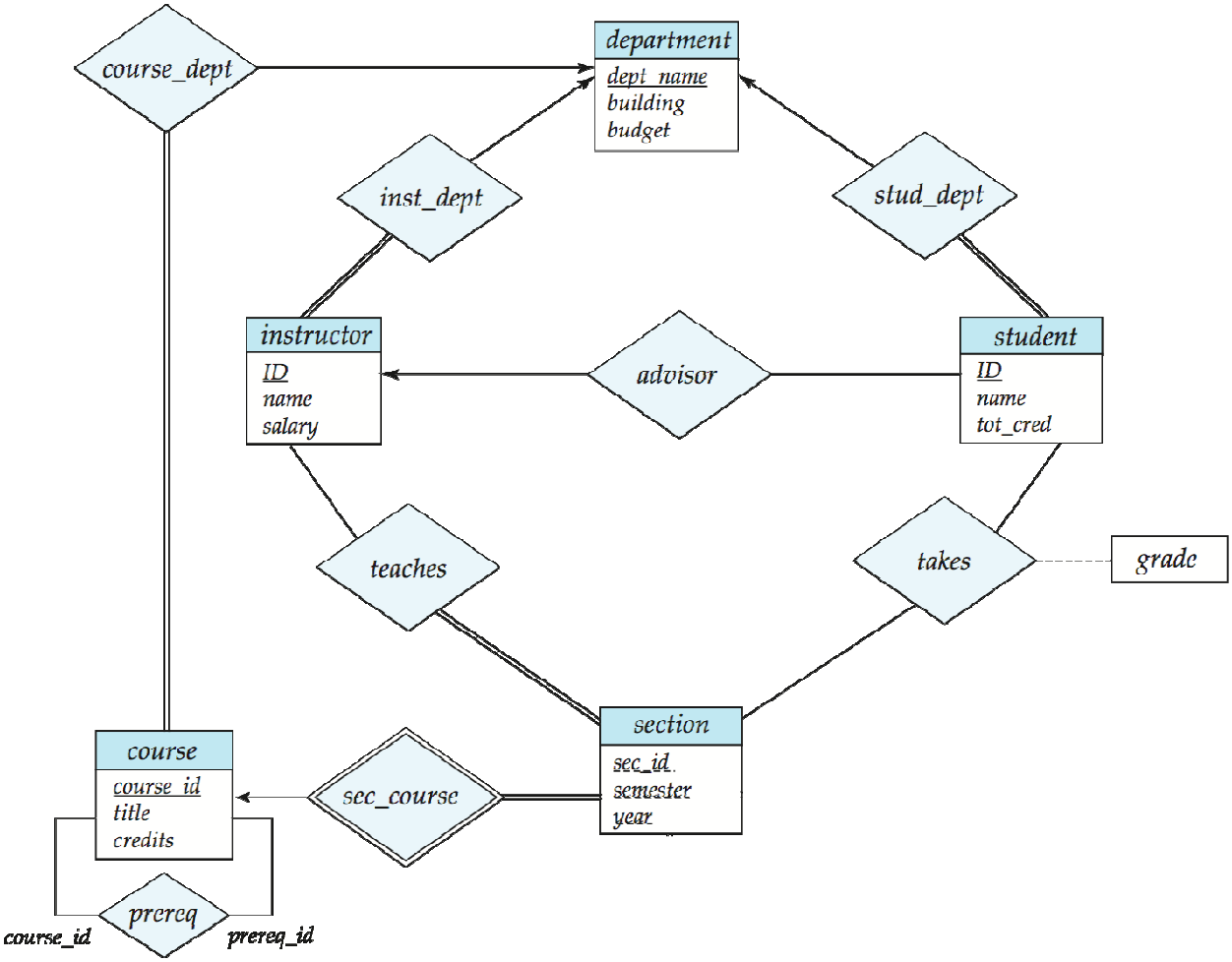
Comprehensive Exam
Databases
Fall 2010

1) (27 points) Consider the following ER diagram for a university enterprise.



On the next page give a collection of one or more relational schemes, i.e., tables, for the above ER diagram. Note that your answer should indicate all attributes, primary keys and foreign keys.

2) (32 points) Consider the following relational schemes. Note that attributes forming the primary key for each relation have been underlined.

student(<u>student-name</u>, street, city)	-- Basic student information.
offering(<u>department</u>, <u>number</u>, population)	-- Courses currently offered; for CSE5260 department is "CSE" and number is 5260. Population is the number of students.
titles(<u>department</u>, <u>number</u>, title)	-- Course titles; "CSE5260" is "Database Systems"
enrollment(<u>student-name</u>, <u>department</u>, <u>number</u>)	-- Indicates which students are enrolled in which courses.

Give a <u>tuple calculus</u> expression for part (a).

(a) For each department, list the course that has the largest population. Include the department, course number, title, and population in the result.

<u>department</u>	<u>number</u>	<u>title</u>	<u>population</u>
MTH	1001	Calculus	57
CSE	4020	Database Systems	25
PSY	4260	Child Development	62
CHM	5264	Introduction to Chemistry	43

Give a <u>relational algebraic</u> expression for part (b).

(b) A list of the names of all students who are enrolled in CSE 5260 or MTH 5100, but not both.

Give an SQL view for part (c).

(c) A list of those courses (department and number) that “Jones” and “Smith” have in common, i.e., that they are both currently enrolled in.

Give an SQL query for part (d). Note that for this question you can use the view created in part (c).

(d) A list of the names of those students who are currently enrolled in every class that “Jones” and “Smith” have in common.

3) (15 points) List and define Armstrong's axions.

4) Consider the following functional dependencies for the relational scheme R=(A,B,C,D,E,F,G).

B=>CE
G=>A
A=>G
D=>BCF

Suppose R is decomposed into the following set of relational schemes.

R1 = (B,C,E)
R2 = (G,A)
R3 = (B,C,D,F)

For each of the following be sure to explain your answer. Note that you may assume that all attributes are "atomic."

(a) (6 points) Is R1 in 3NF (yes or no)? Is R1 in BCNF (yes or no)?

(b) (6 points) Is R2 in 3NF (yes or no)? Is R2 in BCNF (yes or no)?

(c) (6 points) Is R3 in 3NF (yes or no)? Is R3 in BCNF (yes or no)?

(d) (4 points) Does the decomposition preserve dependencies (yes or no)?

(e) (4 points) Does the decomposition have a loss-less join (yes or no)?