

Assignment 1 (10% of total marks)

Due date: Sunday, 27 April 2025 by 9:00 pm Singapore time.

Scope:

The tasks of this assignment cover **functional dependency**. The assignment covers the topics discussed in lecture 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 (3.0 marks)

Consider the relational schemas given below and the respective sets of functional dependencies valid in the schemas.

$R(P, Q, R, S, T, U, V, W)$

Functional Dependency: $RW \rightarrow V, P \rightarrow QR, Q \rightarrow RUW, T \rightarrow P, U \rightarrow TV$

- Find **all** the minimal super keys of the relational table R . List the derivations of all minimal keys.
- Identify the highest normal form of the relational table R . Remember that the identification of a normal form requires analysis of the valid functional dependencies.
- Decompose the relational table R into minimal number of normalized relational tables in BCNF. Remember to indicate the primary key and foreign keys (if any).

Deliverables

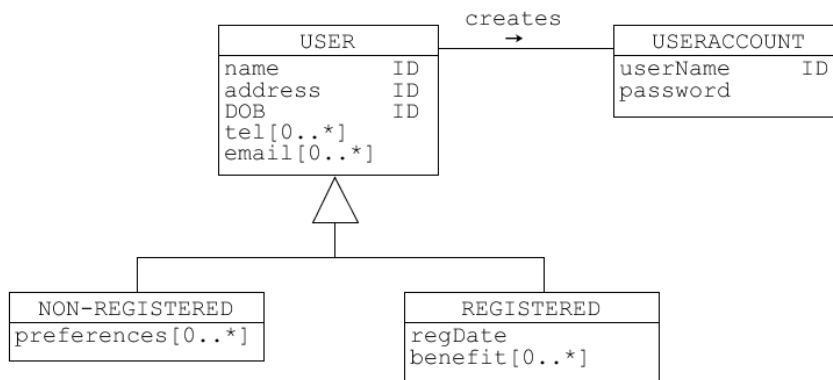
A file **solution1.pdf** with the outcomes of the steps (i), (ii), and (iii) listed above. Note, that "educated guesses" of the solutions score no marks. You must provide complete justification for your answers.

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

Task 2 (3.0 marks)

Analysis of relational schemas and normalization

Consider the following conceptual schema of a sample database domain that contains information about users, the type of users and the user's account of an application.



The following are partially completed collection of relational schemas.

USER(*name*, *address*, *DOB*, *tel*[0..*], *email*[0..*])

USERACCOUNT(*userName*, *password*)

NON – REGISTERED(*preferences*[0..*])

REGISTERED(*regDate*, *benefit*[0..*])

- Find all functional and multivalued dependencies in the relational schemas **USER**, **USERACCOUNT**, **NON-REGISTERED**, and **REGISTERED**.
- Find all minimal keys in the relational schemas **USER**, **USERACCOUNT**, **NON-REGISTERED**, and **REGISTERED**. List the derivations of all minimal keys.
- 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.
- 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 **solution2.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 complete justification for your answers.

Task 3 (4.0 marks)

Consider the following un-normalized relational schema holding information about a shopping basket submitted by a customer.

shoppingBasket(custNum, custName, custAddress, custContact, ordNum, ordDate, ordLineNum, itemDesc, quantity, totItemPrice, deliveryPerson, deliveryPersonContact, expectedDeliveryDate, creditCardNum, totOrdPrice)

In an online application, a customer may submit many orders online. Each order may contain multiple items. Once the orders are confirmed, checked out, and payment made, the respective items in the orders are then assigned to delivery personnel to deliver to the customers. Customer can make the payment with any of his/her credit cards.

The attributes of the relational schema shoppingBasket satisfy the following properties:

- $custNum \rightarrow custName, custAddress, custContact$
 - $ordNum \rightarrow ordDate, totOrdPrice$
 - $deliveryPerson \rightarrow deliveryPersonContact$
 - $ordNum, ordLineNum \rightarrow itemDesc, quantity, totItemPrice$
 - $ordNum, ordLineNum, custNum \rightarrow deliveryPerson, expectedDeliveryDate$
 - $custNum, ordNum \rightarrow creditCardNum$
 - $creditCardNum \rightarrow custNum$
- i. Find all minimal-super-keys in the relational schema shoppingBasket. List the derivations of all minimal keys.
 - ii. Find the highest normal form the relational schema shoppingBasket. Provide justification for your answer.
 - iii. Decompose the relational schema shoppingBasket into a minimal number of relational schemas in BCNF. List all relational schemas obtained from the decompositions.

Deliverables

Submit a pdf file consisting of the normalization process and explanation of the processes of the above relational tables. Name your pdf file as **solution3.pdf**.

Submissions

This assignment is due on Sunday, 27 April 2025 by 9:00 pm Singapore time.

Submit the files **solution1.pdf**, **solution2.pdf**, and **solutions3.pdf** through Moodle in the following way:

- 1) Zip all the files (Solution1.pdf, solution2.pdf, and solution3.pdf into one zipped folder.)
- 2) Access Moodle at **<http://moodle.uowplatform.edu.au/>**
- 3) To log in use a Login link located in the right upper corner the Web page or in the middle of the bottom of the Web page
- 4) When successfully logged in, select a site CSCI235 (SP225) Database Systems
- 5) Scroll down to a section Submissions of Assignments
- 6) Click at Submit your Assignment 1 here link.
- 7) Click at a button Add Submission
- 8) Move the zipped file created in Step 1 above into an area provided in Moodle. You can drag and drop files here to add them. You can also use a link *Add...*
- 9) Click at a button Save changes,
- 10) Click at check box to confirm authorship of a submission,
- 11) 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