Student number:_____

UNIVERSITY OF VICTORIA
Faculty of Engineering

Department of Computer Science

CSC 370 (Database Systems)
Instructor: Daniel M. German

Midterm
22 Oct. 2002

Duration: 60 minutes

You are only allowed one sheet of paper.

This examination paper consists of **8** pages and **5** sections. Please bring any discrepancy to the attention of an invigilator. The number in parenthesis at the start of each question is the number of points the question is worth.

Answer all questions.

Please write your answers clearly.

For instructor's use:

	Score
1 (6)	
2 (9)	
3 (6)	
4 (6)	
5 (13)	
Total (40)	

For this exam, consider the following schema and instances of the relations. Feel free to remove this page from the exam.

Attributes with an empty value should be assumed to be NULL.

```
Students(sid:integer, name: string, login: string,
         age: integer, gpa: real)
```

sid	*name*	*login*	*age*	*gpa*
53666	Jones	Jones@cs	18	7.4
53668	Smith	smith@ee	18	7.8
53650	Smith	smith@math	19	7.4
53831	Madayan	madayan@music	11	8
53832	Guldy	guldu@music	12	

```
Courses(cid: string, cname: string, credits: integer)
```

cid	*cname*	*credits*
SENG265	Introduction to Software Engineering	3
CSC370	Database Systems	3
CSC360	Introduction to Operating Systems	3
CSC320	Foundations in Computer Science	3

```
Enrolled(sid: integer, cid: string, grade: string)
```

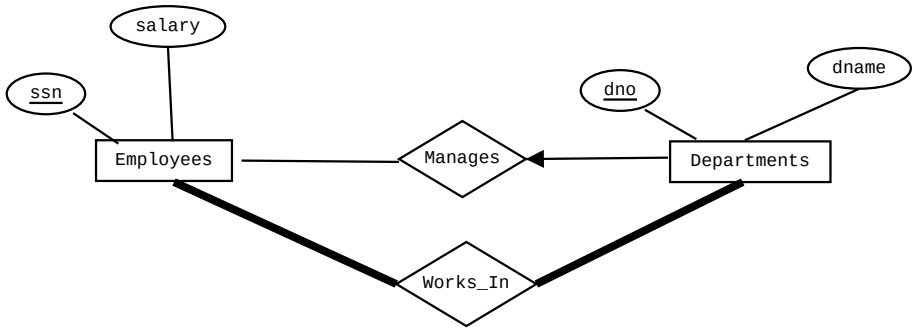
sid	*cid*	*grade*
53666	SENG265	98
53666	CSC370	78
53668	CSC370	91
53831	SENG265	

1. Database Concepts

(a) [3] Give an example of an external schema on the schema in page 2.

(b) [3] Consider the relation *Students*, and its instance as shown in page 2. Which attributes **cannot** be candidate keys, based on this instance being legal? Explain why.

2. Entity-Relationship Diagrams



(a) [6] Provide `CREATE TABLE` statements for the entities `Employees`, `Departments` and for the relation `Manages`. Choose appropriate data types for each field and include any referential integrity constraints.

(b) [3] Briefly explain why the relation `WorksIn` cannot be expressed with a `CREATE TABLE` alone.

3. Relational Algebra

Give relational algebra expressions for the following questions using the schema in page 2.

(a) [3] The *name* of the students who are taking `SENG265`.

(b) [3] The *login* of the students with $gpa > 7$ who are taking `CSC370`.

4. Writing SQL queries

Answer the following questions using the schema in page 2.

(a) [3] Provide a `SELECT` statement that retrieves the *name* of the students who are taking `SENG265`.

(b) [3] Provide a `SELECT` statement that retrieves the *sid* of the students who do not have a grade yet on a course to which they are registered.

5. Interpreting SQL queries

Based on the instances of page 2, what is the answer to the following queries?

(a) [3]

```
SELECT S.name, S.gpa FROM Students S
    WHERE S.sid IN (SELECT E.sid from Enrolled E
                    WHERE E.cid = 'SENG265')
```

(b) [3]

```
SELECT S.sid, E.cid  FROM
   Students S NATURAL FULL OUTER JOIN Enrolled E
```

(c) [3]

```
SELECT C.Cid, count(*) AS CourseCount
        FROM Courses C, Enrolled E
        WHERE E.grade < 95
        GROUP by C.cid
        HAVING C.Cid = 'CSC320';
```

(d) [4] For the previous query, explain the intermediary steps required to compute it. Use the conceptual evaluation strategy discussed in class. If you want, you can provide the instances of the intermediary relations, but it is not required.

End of examination
Total pages: 8
Total marks: 40