

**TEMPLE UNIVERSITY**

DEPT. OF COMPUTER AND INFORMATION SCIENCES

CIS 331 – Principles of Database Systems

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**SAMPLE Midterm Exam – 1 Hour 20 Minutes**

Name:

Grade (out of 100pts):

Problem Set	Points
1. (18 points)	
2. (20 points)	
3. (25 points)	
4. (20 points)	
5. (17 points)	

Instructions:

1. Put your name and student number on your exam *now*.
2. Give your answer in the provided space. If you need more space, use the back of the pages and make a note of it, BUT it should not be necessary.
3. **Show all your work!** Partial credit is possible for a wrong answer but *only* if you show the intermediate steps in obtaining an answer.
4. The number of points for each part of each question is given in parentheses. There is a total of 100 points.
5. Good Luck!

Problem Set 1: General Concepts (18 points)

1. (4 pts) What is a data model?
2. (4 pts) What is the difference between a relational table, a file of records, and a spreadsheet?
3. (5 pts) Why is referential integrity not necessary in the ER model, although it is important in the relational model?
4. (5 pts) Define *outer union* and explain its usage.

Problem Set 2: Relational Algebra & SQL (20 points)

1. In the following relation schemas all three attributes form the primary key:

$$R=(A,B,C) \quad S=(D,E,F)$$

Let relations  $r(R)$  and  $s(S)$  be given. Give an expression in SQL that is equivalent to each of the three queries below:

(a) (9 pts)  $\sigma_{B=13}(r \bowtie s)$

(b) (11 pts)  $\sigma_{B=13}(\pi_{B,D,F}(r \bowtie_{A=D \wedge C=D} s))$

Problem Set 3: SQL (25 points)

1. (25 pts) Given the populated relations  $r$ ,  $s$  below, what would the following SQL queries return:

r:

A	B
0	1
1	1
3	1
4	1
2	2
3	2
4	2
1	4

s:

B	C
1	0
1	0
1	2
1	3
2	1
3	4
4	2
4	3

- a. (7 pts)  
`select A from r where not A = any (select C from s)`
- b. (9 pts)  
`select avg(A) as A_AVG, r.B as B  
from (r natural join s)  
where s.C > 0  
group by r.B  
having count(*) > 3;`
- c. (9 pts)  
`select avg(A), r.B  
from r, s  
where r.B = s.B and C > 20  
group by r.B  
having avg(A) >= (select avg(C) from s);`

Problem Set 4: SQL (20 points)

1. (20 points) Consider the following schema: (SSN stands for social security number and is the key of EMPLOYEE. SUPERSSN is the social security number of a person's supervisor. DNUMBER is the key of DEPARTMENT and MGRSSN is the social security number of the department manager. Both attributes of DEPTLOCATIONS form a key.)

EMPLOYEE (SSN,FName,LName,Address,City,Salary,SuperSSN,DNO)  
DEPARTMENT(DNUMBER,DName,MGRSSN)  
DEPTLOCATIONS(DNUMBER,DLocation)

Translate to SQL the two queries below:

Query 1: List the full names and the departments of all employees whose salary is between 50000 and 75000 and who live and work in Phg.

Query 2: List the full names of all employees who are directly supervised by their department manager.

Problem Set 5: Functional Dependencies (17 points)

- Consider the following set  $F$  of functional dependencies for relational schema  $R = (A, B, C, D, E)$ :

1.  $A \rightarrow BC$

2.  $CD \rightarrow E$

3.  $B \rightarrow D$

4.  $E \rightarrow A$

Compute  $B^+$ .