

# CMPT 354 –Database Systems I (Section D100)

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Final Assignment #11  
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Total Marks: 50 (5% of the Individual Assignments)  
Due Date: Dec 2, 14:30 (paper and/or via the Online Submission Server)

**Question 1)** A university database contains information about professors (identified by social security number, or SSN) and courses (identified by courseid). Professors teach courses; each of the following situations concerns the Teaches relationship set. For each situation, draw an ER diagram that describes it (assuming no further constraints hold).

1. Professors can teach the same course in several semesters, and each offering must be recorded.
2. Every professor teaches exactly one course (no more, no less).
3. Every professor teaches exactly one course (no more, no less), and every course must be taught by some professor.

**Question 2)** Create the SQL statements to create the tables required for Question 1.2 above (“*Every professor teaches exactly one course (no more, no less)*”). [5 marks]

**Question 3)** Assume your database is made up of the Customer, CustomerAddress, Address tables from AdventureWorks. These 3 tables are represented below as C, CA and A, respectively. Given the Relational Algebra (RA):

$$\pi_{FirstName,AddressType,Address} \cdot \sigma_{A.City='Burnaby' \text{ AND } LastName \neq 'Doe'} (C \bowtie CA \bowtie A)$$

- a) What does it mean in English? [1 mark]
- b) Write the corresponding SQL code [2 marks].
- c) Write the RA that is more efficient (no need to include calculations)? [3 marks]
- d) Write the SQL code corresponding to the *efficient* RA? [3 marks]

*For the below questions, you can refer to Chapter 19 of the text, and slides from Week 8.*

**Question 4)** Consider a relation R with five attributes ABCDE. You are given the following dependencies:  $A \rightarrow B$ ,  $BC \rightarrow E$ , and  $ED \rightarrow A$ .

1. List all keys for R. [3 marks]
2. Is R in 3NF? [2 marks]
3. Is R in BCNF? [2 marks]

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**Question 5)** Decompose  $R_1(A,C,B,D,E)$  with functional dependency of  $A \rightarrow B$  and  $C \rightarrow D$  into BCNF. [2 marks]

**Question 6)** Suppose you are given a relation  $R(A,B,C,D)$ . The dependencies  $B \rightarrow C$  and  $D \rightarrow A$  hold.

- a) What is the candidate key(s) for R? [2 marks]
- b) Is decomposing them into BC and AD a good decomposition? Why? [4 marks]

**Question 7)** Suppose you are given a relation  $R(A,B,C,D)$ . The dependencies  $A \rightarrow B$ ,  $B \rightarrow C$  and  $C \rightarrow D$  hold.

- a) What is the candidate key(s) for R? [2 marks]
- a) Is decomposing them into AB, AD and CD a good decomposition? Why? [4 marks]

**Question 8)** Assume that you are given a relation with attributes ABCD and that no record has NULL values. Write an SQL query that checks whether the functional dependency  $A \rightarrow B$  holds.

HINT:  $A \rightarrow B$  means that for each value of A, there is a single value of B (the converse is not true: for a value of B, there could be multiple values of A). [6 marks]