School of Engineering and Computer Science

SWEN 304 **Database System Engineering**

Assignment 1

The objective of this assignment is to test your understanding of database foundations, basic terms, and the relational data model. It is worth 5% of your final grade. The assignment is marked out of 100.

The assignment is due on **Monday, 7 August, 23:59 pm**. **Submit via the submission system.**

Question 1 [10 marks]

a) [2 marks] What is a relation schema and what is a relation?

b) [3 marks] What is a candidate key? List the properties of a candidate key. What is a foreign key? List the properties of a foreign key.

c) [2 marks] What is a database and what are its main features?

d) [3 marks] What is a database management system (DBMS)? What are the tasks of a DBMS?

Question 2 [25 marks]

Consider the instance of the STAFF relation shown in the following table. It stores basic data for restaurant staff.

STAFF

Employee	DoB	StaffNo	JobTitle
Tom	22/01/1985	85-11	Waiter
Mickey	11/02/1993	96-02	Chef
Jerry	22/01/1985	85-08	Waiter
Tom	15/05/1990	90-01	Trainee
Minnie	12/07/1990	90-04	Manager
Minnie	25/11/1996	96-22	Waitress

a) **[12 marks]** For every set of attributes (that is, for every subset of {Employee, DoB, StaffNo, JobTitle}) decide whether you can deduce that it is *not* a candidate key, assuming the instance is legal. Justify your answer.

b) **[10 marks]** For every remaining set of attributes (that is, every set not ruled out as a candidate key in part **a**)), discuss whether you consider it a suitable candidate key? Justify your answer.

c) **[3 marks]** Which of the candidate keys identified in part **b**) would you choose as the primary key?

Question 3 [20 marks]

Your supermarket is using a relational database to manage its data on products and their suppliers. Suppose the underlying database schema includes the following relation schemas:

- SUPPLIER (SID: STRING, Name: STRING, Location: STRING)
  with primary key {SID}
- PRODUCT (PID: STRING, Name: STRING, SID: STRING, OnStock: INTEGER, Price: INTEGER)
  with primary key {PID, SID} and foreign key SID $\subseteq$ SUPPLIER[SID]

Below you find instances of these two relation schemas:

PRODUCT

PID	Name	SID	OnStock	Price
46557	Apple	23XY	50	21
85520	Pear	A15F	0	78
63311	Pear	FVT35	211	49
36773	Kiwi	23XY	50	21
36773	Kiwi	FVT35	29	22

SUPPLIER

SID	Name	Location
23XY	GreatFruits	Wellington
FVT35	Yummy	Wellington
F15A	GreatFruits	Levin
A15F	BetterFruits	Lower Hutt
5AB32	NiceCars	*null*

Your tasks are as follows. **Justify your answers**!

a) **[10 marks]** Decide which of the following tuples can be added or removed, respectively.

1. Insert tuple ('XYZ4', 'Wellington', 'Yummy') into SUPPLIER

2. Insert tuple ('F15A', 'GreatFruits', 'Porirua') into SUPPLIER

3. Insert tuple (*null*, 'Tasty', 'Wellington') into SUPPLIER

4. Delete tuple ('F15A', 'GreatGruits', *null*) from SUPPLIER

5. Delete tuple ('A15F', 'BetterFruits', 'Lower Hutt') from SUPPLIER

b) **[10 marks]** Decide which of the following tuples can be added or removed, respectively.

1. Insert tuple ('55555', *null*, 'F15A', 2, 99) into PRODUCT

2. Delete tuple ('46557', 'Apple', '23XY', 1, 21) from PRODUCT

3. Insert tuple ('54556', 'Lemon', 'FV35', 20, 43) into PRODUCT

4. Delete tuple ('36773', 'Kiwi', '23XY', 50, 21) from PRODUCT

5. Insert tuple ('53477', 'Apple', '5AB32', 500, 1) into PRODUCT

Question 4 [45 marks]

A travel agency is using a relational database to manage its business data. Suppose the following relation schemas are part of the underlying database schema.

- CUSTOMER (emailaddress, name, dob, phone) with primary key {emailaddress}
- AGENT (staffId, name) with primary key {staffId}
- BOOKING (staffId, tourId, emailaddress, dateFrom, noOfDays, noOfTravellers) with primary key {tourId, emailaddress, dateFrom}
- TOUR (tourId, destination)

The following additional constraints are known:
1. Every customer may only use a single emailaddress.
2. An agent may also be a customer, but may not book a tour for her/himself.
3. For every booking, noOfTravellers must be specified, while noOfDays may be left blank.
4. A tour may visit up to five destinations.

Your tasks are as follows:

a) **[5 marks]** For the relation schema TOUR, identify all suitable candidate keys (if there are any). Explain your answer.

b) **[10 marks]** For each of the relation schemas, identify all suitable foreign keys (if there are any). Explain your answer.

c) **[7 marks]** Is it possible to add a booking to the database in the emailaddress of a customer who is not listed in the CUSTOMER relation? Explain your answer.

d) **[7 marks]** What would be the consequence of removing the attribute tourId from the primary key of BOOKING? Explain your answer.

e) **[8 marks]** Suppose, a customer ('tom@vuw.ac.nz', 'Tom', 22/01/1985, '381-1230') in the CUSTOMER relation has made several bookings stored in the relation BOOKING. When deleting the record of this customer from CUSTOMER, all his bookings should be deleted, too. How would you ensure this requirement? Explain your answer.

f) **[8 marks]** Suppose, an agent (007, 'James') in the AGENT relation quits his job at the travel agency. When deleting the record of this agent from AGENT, all the bookings he made for customer should not be lost. How would you ensure this requirement? Explain your answer.

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