6 weeks	Eleanor	NZAP	16
03-Nov-20	Strength Studio	Strength Circuit	Tuesday	13:00	132 Victoria	8 weeks	Jason	PPOA	15
04-Nov-20	Pilates Studio	Pilates Conditioning	Wednesday	7:00	343 A Lygon	6 weeks	Melissa	NZAP	12
04-Nov-20	Flemming Park	Strength	Wednesday	7:30	Flemming	8 weeks	Eleanor	NZAP	24
04-Nov-20	Reformer Studio	Reformer Mat	Wednesday	18:00	354 Lygon	6 weeks	Brigitte	AFP	15
09-Nov-20	Pilates Studio	Pilates Conditioning	Monday	7:00	343 A Lygon	6 weeks	Filomena	PIA	12
09-Nov-20	Reformer Studio	Pilates Conditioning	Monday	7:00	354 Lygon	6 weeks	Georgia	CPAA	18
09-Nov-20	Pilates Studio	Reformer Mat	Monday	13:15	343 A Lygon	6 weeks	Melissa	NZAP	12
09-Nov-20	Strength Studio	Strength Circuit	Monday	13:15	132 Victoria	8 weeks	Jason	PPOA	15
10-Nov-20	Pilates Studio	Mobility & Release	Tuesday	7:00	343 A Lygon	6 weeks	Georgia	CPAA	12
10-Nov-20	Flemming Park	Strength	Tuesday	7:30	Flemming	8 weeks	Brigitte	AFP	24
10-Nov-20	Strength Studio	Core Power	Tuesday	9:00	132 Victoria	4 weeks	Jason	PPOA	15
10-Nov-20	Pilates Studio	Pilates Conditioning	Tuesday	12:00	343 A Lygon	6 weeks	Filomena	PIA	12
10-Nov-20	Pilates Studio	Pilates Mat	Tuesday	15:00	343 A Lygon	6 weeks	Melissa	NZAP	12
11-Nov-20	Flemming Park	Reformer	Wednesday	8:00	Flemming	6 weeks	Brigitte	AFP	16
11-Nov-20	Reformer Studio	Pilates Conditioning	Wednesday	17:00	354 Lygon	6 weeks	Stephanie	PIA	18

DATE, VENUE, CLASS is the candidate key for this relation

The following functional dependencies hold:

Date, Venue, Class --> Trainer

Date, Venue, Class --> Time

Venue, Class --> Capacity

Date --> Day

Trainer --> Certification

Venue --> Address

Class --> Weeks

Q5. Please normalise the data to third normal form (3NF) and show the final table data structures as a logical ER model. Be sure to show each stage of normalisation (1NF, 2NF, 3NF).

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

(15 marks)

GOOD LUCK!

END OF EXAM: PART 1