Concordia University
Dept. of Computer Science & Software Engineering
COMP 353 – Databases
SAMPLE MIDTERM EXAM

NOTE: The proportion points in parts A and B below may be different in your actual midterm.

Student ID: .....
Last Name: .....
First Name: .....

1. Max time: **70 minutes**.
2. Books, notes, sheets are not allowed.
3. Make sure you have **7 pages** excluding this cover page.
4. Provide your answer at the area below each question; Use other areas for rough work.
5. Please do not unstaple the exam booklet.

Part A / 12	Part B / 8	Total / 20

Good Luck!

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Part A [10 Points] This part has 10 multiple-choice questions.
Note: By "Key" we always mean "minimal key."

** Of the following statements, which one is NOT correct?

- E/R is a language for describing database schemas.
- DDL is a database design notation.
- DML is a language for accessing the data.
- ODL is a language for describing database structures.

** Which of the following statements is NOT correct?

- A relation instance that has no tuples, may have no keys.
- A relation with a set of trivial FD's has a unique key.
- In ODL, it is optional to define a key for a class.
- A relation with an empty set of FD's has just one key.

** Let $R = \{A_1, \ldots, A_k\}$ be a relation schema, and r be an instance of R. Which of the following statements is NOT correct?

- If r has n tuples, then r can be represented in $k! \times n!$ ways.
- Suppose $\{A_1\}$ is a key of R. If r has n tuples, then the number of different values of A_1 in r could be less than n.
- If $\{A_1\}$ is a key of R, then R has 2^{k-1} superkeys.
- In relational model, every relation has at least one key.

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** Consider the relations schemas $R(A, B)$, $S(A, B)$, and $T(A, B)$. Suppose $\{A\}$ is the key of all these relations. If $U = R \cup S \cup T$, that is U is the set union of these relations, then what is/are the key(s) of U?

- $\{A\}$
- $\{B\}$
- $\{A, B\}$
- $\{A\}$ and $\{B\}$

** Which of the following statements is correct?

- In the E/R-style method, we normally create more relations than the OO or nulls methods.
- Taking the OO method, we create a class for all entity sets, even those that have no attributes.
- Taking the nulls approach, we create a relation for an entity set that has no attributes.
- Taking the E/R-style method to convert an *isa* hierarchy, we create a relation for an entity set that has no attributes.

** Consider a relation schema $S(A, B, C, D)$ and the FD's $F = \{A \to B, BC \to D\}$. Which of the following statements is NOT correct?

- F is a cover of itself.
- The FD $AC \to D$ follows from F.
- The FD's $B \to D$ and $C \to D$ follow from F.
- The FD $AC \to AD$ follows from F.

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** Consider the relation schema $R = \{A, B, C, D\}$. Let $F = \{A \to B, B \to C\}$ and $G = \{A \to B, B \to C, A \to C\}$. Which of the following statements is NOT correct?

- F is a minimal cover for itself.
- G is a cover for F.
- F is a minimal cover for G.
- G is a minimal cover for itself.

** Consider the relation T and FD's F given in the previous question. Which of the following statements is correct?

- $\{A\}$ is the key of T.
- $\{B, C, D\}$ is the key of T.
- $\{A, D\}$ is the key of T.
- $\{A, C, D\}$ is the key of T.

** Which of the following statements is correct?

- A relation instance is a set of attributes.
- A database instance is a set of tuples.
- A database schema is a set of attributes of the existing relations.
- A relation schema is a set of tuples.

** Which of the following statements is NOT correct about *meta-data*?

- Meta-data describes the indexes to access data efficiently.
- A DBMS uses meta-data to locate data.
- Meta-data describes the structure of the database.
- Meta-data describes the constraints on the database.

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Part B [10 Points] This part has 2 questions, B1 (on this page) and B2 (the next page).

B1. [5 Points] Consider the relation schema $S = (A, B, C, D)$ and the sets of FD's

$$F = \{C \to AB, \quad A \to D, \quad B \to D, \quad A \to B, \quad B \to A\}.$$

i. Give a relation instance of S with 2 tuples that satisfies the FD's in F.

ii. Prove or disprove that F covers G ($F \models G$), where

$$G = \{C \to A, \quad A \to D, \quad B \to D, \quad A \to B, \quad B \to A\}.$$

iii. Obtain a minimal cover for F.

iv. How many minimal covers F has? Explain.

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B2. [**5 Points**] This question is on the database design. In a company, there are employees, which have Eid's, Ename's, and Eaddress's. Each employee has one position in his/her "home" department, and could have other positions in the other departments, as part-time. Each employee gets a contract for each part-time employment. Each contract has a salary. No employee gets a total salary which is more than the total salary of any of his/her boss(es). Each employee could have some dependents and the company keeps track of this information for the purpose of insurance benefit only.

(a) Express this information in E/R model. Be "reasonably" creative, but not too much! Be careful, some of this information may not be modeled. Identify such information as well.

(b) Express in ODL the relationship *contract*. For this, you need to identify which classes are involved and how/where to express the relationships.

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Part C [5 Points] For each of the 5 questions in this part, mark **T** if the given statement is **ALWAYS** true. Otherwise mark **F** and **justify** your answer.

- Two sets of FD's are equivalent if they yield the same set of keys. ☐**T** ☐**F**

- Given any relation instance with 3 tuples, we can determine its FD's. ☐**T** ☐**F**

- ODL allows using complex attributes of types sets and bags. ☐**T** ☐**F**

- If F is a cover for itself, then F is in canonical form. ☐**T** ☐**F**

- A "trivial" FD is called so because it is easy to check if it is violated. ☐**T** ☐**F**