Name:	Student ID:
Signature:	

MIDTERM EXAM 2, Fall 2006

CS 564 Introduction to Database Management Systems Department of Computer Science University of Wisconsin-Madison

Exam Rules:

- 1) Close book and notes, 60 minutes
- 2) Please write down your name and student ID number NOW.
- 3) Please wait until being told to start reading and working on the exam.
- 4) If you think a problem is ambiguous, write down your assumptions, argue that they are reasonable, then work on the problem using those assumptions.

	Project(pname, member, start-date, end-date, budget, dept-id) Department(id, head) Employee(ename, dept-id)		
vh	where Project.member is the name of employee, and Department.head is also the name of some employee.		
	(a) Write an algebra expression that finds the names of all employees who are the heads of departments in which there is at least one project with budget over 100K.		
	(b) Write a SQL query that finds the employees who are involved in at least one project in which their department head is not involved.		

1. (20 points) Consider a database with the following relations:

2.	(20 points) Consider a database schema with the following relations: Student (ssn, name) Prof (ssn, name) Course (number, instructor-ssn, title, credits, room#) Enroll (student-ssn, course#) Room (number, capacity)
a.	Write a relational algebra query that finds the names of all students who are enrolled in a class taught by "Jones," AND are enrolled in a class called "Physics."
b.	Write a relational algebra query that finds the names of all students who are NOT enrolled in two classes held in the same room.

3.	(20 points) Using the same schema, which we duplicate below: Student (ssn, name) Prof (ssn, name) Course (number, instructor-ssn, title, credits, room#) Enroll (student-ssn, course#) Room (number, capacity)
a.	Write an SQL query that lists the title of all courses either taught by "Smith" OR are taught in room number 444. Do not list duplicate titles.
b.	Write an SQL query that considers all the courses that have ever been taught by "Brown" and are of 3 credits, and groups them according to title. For each course, the query gives the average capacity of rooms in which the course has been offered, and the query only returns courses for which this average is more than 20.

4. (15 points) Consider the relation R(A,B,C,D,E) with the following functional dependencies:

 $A, B \rightarrow E, C, D \rightarrow E, A \rightarrow C, C \rightarrow A.$

Decompose R into relations that are in BCNF.

- **5.** (15 points) For the following schema and set of FDs,
 - (i) What are the keys of the relation?
 - (ii) Decompose the relation, as necessary, into collections of BCNF relations.

R(A,B,C,D) with FDs BC -> D, C -> A, AB -> C

6. (10 points) A major goal of normalization is (circle all but one):

avoiding redundant data avoiding update anomalies efficient query processing