CSCI 4333 Design of Database Systems
Spring 2024
Section 1 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 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 database to *partially support a league of soccer teams.* Construct an UML class diagram to capture and model the partial requirements below. 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.

The league is composed of teams. The names of teams must be stored. There are players in the league. The last name, first name, phone and email of a player should be stored. However, the email is optional. A player has a unique id. A player can join only one team as a member.

There are coaches. They must be registered to serve as coaches. The field CoachId is a unique identifier for a coach, and it must be stored. The name and email address of a coach should also be stored. A team must have a main coach and may have any number of assistant coaches. A coach can serve any number of teams in various capacities.

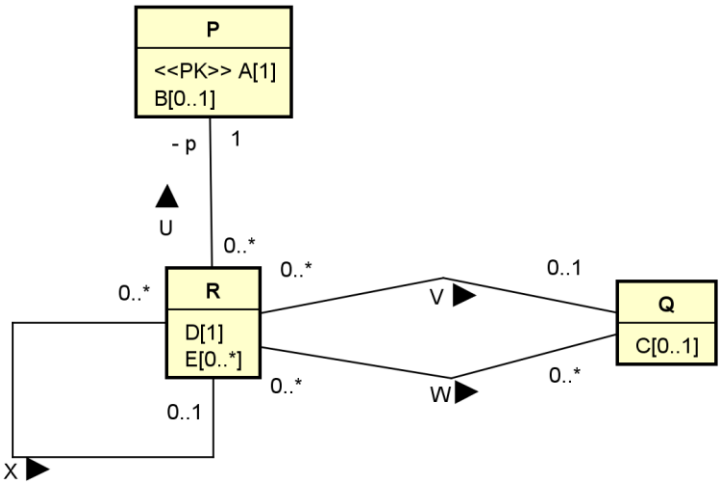
A game is conducted between two teams (team 1 and team 2). The game date must be stored. The scores of the two competing teams, when available, should be stored. A team can play in any number of games. An example of a game:

Game Date: 2/3/2024
Team #1: “Soaring Eagle”, score: 4
Team #2: “Crouching Tiger”, score: 3

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 multiplicity is 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] A table in Microsoft's Access must have at least one column.

(b) [T or F] A relation may not have any foreign key.

(c) [T or F] In MS Access, an attribute that is a foreign key cannot have a null value.

(d) [T or F] A relation schema cannot be changed.

(e) [T or F] Relational calculus is an object-oriented language.

(f) [T or F] The Excel spreadsheet's data model is set-theoretic.

(g) [T or F] {A} and {A, B} cannot be candidate keys of a relation R at the same time.

(h) [T or F] When mapping an UML class diagram to relational schema, an association is always mapped to a new relation.

(i) [T or F] In SQL, a SELECT statement may not have a WHERE clause.

(j) [T or F] It is possible to store null value directly in MySQL.

(k) [T or F] One advantage of DBMS over a file system is its higher degree of access control.

(l) [T or F] A candidate key is a property of a database that must always be unique for all relations in the database.

(m) [T or F] It is possible for R(A,B,C,D,E) to have no prime attribute.

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 names of students with 30 or more credits (ach) with an advisor from the dept 'CSCI', together with the names of their major departments and the numbers of credits (ach) in the following manner.

```
+-------+-------+------------------+---------+
| lname | fname | major            | credits |
+-------+-------+------------------+---------+
| Hawk  | Tony  | Computer Science |      40 |
| Hawk  | Mary  | Computer Science |      35 |
| Hawk  | David | Computer Science |      66 |
+-------+-------+------------------+---------+
3 rows in set
```

(b) List the names, ranks and departments of all faculty members in the school 'CSE' who advise at least one student and teaches at least one class in the following manner.

```
+-------------+------------------------------+---------------------+
| faculty     | department                   | rank                |
+-------------+------------------------------+---------------------+
| Daniel Kim  | Computer Information Systems | Professor           |
| Andrew Byre | Computer Information Systems | Associate Professor |
| Paul Smith  | Computer Science             | Professor           |
| Mary Tran   | Computer Science             | Associate Professor |
+-------------+------------------------------+---------------------+
4 rows in set
```

(c) List all student names who have enrolled in at least two classes with a grade of A.

```
+------------+
| student    |
+------------+
| Tony Hawk  |
+------------+
1 row in set
```