

CS585
Database Systems
Spring 2011
Exam I

Name: _____
Student ID: _____

____Monday ____Wednesday ____DEN

	Maximum	Received
Problem 1	20	
Problem 2	16	
Problem 3	14	
Problem 4	15	
Problem 5	12	
Problem 6	15	
Problem 7	8	
Total	100	

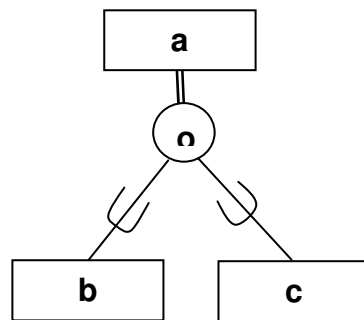
DURATION: 2 Hours

It is suggested that you look over the entire exam first and start with easy questions. Good luck!

Problem 1: (20 points)

Indicate whether each of the following statements is true or false (T/F):

- ___ The degree of a relationship set in ER model is the same as the cardinality of the relationship set.
- ___ In EER model, the higher level entity set in specialization is called the owner entity set.
- ___ Assuming reduction to a pure relational model, the following EER schema can be represented by two relations without resulting in inconsistency.



- ___ A relationship is an association among two or more attributes.
- ___ One owner entity is associated with one or more weak entities, but each weak entity has a single owner.
- ___ An integrity constraint is a condition specified on a relation instance.
- ___ A foreign key could not refer to the same relation.
- ___ By default, a constraint is checked at the end of every transaction that could lead to a violation.
- ___ If a primary key comprises of two attributes, none of their values can be null.

Problem 1 (Cont'd)

___ If “group by” keyword is omitted, the whole table is treated as a group.

___ If we compare two *null* values using $<$, $>$, $=$, and so on, the result is always true.

___ In an R-tree, an optimal split of an MBR is possible in linear time with respect to the number of MBRs within it.

___ In an OODBMS, there is no need to explicitly come up with primary keys.

___ A subquery can reference attributes in the outer query.

___ An attribute declared as UNIQUE can have NULL as its value.

___ Quad trees have an advantage over kd-trees in that they keep the tree balanced therefore keeping the search efficient at all times.

___ In an R-Tree, we may not know exactly which branch of the tree to follow to find an object stored in the database.

___ OODBMS is not suitable technology for applications running on mobile devices.

___ In an R-tree, an optimal split of an MBR is possible in linear time with respect to the number of MBRs within it.

___ Using views one can update derived attributes.

Problem 2: (16 points)

Consider the following schema:

Suppliers(sid: integer, sname: string, address: string)

Parts(pid: integer, pname: string, color: string)

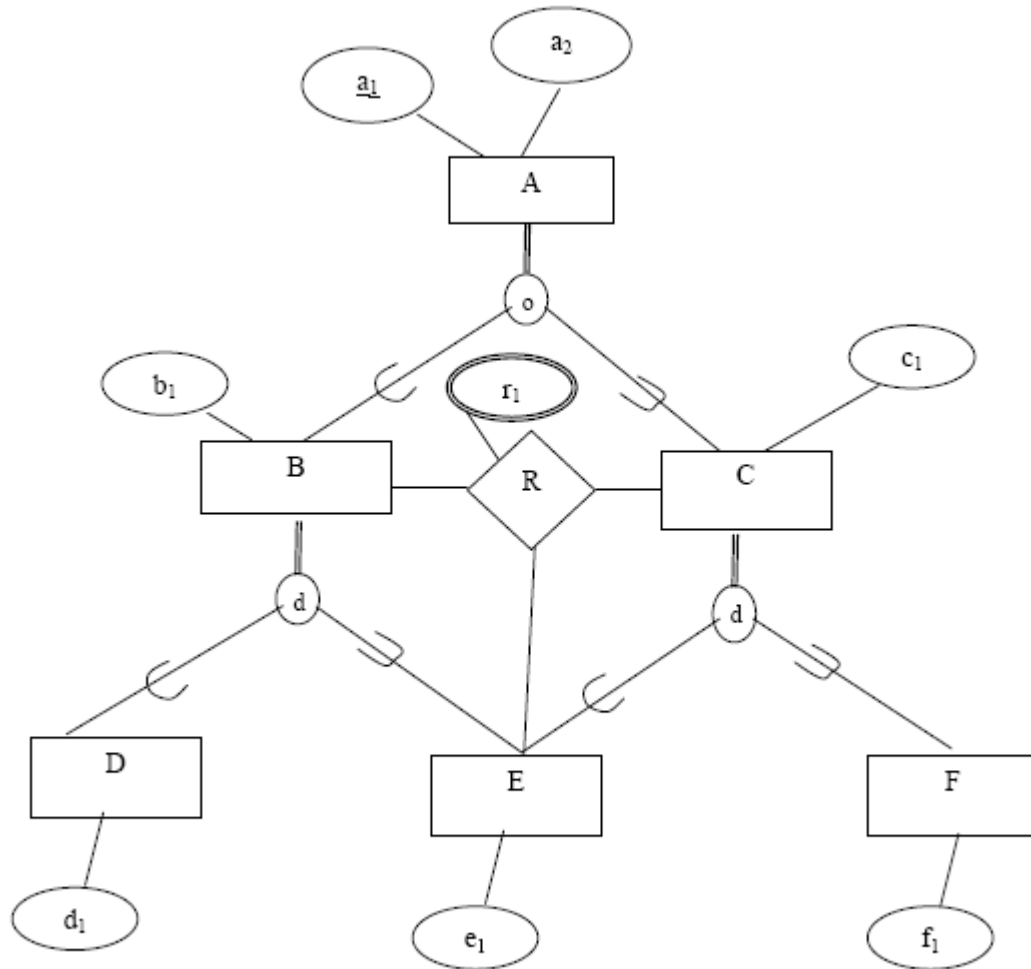
Catalog(sid: integer, pid: integer, cost: real)

The Catalog relation lists the prices charged for parts by Suppliers. Write the following queries in SQL:

1. Find the pnames of parts for which there is some supplier.
2. Find sids of suppliers who charge more for some part than the average cost of that part (averaged over all the suppliers who supply that part).
3. Find sids of Suppliers who supply a red part and a green part
4. For every supplier that only supplies green parts, print the name of the supplier and the total number of parts that she supplies.

Problem 3: (14 points)

Map the following ER diagram to the relational model. Make sure all integrity constraints that are required are specified.



Problem 4: (15 points)

Assume the following table for the position of some of the streets in Los Angeles is stored in a database with spatial support.

<i>ID</i>	<i>Name</i>	<i>Location</i>
1	W Pico Blvd	(0,0) (7,3)
2	Sepulveda Blvd	(7,0) (3,3)
3	Sawtelle Blvd	(0,5) (5,3)
4	Washington Blvd	(3,5) (5,10)
5	Riverside Drive	(3,7) (7,5)

Also assume we insert the above data in a table with an R-Tree index structure. The branching factors are $m=1$, $M=2$, and the data is inserted as the rows appear above.

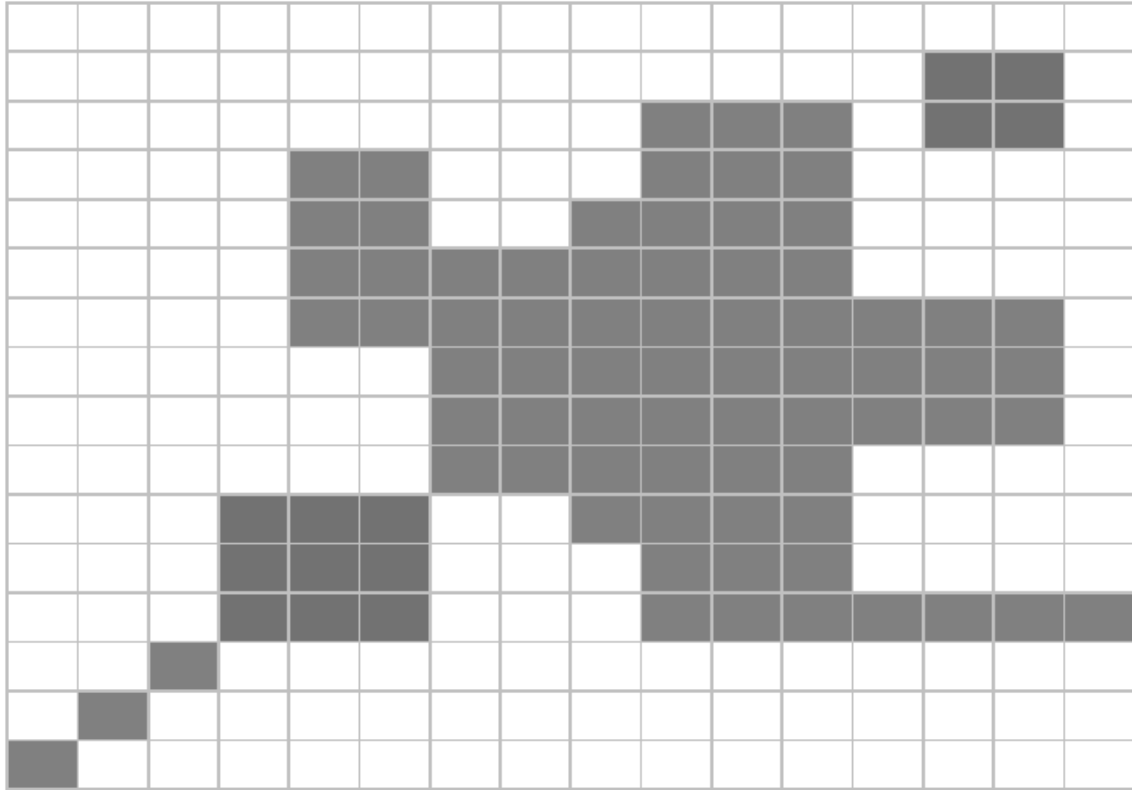
a) Draw resulting R-tree index structure.

b) Specify which splitting algorithm you chose and why.

c) What are the major differences between an R-Tree and an R+-Tree ?

Problem 5: (12 points)

Decompose the following region based the Region QuadTree and draw the resulting QuadTree.



Problem 6: (15 points)

Computer Sciences Department frequent fliers have been complaining to Dane County Airport officials about the poor organization at the airport. As a result the officials have decided that all information related to the airport should be organized using a DBMS and you've been hired to design the database. Your task is to organize the information about all the airplanes that are stationed and maintained at the airport. The relevant information is as follows

- Every airplane has a registration number and each airplane is of a specific Model.
- There are a number of airplane models accommodated at the airport and each one is identified by a model number (e.g. DC-10) and has a capacity and a weight.
- A number of technicians work at the airport. For each one, you need to store their name, SSN, address, phone number, and salary.
- Each technician is an expert on one or more plane models and his or her expertise may overlap with that of other technicians. This information about technicians must also be recorded.
- Traffic controllers must have an annual medical examination. For each traffic controller you must store the date of the most recent exam.
- All airport employees including technicians belong to a union. So for each employee you must store their union membership number. You can assume that each employee is uniquely identified by their social security number.
- The airport has a number of tests that are used periodically to ensure that airplanes are still airworthy. Each test has an FAA test number, a name and a maximum possible score.
- The FAA requires the airport to keep track of each time that a given airplane is tested by a given technician using a given test.
- For each testing event the information needed is the date, the number of hours the technician spent doing the test, and the score that the airplane received on the test.

Draw the corresponding ER diagram.

Problem 7: (8 points)

For each of the following statements, choose ONE answer among A,B,C,D. You will get 2 points for each correct answer, 0 point for each incorrect answer.

(1) Which of the following pairs represents a super class - subclass relationship?

- A. professors-students
- B. sons-daughters
- C. table-leg
- D. appliance-dishwasher

(2) What is NOT a good design principle in designing E-R models?

- A. simplify by limiting the number of relationships
- B. use redundancy in the model to prevent loss of data
- C. keeping the design faithful to the part of real world you're modeling
- D. avoid complexity such as introducing extra entities which will reduce errors and space usage

(3) How does one differentiate a relationship that refers to the same entity set multiple times?

- A. using multiplicities
- B. using indexes
- C. using roles
- D. using aggregations

(4) Which of the following is a foreign key of the PurchaseOrder table?

```
CREATE TABLE PurchaseOrder(pid int PRIMARY KEY,  
                             customerid int REFERENCES Customer(id),  
                             ordertime datetime,  
                             storename VARCHAR(255), UNIQUE KEYS(datetime));
```

- A. pid
- B. ordertime
- C. Customer
- D. customerid

Additional space

Additional space