

# CSE 444 Midterm --- Fall 2006

Name \_\_\_\_\_ Student ID \_\_\_\_\_

#	1	2	3	Total (100)
Score				

**Time: 50 minutes. Number of Total Points: 100.**

1. [40 points] A manufacturing company maintains a database of their technical manuals. Their schema are described as following:

**MANUAL**(mid, mTitle, year) /\* key= mid \*/  
**CHAPTER**(cid, mid, number, cTitle, text) /\* key= (cid,mid) \*/  
**CITES**(mid, cid, position, midRef) /\* key = everything \*/  
**WORD**(wid, word) /\* key= wid \*/  
**OCCURS**(wid, cid, mid, position) /\* key = everything \*/

Chapters have a foreign key to the manuals where they belong, and a chapter number (typically 1, 2, 3, ... for the chapters in a manual). The text in a chapter may have a reference to another manual, and this is recorded in CITES. For example a record in CITES:

('m832', 'c432', 120, 'm7702')

means that the chapter with key ('m832', 'c432') has a reference to the manual 'm7702', and this reference occurs on position 120 of the text. Finally WORDS represents the collection of all the words in all the manuals, and OCCURS is a many to many relationship recording every occurrence of a word in a chapter.

a. [10 points] Typically each reference is to a manual written earlier. Write a query that returns all manuals that contain some reference to a manual written later (i.e. in a later year). Your query should return **mid**, **mTitle** pairs.

[This page is intentionally left blank. Use it to write your answer.]

**b.** [10 points] Write a query that computes for each word the total number of occurrences in all manuals. That is, if the word **'bearing'** occurs in manual 1, chapter 1, positions 10 and 20, then in chapter 2, positions 5,10, and 30, and then again in manual 2, chapter 1, position 20, then you will return **('bearing', 6)**. If the word 'database' doesn't occur anywhere then you will return **('database', 0)**.

c. [10 points] Write a query that computes for every word in how many manuals it occurs. For the example above, you would return (**'bearing', 2**) and (**'database', 0**).

d. [10 points] For each pair of queries below say whether they are equivalent, i.e. return exactly the same answers. You have to answer 'yes' or 'no'.

(i)

**Q1:** **select distinct** c1.mid  
**from** CHAPTER c1, CHAPTER c2, CITES r1, CITES r2  
**where** c1.cid = r1.cid and c1.mid = r1.mid  
and c2.cid = r2.cid and c2.mid = r2.mid  
and r1.position < 200 and r2.position < 300

**Q2:** **select distinct** c1.mid  
**from** CHAPTER c1, CITES r1, CITES r2  
**where** c1.cid = r1.cid and c1.mid = r1.mid  
and r1.position < 200 and r2.position < 300

Are they equivalent?: \_\_\_\_\_

(ii)

**Q1:** **select distinct** m.mid, m.title  
**from** MANUAL m, CHAPTER c1, CITES r, MANUAL m2  
**where** m.mid = c1.mid  
and c1.number > 5  
and c1.mid = r.mid and c1.cid = r.cid  
and r.midRef = m2.mid  
and m2.year = m.year

**Q2:** **select distinct** m.mid, m.title  
**from** MANUAL m, CHAPTER c1, CHAPTER c2, CITES r, MANUAL m2  
**where** m.mid = c1.mid and m.mid = c2.mid  
and c1.number > 5 and c2.number > 3  
and c1.mid = r.mid and c1.cid = r.cid  
and r.midRef = m2.mid  
and m2.year = m.year

Are they equivalent?: \_\_\_\_\_

(iii)

**Q1:** **select** c.cid, c.mid  
**from** CHAPTER c  
**where** c.cid not in (**select** r.cid  
**from** CITES r  
**where** r.mid = c.mid)

**Q2:** **select** c.cid, c.mid  
**from** CHAPTER c, CITES r  
**group by** c.cid, c.mid  
**having** count(\*) > 0

Are they equivalent ?: \_\_\_\_\_

2. [30 points]

a. [15 points] Design an E/R diagram for an application domain consisting of the following entity sets::

- **Projects.** Attributes: **name, budget**
- **Teams.** Attributes: **team\_name**
- **Empolyees.** Attributes: **name, phone\_number**
- **Consultants.** Attributes: **name, phone\_number, hourly\_rate**

And the following relationships:

- Each team works on one or more projects.
- Each project has an auditor, who is an employee
- Consultants are employees

Your answer should consist of an E/R diagram with entity sets, attributes (make sure you create appropriate keys: you may incorporate new attributes if **needed**), relationships, and inheritance.

[This page is intentionally left blank. Use it to write your answer.]

**b.** [15 points] Create in SQL the tables for the E/R diagram in the previous point. All your attributes should be of type **varchar**( . . . ), except for **budget** and **hourly\_rate**, which are integers. (Pick appropriate types for the key attributes). Indicate all keys and all foreign keys. You have to turn in several CREATE TABLE statements.



3.[30 points]

a.[10 points] X, Y are sets of attributes. Indicate for each statement below if it is **true** or **false**:

if  $X \rightarrow Y$  then the set  $X^+$  contains  $Y^+$

Your Answer: \_\_\_\_\_

if  $X, Y \rightarrow Z$  then  $X \rightarrow Z$

Your Answer: \_\_\_\_\_

if  $X \rightarrow Y$  and  $Y, U \rightarrow V$  then  $X, U \rightarrow V$

Your Answer: \_\_\_\_\_

if the set  $X^+$  is contained in  $Y^+$  then X is contained in Y.

Your Answer: \_\_\_\_\_

b. [10 points] Consider two relations  $R(A,B,C,D)$  and  $S(C,D,E,F)$ , and suppose the following functional dependencies hold:

in R:  $A \rightarrow C, B \rightarrow D, D \rightarrow B$

in S:  $C, E \rightarrow F, F \rightarrow E$

Now consider the following table  $T(A,B,C,D,E,F)$  defined by a SQL view:

```
create view T as  
select distinct R.A, R.B, R.C, R.D, S.E, S.F  
from R, S  
where R.B = 'bbb' and R.C = S.C and R.D = S.D
```

Compute all the keys in T.

[This page is intentionally left blank. Use it to write your answer.]

c. [10 points] Decompose the table  $R(A,B,C,D,E)$  in BCNF, assuming the following functional dependencies hold on  $R$ :

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

$$B,D \rightarrow A$$

$$B, E \rightarrow A$$

Show your steps.