SIM GLOBAL EDUCATION

UNIVERSITY OF WOLLONGONG AUSTRALIA

School of Computing and Information Technology

Student to complete:

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CSCI235
Database Systems

Final Examination Paper
Session 2 2020
3 June 2020

Exam duration	3 hours and 10 minutes
Weighting	40% of the subject assessment
Marks available	40 marks
Items permitted by examiner	Text-book, Lecture slides, and Tutorial notes
Directions to students	4 questions to be answered. Marks for each question are shown beside the question. All answers must be written / typed neatly. **No asking for explanation of question is allowed during the examination. However, if you suspect that there is a typo or incorrect question, you can ask the invigilator to confirm.**

This examination is a take-it-home examination to be done on-line on the date of examination.

Version 1.1

Question 1 – (Total 10 marks)
Functional Dependency and Normalization

Time allocated: 40 minutes
Start time: 10:00 am SGT
End time: 10:40 am SGT
Submission time start: 10:35 am SGT
Submission time end: 10:45 am SGT

a) Consider the relational schemas given below and the respective sets of valid functional dependencies in the schemas. For each one of the relational schemas **identify its highest normal form**. Remember that identification of a normal form requires the derivations of minimal keys from the analysis of functional dependencies. **A solution with no comprehensive analysis of the valid functional dependencies and the minimal keys scores no marks**.

(i) P = (S, N, C, A, K)

S->N
S->A
C->N

(1.0 mark)

Via UNION RULE,
S -> N,A

VIA AUGMENTATION RULE,
SCK - > N,A,C,K
MINIMAL SUPERKEY = (S,C,K)

HIGHEST NORMAL FORM = **1NF** DUE TO PARTIAL DEPENDENCY [C -> N]

(ii) P = (R, N, O, C, E)

R->N

R->E
O->C
O->R

(1.0 mark)

VIA UNION RULE,
R -> N,E
O -> C,R
R,O -> N,E,C

MINMAL SUPERKEY = (R,O)

TABLE IS NOT IN 3NF AS THERE IS A TRANSITIVE DEPENDENCY [O -> R]
HIGHEST NORMAL FORM IS **2NF**

(iii) R = (A, B, C)

The attributes A, B, and C do not have any functional dependency among them.

(1.0 mark)

HIGHEST NORMAL FORM IS **BCNF** AS THERE IS NO TRANSITIVE DEPENDENCY AND NO NON-TRIVIAL DEPENDENCY

(iv) In this case to identify the highest normal form of the relational table BUILDINGROOM, the functional dependencies must be discovered from a description of a database domain given below.

A higher education institution consists of 3 blocks. Block A is used for laboratory and practical classes only. Block B is used for conducting lectures and seminars only, and Block C is housing administrative offices and meeting rooms. Hence all laboratory and practical classes will be conducted in Block A, all lectures and seminars will be conducted in Block B, and administrative office and meeting rooms are located in Block C. All the rooms in the building are of different sizes and each has different sitting capacity. Each room identified by a room number. The room number is unique within a building, but not across buildings in the institution; For example, room# 1 may exist in Building A, Building B or Building C. A room type is used to indicate if the room is laboratory room, practical room, lecture room, seminar room, office room, or a meeting room. The following table is used to capture the information related to the buildings and the respective rooms

```
BUILDINGROOM (BuildingNum, RoomNum, SittingCapacity,
RoomType)
```

(2.0 marks)

MULTI VALUE FUNTIONAL DEPENDENCY:
Buildingnum -> roomnum
(room number is unique within a building)

FUNCTIONAL DEPENDENCY:
Buildingnum, roomnum -> sittingcapacity, roomtype
(by knowing the exactly identity of the room, we can identify the sitting capacity and room type)

HIGHEST NORMAL FORM IS ALREADY IN BCNF BUT NOT IN 4NF DUE TO THE MULTI VALUE DEPENDENCY.

b) Considering the un-normalized relational table BOOK below:

`BOOK (ISBN, BookTitle, AuthorFName, AuthorLName, Publisher, Royalty, Edition)`

The attributes of the relational table BOOK satisfy the following properties:

- An ISBN (International Standard Book Number) is unique to each book title, the publisher of the book, and the edition the book.
- Book title is unique to a publisher.
- The author is paid a royalty for each book (identified by ISBN) the author wrote.

Decompose the relational table BOOK into a **minimal** number of relational tables in BCNF (Boyce Codd Normal Form).

(5.0 marks)

ISBN -> booktitle, publlisher, edition

ISBN, authorfname, authorlname -> royalty

PARTIAL FUNCTIONAL DEPENDENCY:
Booktitle -> publisher

SEPARATE INTO 2 TABLES
BOOK-DETAILS(ISBN, BOOKTITLE, EDITION)
PK: ISBN -> BOOKTITLE, EDITION
FD: BOOKTITLE -> PUBPLISHER

AUTHORROYALTIES(ISBN, AUTHORFNAME, AUTHORLNAME, ROYALTY)
PK: ISBN, AUTHORFNAME, AUTHORLNAME -> ROYALTY

BOOKTITLE -> PUBLISHER VIOLATES BCNF. SPLIT TABLE INTO 2.
BOOKPUBPLISHER(BOOKTITLE,PUBLISHER)
PK: BOOKTITLE

BOOKDETAILS(ISBN,BOOKTITLE,EDITION)

PK: BOOKTITLE
FK: BOOKTITLE REFERENCES BOOKPUBLISHER(BOOKDETAILS)

End of specification

Answer:

Answer:

Answer: