CS585 - Database Systems

Midterm Exam

Please Complete the Following:

| Name	
Student ID#	
Location (if remote)	

Duration: 1 hour and 15 minutes

Please look over the entire exam first,
You may not have enough time to finish the entire exam,
Select easy questions first, Don't Panic,
relax, and good luck!

Problem 1:
Indicate whether each of the following statement is true or false (T/F):

__ 1. The degree of a relationship set in ER model is the same as the cardinality of the relationship set.

__ 3. The higher level entity set in the specialization of EER model is called owner entity set.

__ 4. Easy implementation is the major advantage of 3-tier architecture over 2-tier architecture.

__ 5. In Oracle ORDBMS, a static method is invoked on object type, not on object instances.

__ 6. Assuming reduction to a pure relational model, the following EER schema can be represented by two relations without resulting in inconsistency.
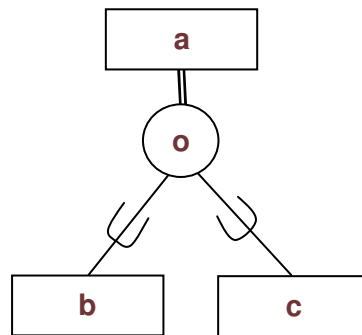
Problem 2

Consider the following SQL statements:
```sql
CREATE TYPE PointType AS OBJECT (
x NUMBER,
y NUMBER);
/
CREATE TYPE LineType AS OBJECT (
end1 PointType,
end2 PointType,
MAP MEMBER FUNCTION something1 RETURN NUMBER);
/
CREATE OR REPLACE TYPE BODY LineType AS
MAP MEMBER FUNCTION something1 RETURN NUMBER IS
BEGIN
RETURN SQRT((end1.x-end2.x)*(end1.x-end2.x) +
(end1.y-end2.y)*(end1.y-end2.y));
END;
END;
/
CREATE TABLE Lines of LineType;
INSERT INTO Lines
VALUES( LineType( PointType(3.0, 3.0), PointType(6.0, 7.0) ) );
INSERT INTO Lines
VALUES( LineType( PointType(0.0, 0.0), PointType(1.5, 2.0) ) );
INSERT INTO Lines
VALUES( LineType( PointType(0.0, 0.0), PointType(6.0, 8.0) ) );
```

a) What does the member function "something1" do?

b) What would be the result after running the following query?
SELECT * FROM lines L
ORDER BY VALUE(L);

Now, assume that we change our type definitions to:
CREATE TYPE PointType AS OBJECT (
x NUMBER,
y NUMBER);
/
CREATE TYPE LineType AS OBJECT (
end1 PointType,
end2 PointType,
ORDER MEMBER FUNCTION something2(line lineType)
RETURN INTEGER);
/
CREATE OR REPLACE TYPE BODY LineType AS
ORDER MEMBER FUNCTION something2(line lineType) RETURN
INTEGER IS
BEGIN
IF SQRT((end1.x-end2.x)*(end1.x-end2.x) +
(end1.y-end2.y)*(end1.y-end2.y)) >

```
SQRT((line.end1.x-line.end2.x)*(line.end1.x-line.end2.x) +
(line.end1.y-line.end2.y)*(line.end1.y-line.end2.y))
THEN
RETURN 1;
ELSIF SQRT((end1.x-end2.x)*(end1.x-end2.x) +
(end1.y-end2.y)*(end1.y-end2.y)) <
SQRT((line.end1.x-line.end2.x)*(line.end1.x-line.end2.x) +
(line.end1.y-line.end2.y)*(line.end1.y-line.end2.y))
THEN
RETURN -1;
ELSE RETURN 0;
END IF;
END;
END;
/
CREATE TABLE Lines of LineType;
INSERT INTO Lines
VALUES( LineType( PointType(0.0, 0.0), PointType(3.0, 4.0) ) );
INSERT INTO Lines
VALUES( LineType( PointType(3.0, 3.0), PointType(4.0, 5.0) ) );
INSERT INTO Lines
VALUES( LineType( PointType(0.0, 0.0), PointType(1.0, 1.0) ) );
INSERT INTO Lines
VALUES( LineType( PointType(0.0, 0.0), PointType(6.0, 8.0) ) );
```

c) What would be the result after running the following query?
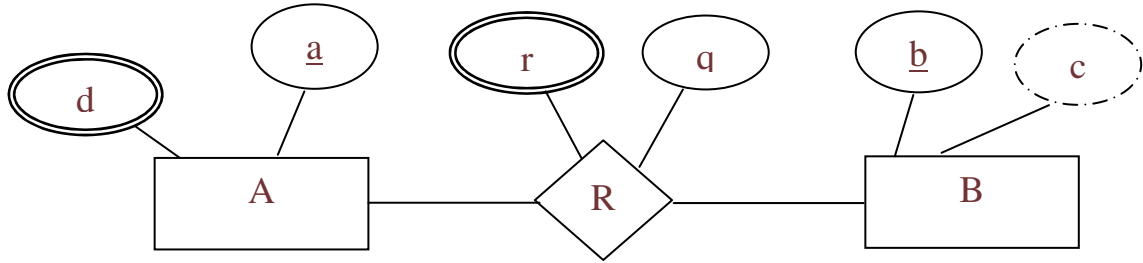
```
SELECT *
FROM lines L
WHERE VALUE(L) = (LineType(PointType(3.0,4.0),PointType(4.0, 6.0)));
```

d) What would be the result after running the following query?
SELECT MAX(VALUE(L))
FROM lines L;

Problem 3

(a). Consider the ER diagram below

(Note: c is a derived attribute)

Table: A

a	d

Table: R

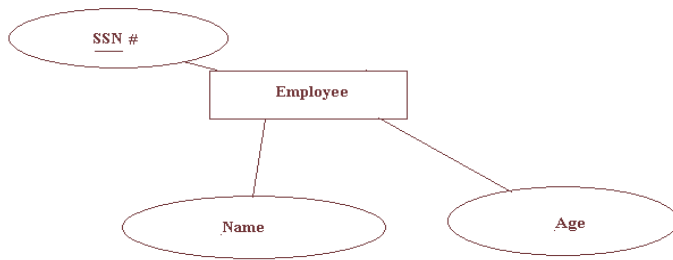| a	b	r	q

Table: B

b	c

(I). Is the given reduction to tables correct? If not, correct it.

(II). What is the primary key of the table corresponding to the relationship R?

(b). Consider the following entity set.

Assume each employee has a unique SSN# and a unique Name. Determine which of the following is a superkey and which is a candidate key and mark it.

	Super Key	Candidate Key
SSN#, Age		
SSN#, Name, Age		
Name		
Name, Age		
SSN#		
Age		

Problem 4:

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)

Here, COURSES contains a tuple for each course, recording its code, title, and department offering the course. STUDENTS records the SSN, name, home department, and GPA of the students. REGISTERED keeps the relation between courses and students.

(a) Retrieve the name of each student who registered in the course titled "Database Systems". (2 points)

(b) Retrieve the title of the course along with the number of students who registered in this course in the descending order of registered student number. (3 points)

(c) Retrieve the name of student(s) who earned the maximum GPA in each department that offers more than 30 courses. (3 points)

(Hint: You can use nested queries in the "FROM" clause of an SQL statement.)

(d) Describe what the following SQL statement does? (6 points)

```
SELECT UNIQUE(c.title)
FROM courses c, students s, registered r
WHERE r.code = c.code AND
 r.SSN = s.SSN AND
 c.code = (SELECT c1.code
           FROM courses c1, students s1, registered r1
           WHERE r1.code = c1.code AND r1.SSN = s1.SSN
           GROUP BY c1.code
           HAVING COUNT(c1.code) >= (SELECT MAX(COUNT(c2.code))
                                     FROM courses c2, students s2, registered r2
                                     WHERE r2.code = c2.code AND
                                           r2.SSN = s2.SSN AND
                                           c2.dept <> s2.dept
                                     GROUP BY c2.code) )
```

Problem 5

Reduce given ER diagram to relations using pure relational model (i.e., No Object Oriented or Object Relational). Be sure to identify all primary and foreign keys.
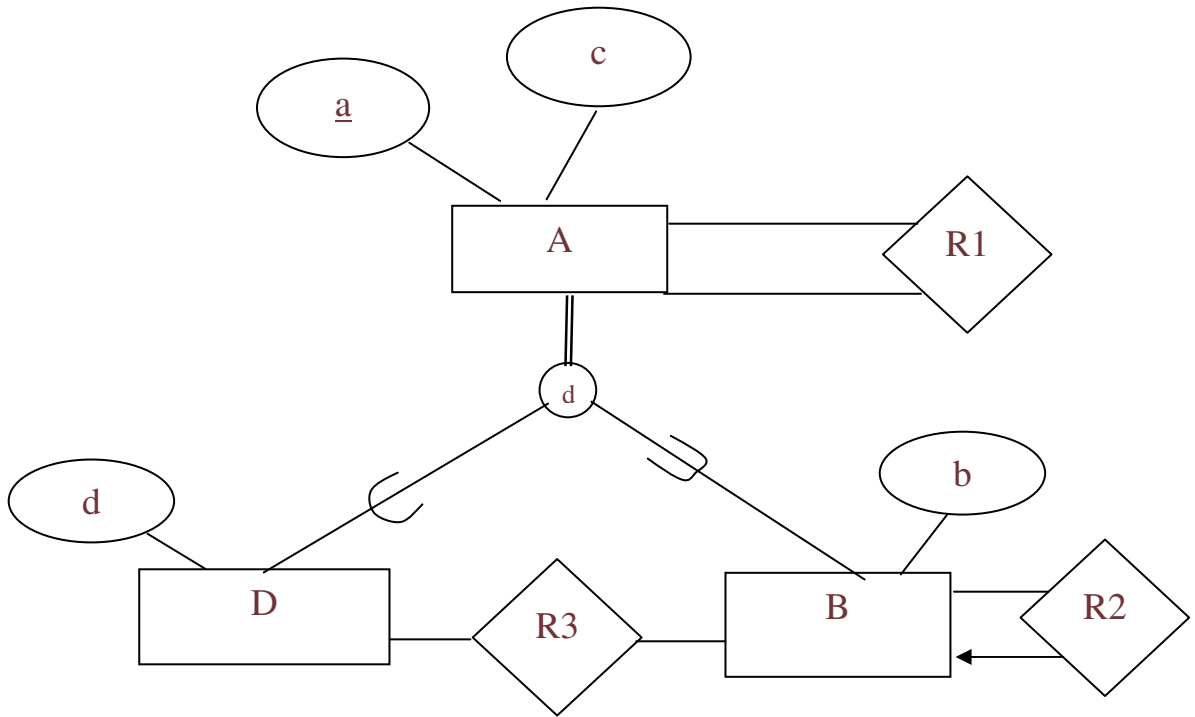
Problem 6

What are the requirements for using ODBC to make connection to a database, and what
are the advantages of using JDBC over ODBC?