CS585

Database Systems

Summer 2013

Exam I

Name: _____

Student ID: _____

	Maximum	Received
Problem 1	20	
Problem 2	15	
Problem 3	15	
Problem 4	15	
Problem 5	10	
Problem 6	15	
Problem 7	10	
Total	100	

1hr 50 minute exam. One 8.5X11 cheat sheet allowed.

1) 20 pts
Indicate whether each of the following statements is true or false (T/F):

F Views can only be used to read data from the database but not write to it

F ER diagram is not useful when designing an object relational database.

T Candidate key is a minimal superkey that uniquely identifies an entity.

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

F Triggers are useful tools to maintain data integrity

F Any ternary relationship can be reduced to two or three binary relationships

T Stored procedures can provide logical data independence

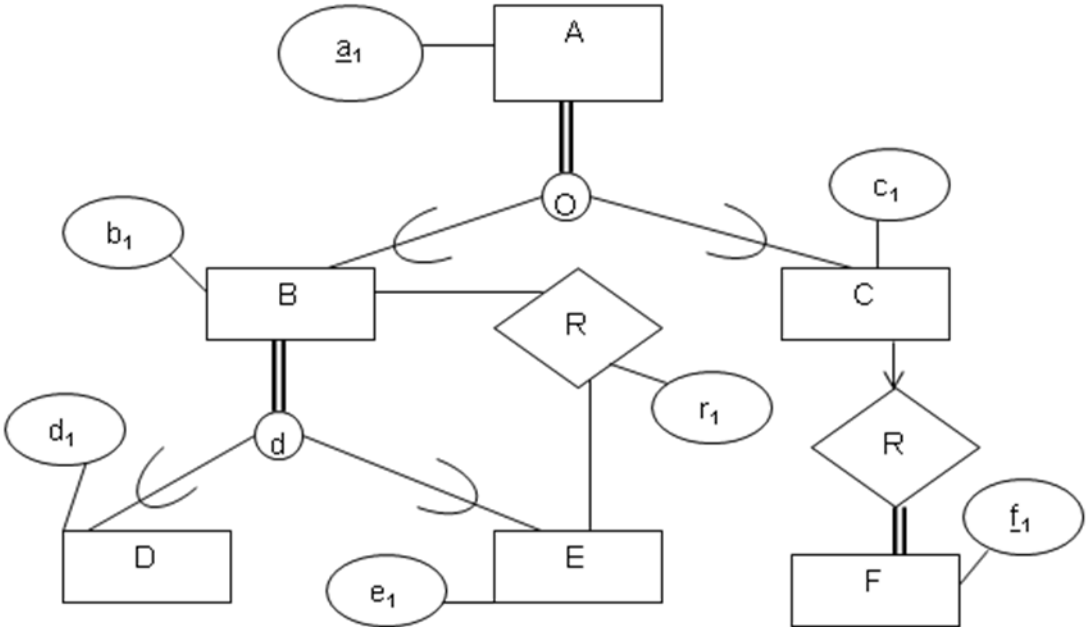
JDBC drivers are DBMS independent

F View is a mechanism that provides support for physical data independence

Code written in SQLJ is platform independent

2) 15 pts

Reduce the given EER diagram to relations using pure relational model (i.e., No Object Oriented or Object Relational). Be sure to identify all integrity constraints.



A(a1) Assertion: B.a1 ∪ C.a1=A.a1 and a1 is not null
B(a1,b1) a1 is FK references A
Assertion: D.a1 ∪ E.a1=B.a1 and D.a1 ∩ E.a1=空集
C(a1,c1) a1 is FK references A
D(a1,d1) a1 is FK references B
E(a1,e1) a1 is FK references B
R(a1,a11,r1) a1 is FK references B, a11 is FK references E
F_R(f1,a1) ai is FK references C

3) 15 pts
Consider the relational conceptual database schema below for keeping track of course registration of students:

COURSES (Code, Title, Dept)
Registered (Code, SSN)
STUDENTS (SSN, Name, Dept, GPA)

(a) Retrieve the name of each student who registered for the course titled "Database Systems".
SELECT S.name
FROM Students S, Courses C, Registered R
WHERE S.SSN=R.SSN AND R.Code=C.Code And C.Title='Database Systems'

(b) Retrieve the title of each course along with the number of students who registered for this course in descending order of registered student numbers.

```
SELECT C.Title, Count(R.ssn) AS Count
FROM Course C, Register R,
Where C.code=R.code
Group by C.code, C.Title
Order by Count DESC
```

(c) Retrieve the name of student(s) who have earned maximum GPA in every department that provides more than 30 courses.

```
Select S.name
From Student S
Where S.dept In
(select C.dept
Frome Course C
Group by C.dept
Having Count(C.code)>30)
AND
S.GPA>=
(select MAX(S.GPA)
From Student S1
Where S1.dept=S.dept)
```

4) 15 pts

Consider the following relational schema:

Emp (*eid:* integer, *ename:* string, *age:* integer, *salary:* real)
Works (*eid:* integer, *did:* integer)
Dept (*did:* integer, *dname:*, *managerid:* integer)

Write SQL code to create tables for Emp, Works, Dept such that Works has two foreign keys referring to Emp (*eid*) and Dept (*did*) respectively, and Dept has a foreign key (*managerid*) referring to Emp respectively. In addition, when a Dept tuple is deleted, all Works tuples referring to it should be deleted. When an Emp tuple is deleted, for all Dept tuples referring to it, the *managerid* should be set to null. Note *eid* is primary key for Emp, and *eid* and *did* together are primary key for Works. And *did* is the primary key for Dept.

```
Create table emp(
Eid integer,
Ename string,
Age integer,
Salary real
Primary key (eid),);

Create table works(
Eid integer,
Did integer,
```

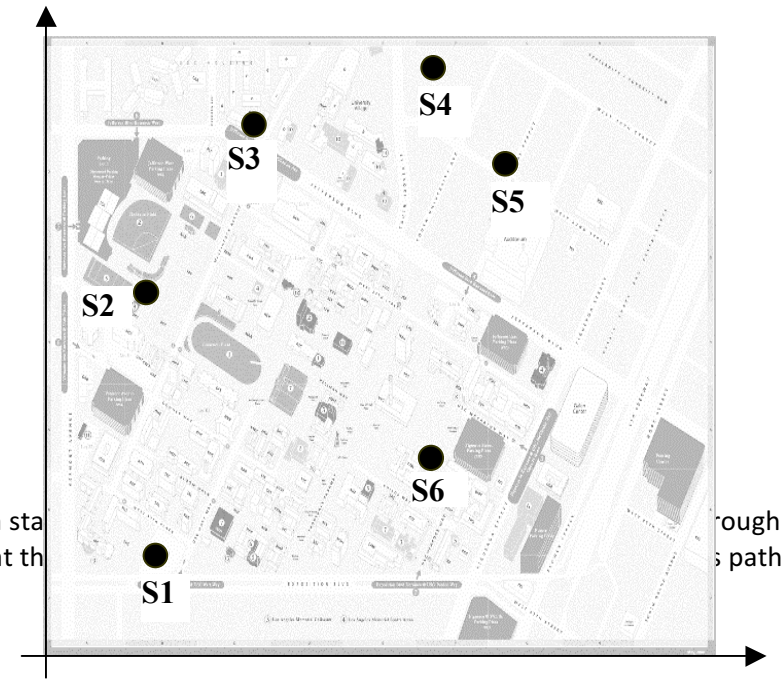
Primary key (eid,did),
Foreign key(eid) references emp,
Foreign key(did) references dept,
On delete cascade);

Create table dept(
Did integer,
Dname string,
Managerid integer,
Primary key (did),
Foreign key (managerid) references emp,
On delete set null)

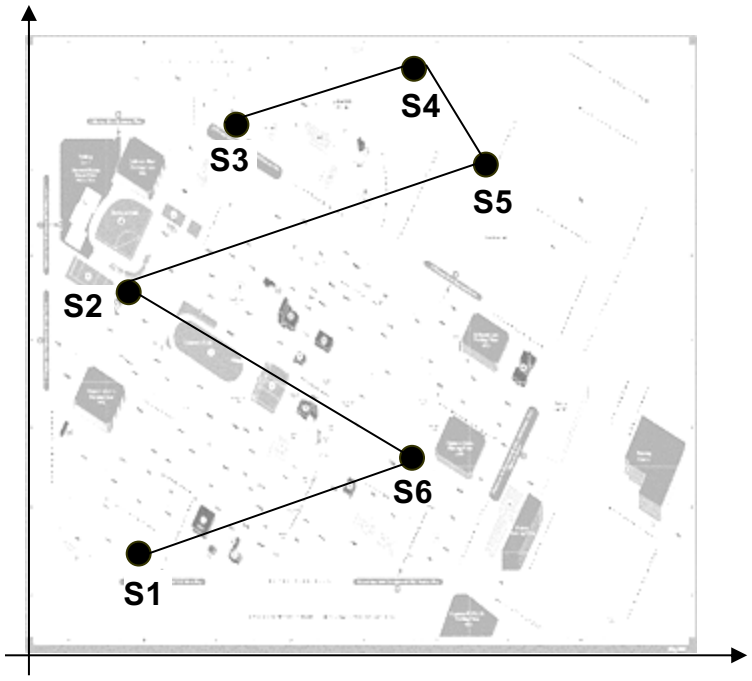
5) 10 pts

Consider the six Tram Stations shown in the following picture of USC campus.

(a) Build a PR Quadtree for these six points. (You do not need to draw the actual tree, just show the partitioning on the above figure)



(b) A Tram sta rough all the stations stops at th s path on the figure below.



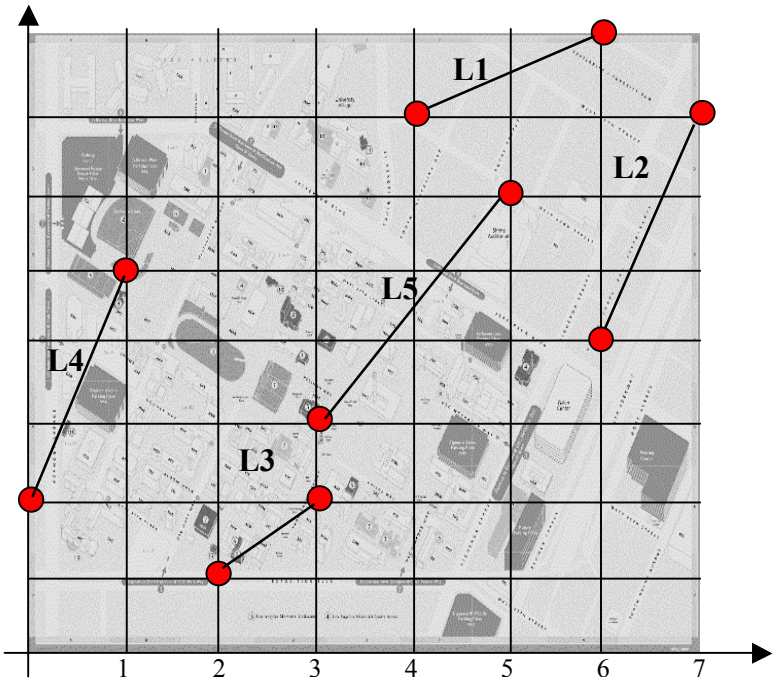
6) 15 pts

A road network is maintained in a spatial database as following:

Road ID	Road Segment
L1	(4, 7), (6, 8)
L2	(6,4), (7, 7)
L3	(2,1), (3, 2)
L4	(0, 2), (1, 5)
L5	(3, 3), (5, 6)

Assume that the roads are inserted in to the table with the ascending order of RoadID (i.e., L1, L2, L3, L4, L5). Also assume that (m,M)=(2,4).

Draw the R-Tree index generated for the above table after each insertion. In other words, you should draw five R-Trees. Use "Quadratic" method to split the R-Tree Nodes. You need to briefly describe what happens after each step. If you need to split a node, you should clearly and completely describe which line(s) you select to become the first element of each child node, and then which lines are added to each child node and why. You could use the following chart to draw the lines.



7) 10 pts

List two pros and two cons of each of the following database models: RDBMS, OODBMS and ORDBMS.

a) RDBMS pros

b) RDBMS cons

c) OODBMS Pros

d) OODBMS Cons

e) ORDBMS Pros

f) ORDBMS Cons

Additional space

Additional space