

Database Systems
Fall 2025
Section 2 Mid-Term Examination

Last Name: _____ **First Name:** _____ **Student Id:** _____

Number: _____

Time allowed: *1 hour 20 minutes*. Total score: 101 points. *Closed book examination. A letter-size information sheet (both sides) prepared by yourself is allowed.*

Answer all questions. Turn in everything: question and answer papers, information sheet and sketch papers. They will be stapled together.

(1) [30 points] The goal is to build a toy prototype application below. Construct an UML class diagram to capture and model the partial requirements. You should list class names, attributes with multiplicities, and associations with multiplicities. The roles of associations should also be provided when appropriate. Multiplicities should be as specific as possible. Show the stereotypes <<pk>> and/or <<unique>> (indicating that the value of the attribute must be unique for each object) when applicable. Since this is only a simplified part of the application, model your design in a flexible way.

Fencer Organization DB

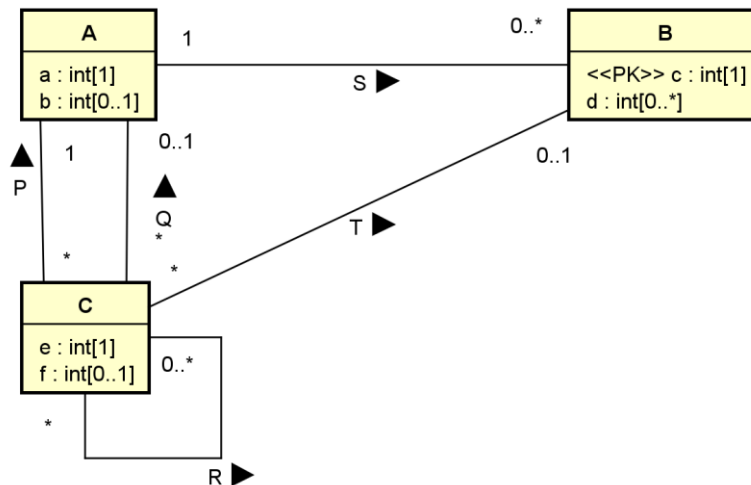
Fencers can join the fencer organization to compete in games of events. A unique id must be stored for every fencer, together with his name, phone and an optional email address. A fencer has a level of play (e.g., 1, 2, etc.) Each level has an optional description (e.g., Level 1: “beginner”.) A fencer may have any number of other fencers as buddies. The organization keeps track of buddy relationships.

The fencer organization organizes events. An event has a date, time and a venue. An event includes many competition games for fencers. A game is a match between two fencers in a specific type of competition, such as foil, Sabre, etc. The scores, called hits, of the fencers in a game need to be recorded.

Please answer your question on the next page.

(1) Your answer here:

(2) [15 points] Consider the following data model in the UML class diagram. Attribute multiplicities are included. Construct a reasonable set of relation schema to implement it. For each relation, list its candidate keys, foreign keys, and all attributes you know for sure that are nullable and non-nullable. Indicate whether a surrogate primary key is created.



Answer: fill in the table below.

Relation		Relation	
[CK] [FK] [Nullable] [Non-nullable] [Note]		[CK] [FK] [Nullable] [Non-nullable] [Note]	
Relation		Relation	
[CK] [FK] [Nullable] [Non-nullable] [Note]		[CK] [FK] [Nullable] [Non-nullable] [Note]	
Relation		Relation	
[CK] [FK] [Nullable] [Non-nullable] [Note]		[CK] [FK] [Nullable] [Non-nullable] [Note]	

(3) [26 points] True or False. *Circle* the choice or write 'T' or 'F' *clearly*.

(a) [T or F] Comparing to a file system, an advantage of DBMS is more nuanced access controls.

(b) [T or F] The relational model is set-theoretic.

(c) [T or F] It is possible for R(A,B,C,D) to have four foreign keys.

(d) [T or F] It is possible for R(A,B,C,D) to have 7 candidate keys.

(e) [T or F] The relational model is based on a two-dimensional array model.

(f) [T or F] Null cannot be used as the value of a primary key in a table.

(g) [T or F] In the relational model, a relation can have more than one candidate key.

(h) [T or F] It is possible for a relation to have no prime attribute.

(Note: a prime attribute is an attribute that appears in a candidate key.)

(i) [T or F] It is possible that executing a DELETE statement in SQL may not delete any row.

(j) [T or F] In MySQL, a table may not have any column.

(k) [T or F] In relational databases, a derived attribute has no value.

(l) [T or F] If R(A, B) has five rows and S(A,C) has two rows, the SQL statement “SELECT * FROM R, S;” always return 10 rows.

(m) [T or F] In MySQL, an UPDATE statement can be used to update more than one row.

Question 4 uses the toyu database, which is provided separately.

(4) [30 points] Write the *SQL* queries for the following data problems. Result orders are unimportant unless explicitly stated otherwise.

(a) List the stuId, name, major (full name) and grade of students enrolled in the class with classId 10003.

```
+-----+-----+-----+-----+-----+
| stuId | fname | lname | major | grade |
+-----+-----+-----+-----+-----+
| 100000 | Tony  | Hawk  | Computer Science | C      |
| 100002 | David | Hawk  | Computer Science | D      |
| 100004 | Larry | Johnson | Information Technology | A      |
| 100005 | Linda | Johnson | Computer Information Systems | NULL   |
+-----+-----+-----+-----+-----+
4 rows in set (0.026 sec)
```

(b) List the names of faculty members, their departments and schools in the following manner. List only those faculty members who advise at least one student.

```
+-----+-----+-----+
| active faculty | department | school |
+-----+-----+-----+
| Art Allister  | Arts       | Human Sciences and Humanities |
| Daniel Kim    | Computer Information Systems | Science and Engineering |
| Andrew Byre   | Computer Information Systems | Science and Engineering |
| Paul Smith    | Computer Science | Science and Engineering |
| Mary Tran     | Computer Science | Science and Engineering |
| Deborah Gump  | Information Technology | Science and Engineering |
+-----+-----+-----+
6 rows in set
```

- (c) List the names of the faculty members who have taught both courses CINF 3321 and CINF 4320 in the following manner.

```
+-----+
| faculty |
+-----+
| Sharon Mannes |
+-----+
1 row in set
```