

Student name: _____ Student ID: _____

General Guidelines: Exam duration: 70 min; Total: 6 questions, 50 marks; No aids allowed.

Question 1

[8 marks in total] TRUE or FALSE: 2 marks for each correct answer; -2 marks for each incorrect answer; 0 mark if no choice is selected.

- a) Every relational algebra query can be expressed in relational calculus.
() TRUE () FALSE
- b) An SQL view that uses "WITH CHECK OPTION" cannot be updated.
() TRUE () FALSE
- c) *Logical data independence* means that the applications are insulated from changes in the physical structure of the data.
() TRUE () FALSE
- d) Every relation has at least one candidate key.
() TRUE () FALSE

Question 2

[4 marks] List (do not discuss) at least four functionalities of a DBMS.

- 1)
- 2)
- 3)
- 4)

Question 3

[14 marks in total] In a library database, you need to store information about books (identified by *isbn*, with additional attributes *title*, *author*, *year*) and users (identified by *cardno*, with additional attributes *name*, *phone*). A book has one or more copies each identified uniquely (by *no*) when the *isbn* is given. Users can borrow any number of (the copies of) the books.



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- a) [6 marks] Draw an ER diagram that captures the above information.
- b) [8 marks] Translate your ER diagram into a relational schema and write SQL statements to create the relations. Capture all the constraints in the specification.

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Question 4

[12 marks in total] Consider the following relations about products and parts that are used in making those products. Attributes *pno* and *mo* in *usedin* are foreign keys respectively referencing parts and products.

parts (*pno*, *pname*, *price*)

usedin (*pno*, *mo*, *qty*)

products (*mo*, *rname*)

Write the following queries in SQL.

a) List the name of every product and the total price of the parts used in the product.

b) Find the *pno* of parts which are not used in any product.

c) Find the name of products that use the largest number of different parts.

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d) Find the *mno* of every product which does not use any part with price over \$800.

Question 5

[6 marks in total] Consider the schema given in Question 4 and write the following queries in relational algebra.

a) Find the names of products that use part (with *pno*) 350.

b) Find the *pno* of parts used in all products.

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Question 6

[6 marks in total] Consider the schema given in Question 4 and write the following queries in either tuple-relational calculus or domain-relational calculus (choose the one that you feel more comfortable).

a) Find the name of every part with price over \$200.

b) Find *pno* for parts which are used in at least two products.