

CSC 370 Midterm

Name: _____

Student Number: _____

- **This Exam is 75 minutes in duration.**
- **This exam has 75 marks total ->use 1 minute per mark as a rough guideline for allotting time to do a question.**
- **No written materials are allowed for this exam.**
- **No electronic devices are permitted.**
- **You will be supplied with scrap paper for working.**
- **All answers should be written in the examination.**
- **Please note...**

As Shakespeare said, "Brevity is the soul of wit."

As a former csc 370 head ta said, "Insanely long answers will be penalized."

As some old probably Greek dude said, "A picture is worth a thousand words."

As Andries van Dam said, "If a picture is worth 1,000 words then a moving picture is worth 1,000 still ones and an interactive moving picture is worth a thousand moving ones -> a million pictures!"

To paraphrase the above, be brief and concise, draw pictures where appropriate, and print legibly, because nobody expects the Spanish Inquisition! (and, no, I don't expect you to actually submit any video presentations...)

Good luck!

1	2	3	4	5	6	Total

Question 1 (13 marks):

For each of the following questions use the relational schema given in Appendix A and give the SQL statement that will give the required result.

a) Select all the courses (the Course name, the semester and year, and the instructor) that have NO students registered.

b) Count the number of courses each student is taking in the Fall semester of 1998. Give the name of each student, along with the number of courses.

c) Insert a new student whose name is Church, student number is 608, class is 5 and major is CSC.

d) Select the names of all the students who have taken every course offered by the CSC department.

e) Write the SQL necessary to create the COURSE table given that CourseName and DepartmentName are Strings, CourseNum and CreditHours are positive integers and CreditHours must be between 1 and 6 inclusive.

f) Count the number of course offered each term by the CSC department. Give the term, year and number of courses.

Question 3 (15 marks):

Draw an ER diagram for a database that will satisfy the requirements given in Appendix C. Keep in mind that there may be EXTRA or DUPLICATE information given in these requirements! You will be marked on style; that is, whether your schema is a good one or not, as well as correctness and completeness of the diagram (e.g. indicate all the information that you can on the diagram, such as keys, cardinality of relationships, etc). NOTE: State any assumptions that you make. Use this page for your diagram.

Question 4 (20 marks):

Consider the schema defined in Appendix B.

Part A

In the following, we describe situations that the hospital's administrator didn't want to happen. For each of these cases, state whether the schema will allow it by writing your answer (yes/no). If the answer is "yes", briefly explain why.

A function X for which there is no nurse certified for it, is ensured by some ward.

A nurse certified for function A works for a ward that ensures functions C and D only.

A nurse has no certification, although she works for ward X.

A nurse with id TT is certified for functions A and B only, and none of the wards of the hospital ensures either one of these two functions.

A nurse certified for function A works for wards X and Y and both wards ensure function A.

Part B

Consider the following version of the database for managing nurses and wards within a hospital. The primary keys are underlined:

```
Nurse(NId, Nname, Bdate, WId)
Function(FId, Fname, Description)
Ward(WId, Wname, Location)
Services(WId, FId)
Certified(NId, FId)
```

Given the following query in Domain Relational Calculus:

$$\{ \langle b \rangle \mid \exists a, c, d \langle a, b, c, d \rangle \in \text{Nurse} \wedge (\forall \langle a1, b1, c1 \rangle \in \text{Function} (\exists \langle a2, b2 \rangle \in \text{Certified} (a = a2 \wedge a1 = b2))) \}$$

Explain what this query does:

Rewrite the query in relational algebra:

Question 5 (10 marks):

Section 8.4 of the text discussed the 5 basic file organizations. Which of the five organizations would you choose for a file where the most frequent operations are as follows (i.e. pick the best one(s) and ***briefly*** explain why):

1. Search for records based on a range of fields values.
2. Perform inserts and scans, where the order of the records does not matter.
3. Search for a record based on a particular field value.

Question 6 (5 marks):

What are **Cursors** and why are they necessary?

• **Appendix A**

COURSE

CourseName	<u>CourseNum</u>	CreditHours	DepartmentName
------------	------------------	-------------	----------------

DEPARTMENT

<u>DepartmentName</u>

STUDENT

Name	<u>StudentID</u>	Major	Class
------	------------------	-------	-------

PREREQUISITE

<u>CourseNum</u>	<u>PrereqNum</u>
------------------	------------------

SECTION

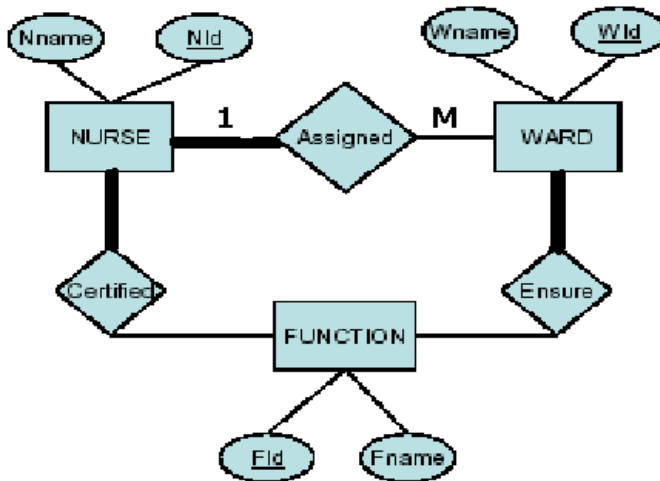
<u>SectionID</u>	<u>CourseNum</u>	<u>Term</u>	<u>Year</u>	InstructorName
------------------	------------------	-------------	-------------	----------------

TRANSCRIPT

<u>StudentID</u>	<u>SectionID</u>	Grade
------------------	------------------	-------

Appendix B

Consider three entity sets NURSE, WARD and FUNCTION used to describe information in a hospital. The following incomplete ER diagram captures the relationships between these entities. Nurses are certified for some functions. Nurses are assigned for some wards. Each ward is responsible to ensure some functions within the hospital.



- The primary key for the entities NURSE, WARD and FUNCTION correspond to NId, WId, and FId respectively.
- Each nurse is assigned to one ward.
- Each nurse is certified for at least one function.
- Some functions may have no nurse certified for them.
- A ward ensures at least one function.
- A function can be ensured by more than one ward.
- Some functions may not be ensured by any ward.

Appendix C

A Karate school (or dojo) has hired you to design a small database system that will track their students. Students begin at the lowest level, and work up through the belts until they either leave the school, or become a teacher themselves. A teacher may still be a student, however, and continue earning belts. In this school, each belt has two levels, except for a black belt, which may have 10 levels. After the 10th level for a black belt there are no more belts. There are two classes offered: senior and junior. Each class runs at different times, and has a different group of teachers (there is more than one teacher per class). There is only one sensei, or top-level teacher, at the dojo. Here is what the database must record:

- the student's name, age, address, phone number, next of kin, date they started training at this dojo
- what belt and belt level the student has, and when they earned it
- a history of when each belt was earned
- the student's current teacher
- what class they are teaching
- which teachers are teaching the class
- the teacher's name, age, address, phone number, next of kin, date they started teaching at this dojo
- what belt and belt level the teacher has, when they earned it, and a history of when each belt was earned
- it must also be recorded whether a teacher is the sensei for the dojo
- each student or teacher, when they join the dojo, must apply for an identification number, which is unique for each person. This must also be stored for each teacher and/or student.