King Saud University

College of Computer and Information Sciences

Department of Information Systems

Introduction to Database Systems (IS230)

First Semester 1438/1439 (Fall 2017)

Final Exam - Date: 12/12/2017

Exam Duration : 1.5 Hours

Total Points : 150 Points

Student Name: First, Middle, Last

Student ID Number:

Question Number	MCQ/25	Q2/25	Q3/50	Q4/50	Total /150
Student /Course Outcome	I / 1	I / 3	C / 3	C / 3	
Marks					

Course Learning Outcomes (CLOs) vs. Student Outcomes (SOs)

#	Course Learning Outcomes	Student Outcomes									
		A	B	C	D	E	F	G	H	I	J
1	Understand the basic concepts of database systems							x			x
2	Design a database with the Entity-Relationship model			x							
3	Use professionally Structured Query Language (SQL)		X							x	
4	Design the Database Schema of a database			x				x			
5	Normalize a Relational Database till the BCNF normal form		X	x				x			
6	Implement and evaluate a computer-based DB system to meet desired users' needs			x						x	x

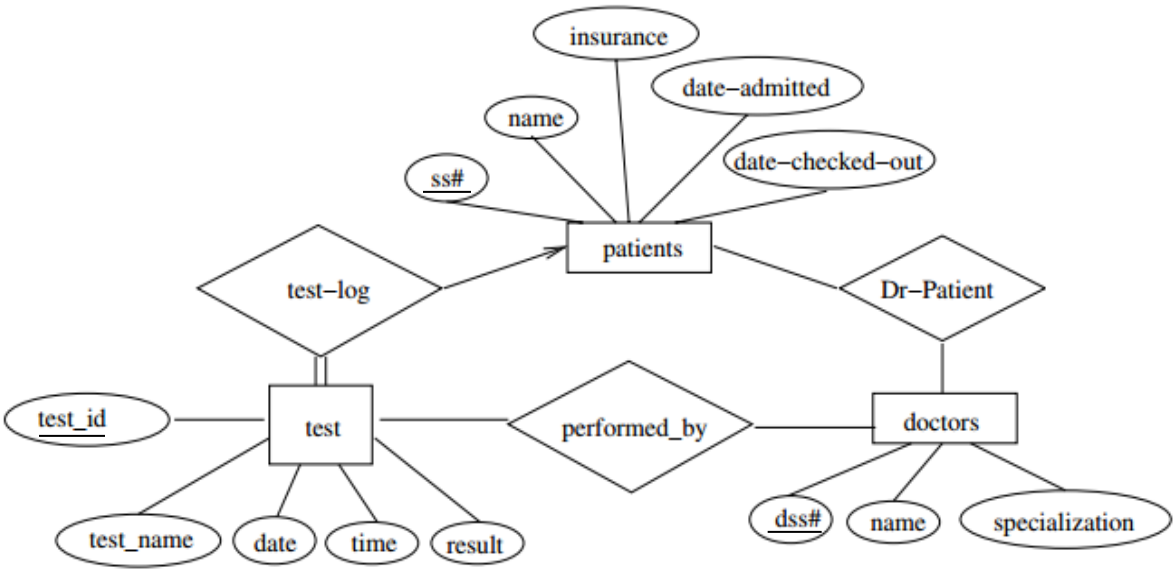
Student Outcome	Outcome Description
C	An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
I	An ability to use current techniques, skills, and tools necessary for computing practice

Question 1: SO- I (25 Points):

True/False questions. Write **T** (for True) or **F** (for False).	**T / F**
1. In SQL the NULL value means that the value of the attribute equals 0 (zero)	F
2. The following SQL query lists the cities with more than 10 customers: SELECT city FROM customer WHERE count(*)>10;	F
3. A view in SQL is a virtual table.	T
4 The following are equivalent: $\sigma_{b=3}$ (r x s) and SELECT b=3 FROM r, s;	F
5 The relational algebra expression $\Pi_{b, c}$ (A) selects the tuples of relation A with b and c.	F

Question 2: SO- I (25 points)

The following figure shows an ER Diagram for a database that used to keep track of hospital patients. Map this ER Diagram into a relational schema, and specify all primary keys and foreign keys.



Answer Model:

Patients (SS#, name, insurance, date-admitted, date-checked-out)
Test (test_id, testname, date, time, result, SS#)
Doctors (dss#, name, specialization)
Dr-Patient (patient-id, doctor-id)
Performed_by (test_id, dss#)

Question 3: SO- C (50 points)

Consider the following schema about a university database:

Student (**snum**, sname, major, level, age, gpa)
Class (**cname**, start_time, room, fid)
Enrolled (**snum, cname**)
Faculty (**fid**, fname, deptid)

Write the following queries in SQL. No duplicates should be printed in any of the answers.

1. Find the names of all Junior Student (level = JR) who are enrolled in a class taught by faculty John Smith.

```
SELECT DISTINCT S.Sname
FROM Student S, Class C, Enrolled E, Faculty F
WHERE S.snum = E.snum AND E.cname = C.name AND C.fid = F.fid AND F.fname = 'John Smith'
AND S.level = 'JR';
```

2. Find the age of the oldest student who is either a History major or is enrolled in a course taught by George Douglas.

```
SELECT MAX (S.age)
FROM Student S
WHERE (S.major = 'History')
OR S.num IN (SELECT E.snum
             FROM Class C, Enrolled E, Faculty F
             WHERE E.cname = C.name AND C.fid = F.fid AND F.fname = 'George Douglas');
```

3. For each major, print the major and the average gpa of students for that major.

```
SELECT major, AVG (gpa)
FROM Student
Group by major;
```

4. List the majors with average gpa of at least 3.5

```
SELECT major, AVG (gpa)
FROM Student
Group by major
Having avg (gpa) >= 3.5;
```

5. Find the names of all classes that either meet in room R128 or have five or more students enrolled.

```
SELECT C.name
FROM Class C
WHERE C.room = 'R128'
OR C.name IN (SELECT E.cname
              FROM Enrolled E
              GROUP BY E.cname
              HAVING COUNT (*) >= 5);
```

Question 4: SO-C (50 Points)

Consider the following **Sales** relational database schema below for managing sales and orders of customers. Primary key attributes are underlined.

```
Salesperson (sname, age, salary)
Order (cname, sname, amount)
Customer (cname, city, business_type)
```

Write the following queries in **relational algebra**:

1) Give an expression in relational algebra that is equivalent to the following SQL query.

```
SELECT SUM (amount) FROM order
WHERE cname IN (SELECT cname FROM customer
                WHERE business_type = "Computer");
```

$\mathcal{G}_{sum(amount)}$ (Order $\otimes$ $\sigma_{business\_type= \text{“Computer”}}$ (Customer))

$\otimes$: *denotes the natural join*

2) Get the names and salaries of salespersons having a salary between 12000 and 15000.

$\Pi_{sname,\ age}$ ($\sigma_{age>= 12000 \text{ and } age <=15000}$ (Salesperson))

3) What is the average amount of orders done by customers for each business type?

business_type $\mathcal{G}_{average(amount)}$ (order $\otimes$ customer)

4) Delete all customers from the city of ‘Jeddah’.

Customer $\leftarrow$ Customer – $\sigma_{city='Jeddah'}$ (Customer)

5) Give all salespersons with salaries less than 40000 a 15 percent salary raise and all others only a 10 percent raise.

salesperson $\leftarrow$ $\Pi_{sname,\ age,\ salary*1.10}$($\sigma_{Salary>=40000}$ (salesperson))

$\cup$ $\Pi_{sname,\ age,\ salary*1.15}$($\sigma_{Salary<40000}$ (salesperson))