



Venue _____

Seat Number _____

Student Number

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| | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|

Family Name _____

First Name _____

Total

Question 1. Data Flow Diagrams (3 Marks)

a) Draw a context level DFD for the following UoD:

When a patient arrives at a clinic with a repeat prescription request, the receptionist checks the prescription file and prints out the prescription. This has to be authorised by the doctor before being passed to the pharmacist for dispensing. The pharmacist then prepares and gives the prescription medication to the patient. If the patient is entitled to free prescriptions, the pharmacist verifies this and records the appropriate details on the free prescriptions register. Otherwise the pharmacist receives the payment from the patient and gives them a receipt.

b) Draw an example of a level 0 DFD with at least two processes and one data store.

Question 2. Entity Relationship Diagrams (4 Marks)

a) Draw an ER to represent the following:

i) A device is identified by its model and serial number.

ii) A student is identified by student-no. There are only two types of students: domestic and international. A student cannot be both domestic and international. For international students the visa type is also stored.

- b) Assume that the specifications below have been obtained from a user of an information system. You are required to construct a **conceptual model of the database using the Entity Relationship Model**. You can assume that the specification below is complete and contains all of the information that is needed to construct the model. Do not include any additional concepts of your own, over and above what is given in the specification. You may use either variant of the ER diagram notation, however, do not mix the notations.

The **Junior Coach Allocation System** is an online system that allows coaches to be appointed to junior soccer matches each weekend.

Coaches register in the system by providing their name, age, phone and address. Each coach is allocated a unique ID. Each of the soccer fields in Brisbane is allocated a venueID, map location, and name. **Various soccer clubs register with the system by providing their club name and their home field**. Teams are registered with their division and club name. Each club is only allowed one team per division, therefore the team's division is unique within the club. Each match played is given a unique ID and kickoff date and time. A match will have a home team and an away team. **The match will be played at the home team's main field**. Coaches may be appointed to one match each weekend.

Question 3. Relational Model (3 Marks)

Use the schema below to give an example for the following concepts

MODEL [mno, name, year]

COMPONENT [mno, cno, cname, price, sno]

SUPPLIER [sno, sname, email]

a) Foreign Key

mno, sno in COMPONENT

b) Minimal Key

MODEL mno

COMPONENT mno,cno

SUPPLIER sno

c) Super Key

sno, sname

d) Non-prime Attribute

sname

e) Entity Integrity constraint violation

primary key cannot be none

f) Composite Key

mno, cno

Question 4. ER to Relational Mapping (4 Marks)

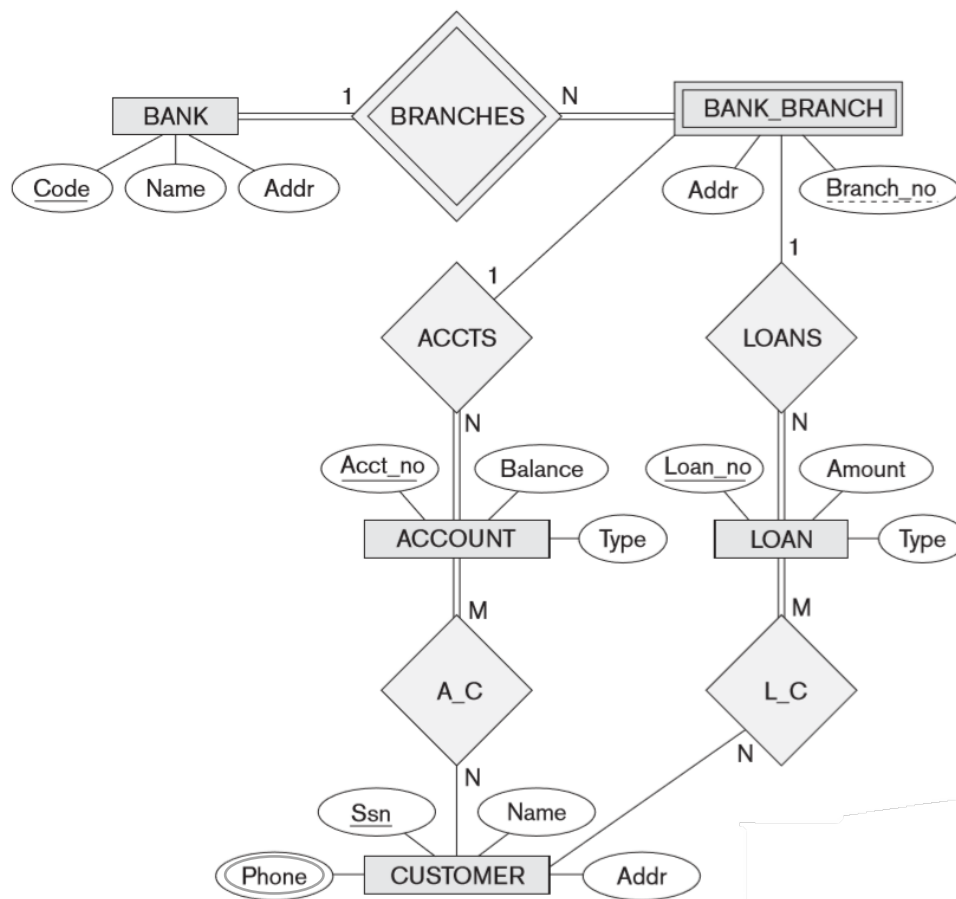
a) Reverse engineer the following schema to make an ER Diagram

i) A (a), B (a, b), C (a, b, c)
 B.a references A.a; C.ab references B.ab

ii) EMP (ssn, ename, supervisor, Dno), DEP (Dno, dname)
 EMP.Dno references DEP.Dno; EMP.supervisor references EMP.ssn

b) Map the following ER diagram into a relational schema.

Attribute(s) that form the primary key should be underlined (do not underline other candidate keys). Do not show the schema in progress after each step. Only give the final relational schema. Use the same names of attributes as in the ER. List all foreign keys in your mapped schema using the dot notation: *Table1.Attribute1 references Table2.Attribute2*



Question 5. FD and Normalization (6 Marks)

a) Determine all (minimal) keys for the following relation.

i) R [A B C D]

$$F = \{A \rightarrow C, C \rightarrow B, B \rightarrow D\}$$

ii) R [A B C D]

$$F = \{D \rightarrow A, BC \rightarrow AD\}$$

iii) R [A, B, C, D, E, F, G, H, I, J]

$$F = \{AB \rightarrow C, BD \rightarrow EF, AD \rightarrow GH, A \rightarrow I, H \rightarrow J\}$$

b) Given the following relation and FDs

UNIT [AssetNo, Weight, Component, Drive, Dimensions, Freq]

$\{\text{AssetNo}\} \rightarrow \{\text{Weight, Component, Drive}\}$

$\{\text{Weight, Component}\} \rightarrow \{\text{AssetNo, Drive}\}$

$\{\text{Drive}\} \rightarrow \{\text{Weight}\}$

$\{\text{Weight}\} \rightarrow \{\text{Dimensions, Freq}\}$

- i) Find all candidate keys

- ii) What is the highest normal form for UNIT

- iii) If needed decompose UNIT into BCNF

Question 6. Basic SQL (4 Marks)

Use the following schema to answer the queries below using SQL

DEVICE [dno, dtype, price]

PROVIDER [pno, pname, web]

SERVICE [dno, pno, servicedate]

SERVICE.dno references DEVICE.dno

SERVICE.pno references PROVIDER.pno

a) Find the dno for the most expensive device

b) Find all providers that have the work *fast* in the name

c) Find the number of different device types (dtype)

d) Give all details of devices with price more than \$400

Question 7. Advanced SQL (6 Marks)

a) Which provider has serviced all devices that provider with pno 24 has also serviced

b) Which device has the highest average price

- c) List providers (PNo) who have only serviced devices with dtype *RouterX*

Question 8. Database Security (3 Marks)

a) Identify and briefly explain three main threats to database security

loss of confidentiality

loss of integrity

loss of availability

b) Give an example of SQL injection where an SQL SELECT statement has been manipulated to bypass authentication

OR '1'='1';

Question 9. Database Systems (3 Marks)

a) Identify and briefly explain two functions of a DBMS

maintain integrity constraints
control redundancy
create, modify, and query a database
provide support for decision making
control access
permit concurrent access (multiusers)
provide loading, backup and recovery

b) Use an example to briefly explain how Views provide Logical Data Independence in database systems

view would not influence based table

Question 10. Challenge Question (4 Marks)

Give an example UoD, corresponding ER diagram, non-trivial functional dependencies and BCNF relational schema.

END OF EXAMINATION