

# COMP3013 2025 Fall

## Assignment 3

Student are expected to submit two files.

- “COMP3013\_25F\_A3\_XXX.sql”, where “XXX” is your student ID. This SQL file contains all the SQL queries for Q1. First line of the file should contain your name and ID as a comment. And question number for each question is also included as a comment. SQL comments are quoted by the sign /\*...\*/.
- “COMP3013\_25F\_A3\_XXX.pdf”, for the rest of the questions.

Submissions which do not following the guideline may **not be marked**.

Q1. The schema of a database is given as follows. Keys are underlined.

- `student=(sID, sname, gender, age, gpa, pname)`  
// gender is either male or female.
- `program=(pname, division)`  
// pgname is the program name
- `course=(cID, cname, pname, credit)`  
// credit is an integer and  $1 \leq \text{credit} \leq 3$ .
- `enroll=(sID, cID, grade)`  
//grade is one of A, B, C, D, or F.

Write a query for each following question. (8 marks for each)

- Find the names of students who have enrolled all courses.
- Find the names of students who have enrolled some courses from every program.
- Find the names of students who has not received an “F” from any course.
- Find the name of the student who has enrolled more courses than other students.
- Create a constraint to guarantee the credit is in the correct range.

Q2. Given an instance of a relational schema  $R = \{A, B, C\}$  and a list of functional dependencies.

A	B	C
a	$\alpha$	T
a	$\beta$	T
a	$\gamma$	T
b	$\varepsilon$	F

Decide whether the functional dependencies are satisfied by the instance. (9 pt)

- |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|
| a) $A \rightarrow B$  | b) $A \rightarrow C$  | c) $B \rightarrow A$  |
| d) $B \rightarrow C$  | e) $C \rightarrow A$  | f) $C \rightarrow B$  |
| g) $AB \rightarrow C$ | h) $AC \rightarrow B$ | i) $BC \rightarrow A$ |

Q3. Let  $A, B, C$  be three arbitrary attributes. Assume the functional dependency  $AB \rightarrow C$  holds. Can we prove  $A \rightarrow C$ ? If yes, then prove it by Armstrong's Axiom; if no, then disprove it by a counter example. (10pt)

Q4. Given a relational schema and a set of functional dependencies

- $R = \{A, B, C, D, E\}$
  - $F = \{AC \rightarrow B, BD \rightarrow C, CE \rightarrow D, DA \rightarrow E\}$
- a) Find all candidate keys of  $R$ . (6 pt)
  - b) Decompose  $R$  into BCNF. Show the steps. (15 pt)
  - c) Does the BCNF decomposition in part b) preserve all functional dependencies? Why? (5 pt)
  - d) Decompose  $R$  into 3NF. Show the steps. (15 pt)