Assignment 1 (10% of total marks)

Due date: Sunday, 28 April 2024 by 9:00 pm SGT.

Scope:

The tasks of this assignment consist of problems related to **functional dependency and normalization**. The assignment covers the topics discussed in lectures 1 and 2.

Assessment criteria:

Marks will be awarded for:

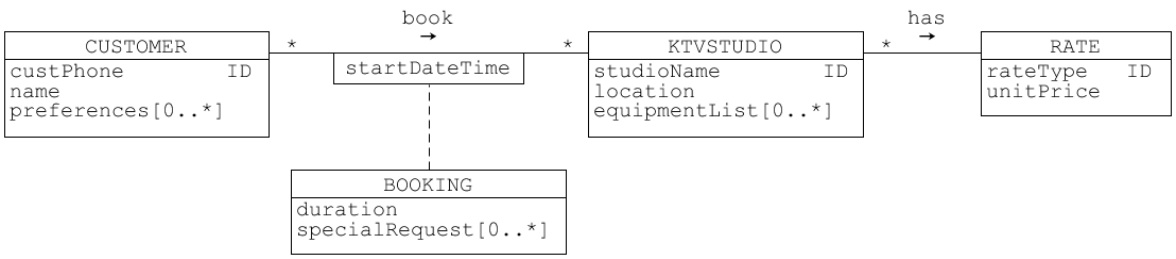
- Correct,
- Comprehensive, and
- Appropriate

application of the materials covered in this subject.

Assignment Specification:

Task 1 (4.0 marks)
Analysis of relational schemas and normalization

Consider the following conceptual schema of a sample database domain that contains information about customers' booking of KTV studio.



A database designer applied a process of logical design, and he/she transformed the conceptual schema into the following collection of relational schemas.

$\boldsymbol{CUSTOMER(custPhone, name, preferences)}$

$\boldsymbol{KTVSTUDIO(studioName, location, equipmentList, rateType)}$

$\boldsymbol{BOOKING(custPhone, studioName, statDateTime, duration, specialRequest)}$

$RATE(rateType, untPrice)$

(i) Find all functional and multivalued dependencies in the relational schemas CUSTOMER, KTVSTUDIO, BOOKING, and RATE.

(ii) Find all minimal keys in the relational schemas CUSTOMER, KTVSTUDIO, BOOKING, and RATE. List the derivations of all minimal keys.

(iii) For each one of the relational schemas find the highest normal form a schema is in. List the justifications for each highest normal form found.

(iv) Decompose all relational schemas that are not in 4nF into 4NF. List all relational schemas obtained from the decompositions. Remember to indicate the primary key and foreign keys (if any).

Deliverables

A file **solution1.pdf** with the outcomes of the steps (i), (ii), (iii), and (iv) listed above. Note, that "educated guesses" of the solutions score no marks. You must provide the complete justifications of your answers.

Task 2 (3.0 marks)
Analysis of relational schemas and normalization

A book is described by a bookTitle, authorName, bookType, listPrice, authorAffil, and publisher. authorAffil refers to the affiliation of author.

BOOK (bookTitle, authorName, bookType, listPrice, authorAffil, publisher)

Suppose the following dependencies exist:

- $bookTitle \rightarrow publisher, bookType$
- $bookType \rightarrow listPrice$
- $authorName \rightarrow authorAffil$

(i) Find all the minimal super keys of the relational table BOOK. List the derivations of all minimal keys.
(ii) Identify the highest normal form of the relational table BOOK. List the justifications for each highest normal form found.
(iii) Decompose the relational table BOOK into minimal number of relational tables in BCNF. List all relational tables obtained from the decompositions.

Task 3 (3.0 marks)
Analysis of business statements and normalization

Each manufacturer manufactures many disk-drives, and the manufacturer assigns each disk-drive a serial number. The serial number is unique within a manufacturer, but not across all other manufacturers. The manufacturer registers the model of the disk-drive it produces to the intellectual property Office of Singapore (IPOS) so that the model of the disk drive is protected and cannot be used by other manufacturer. The disk-drives are manufactured by batch, and all the disk-drives manufactured in a batch are of the same model, and all the disk-drives of the same model have the same capacity. A distributor collaborates with many manufacturers to help the manufacturers to distribute the disk-drives the distributor receives to retailers. A distributor creates a relational table DISK_DRIVE to store the information/attributes of the disk drive it distributes to retailers as follows:

DISK_DRIVE(serialNum, manufacturer, model, batch, capacity, retailer)

Each tuple in the relation DISK_DRIVE contains information about a disk drive with a unique serialNum, made by a manufacturer, with a particular model number, released in a certain batch, which has a certain storage capacity and is sold by a certain retailer. For example, the tuple Disk_drive('1978649', 'WesternDigital', 'A2235X', '765234', 500, 'CompSingapore') specifies that WesternDigital made a disk drive with a serial number 1978649 and a model number A2235X, released in batch 765234; it is 500GB and is sold by CompSingapore.

Write each of the following statements as a function dependency:

i. The manufacturer and serial number uniquely identify the drive.
ii. A model number is registered by a manufacturer and therefore cannot be used by another manufacturer.
iii. All disk drives in a particular batch are the same model.
iv. All disk drives of a certain model of a particular manufacturer have exactly the same capacity.

Deliverable

A file solution3.pdf with the solutions of the problems included in Task 3.

Submission of a file with a different name and/or different extension and/or different type scores no marks!

Submissions

This assignment is due on Sunday, 28 April 2024 by 9:00 pm (21:00 hours) Singapore time.

Submit the files **solution1.pdf, solution2.pdf, and solution3.pdf** through Moodle in the following way:

1) Access Moodle at **http://moodle.uowplatform.edu.au/**
2) To login use a Login link located in the right upper corner the Web page or in the middle of the bottom of the Web page
3) When successfully logged in, select a site CSCI235 (SP224) Database Systems
4) Scroll down to a section Submissions of Assignments
5) Click at Submit your Assignment 1 here link.
6) Click at a button Add Submission
7) Move the files created into an area provided in Moodle. You can drag and drop files here to add them. You can also use a link *Add…*
8) Click at a button Save changes,
9) Click at check box to confirm authorship of a submission,
10) When you are satisfied, remember to click at a button Submit assignment.

A policy regarding late submissions is included in the subject

outline. Only one submission per student is accepted.

Assignment 1 is an individual assignment, and it is expected that all its tasks will be solved individually without any cooperation with the other students. Plagiarism is treated seriously. Students involved will likely receive zero. If you have any doubts, questions, etc. please consult your lecturer or tutor during lab classes or over e-mail.

End of specification