	King Saud University College of Computer and Information Sciences Department of Information Systems **Introduction to Database Systems (IS230) (3-0-1)** **Second Semester 1439/1440 (Spring 2019)**	
	Second Midterm Exam – March 28, 2019	
	Total Points : 150 Points	
Student Name	**(Last, Middle, First)**	
	Student ID Number:	

Student Outcomes (SOs) Covered by Course

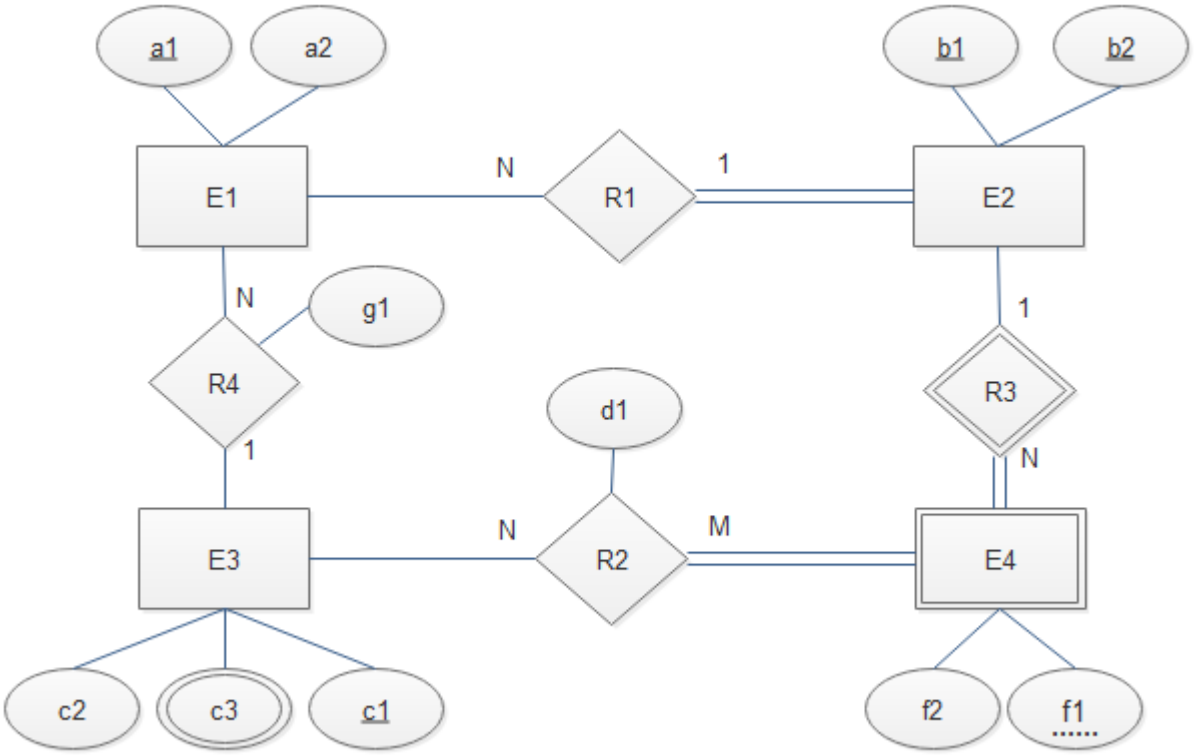
Outcome	Student Outcome Description	Coverage
(C)	An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs	√
(I)	An ability to use current techniques, skills, and tools necessary for computing practice.	√

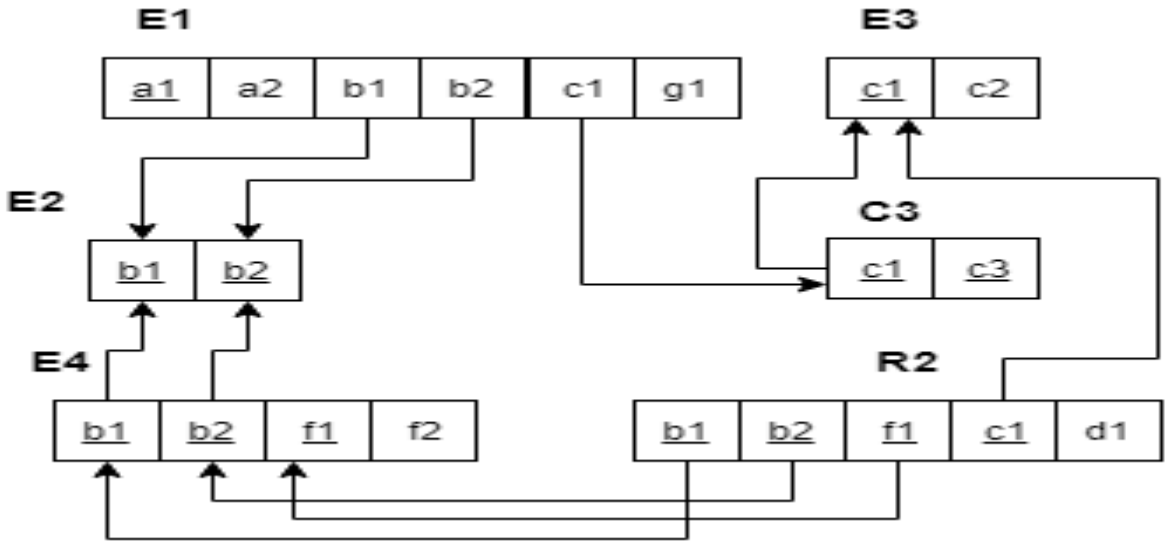
Course Learning Outcomes (CLOs) vs. Student Outcomes (SOs)

	Course Learning Outcomes	Student Outcomes	
		C	**I**
1	Express a query using Relational Algebra	x	
2	Design the Database Schema of a database	x	
3	Use professionally Structured Query Language (SQL)		x

For Instructor Use				
Question	**Q1**	**Q2**	**Q3**	**Total**
CLO covered	**1**	**3**	**2**	
SO covered	**C**	**I**	**C**	
Points	**40**	**50**	**60**	**150**
Score				

Q1) (SO-C) (40 Points): The following figure shows an ER Diagram for a database that used by ABC company. Map this ER Diagram into a relational database schema and specify all primary keys and foreign keys





Q2) **(SO-I)** (5**0 Points**) **Given the following database schema:**

person (driver-id#, name, address)

car (license, model, year)

accident (report-number, date, location)

owns (driver-id#, license)

participated (driver-id#, license, report-number, damage-amount)

a. Find the total number of people who owned cars that were involved in accidents in 2015.

```
Select count (distinct driver-id#)
From accident, participated
Where accident.report-number = participated.report-number
and date between '2015-01-01' and '2015-12-31';
```

b. Find the number of accidents in which the cars belonging to Ali Ahmed were involved.

```
Select count (distinct *)
From accident
Where exists
        (Select *
        From participated, person
        Where participated.driver-id = person.driver-id
        and person.name = 'Ali Ahmed'
        and accident.report-number = participated.report-number) ;
```

c. Retrieve all cars that have not involved in any accident.

```
(Select license From car)
Except
(Select license From participated) ;
```

d. Find the names of people whose all cars they owned were involved in accidents.

```
Select name
From person
Where Not Exist (       (Select license
                        From owns
                        Where person.driver-id = owns.driver-id)
                        Except
                        (Select license
                        From participated)      ) ;
```

e. For each driver who owns more than two cars, retrieve the driver name, address and the total numbers of cars he owns.

```
Select driver-id, name, address, count (*)
From Person, Own
Where Person.driver-id = Own.driver-id
Group by driver-id, name, address
Having count (*) > 2
```

f. Create a view of person details giving the driver number, driver name, address, and license .

```
CREATE VIEW ABC (driver-id#, name, address, license)
AS SELECT P.driver-id#, P.name, P.address, O.license
FROM Person P, Own O
WHERE P.driver-id = O.driver-id;
```

Q3-a) (20 Points) Consider the two following relations R1 and R2:

R1

A	B
1	a
3	e
5	d
4	a
2	a

R2

X		Y
2		a
4		c
7		a
3		d
5		d

Show the result of the following operations:

1) $\Pi_{R1.B}\ (\sigma_{R1.B='a'}\ (R1))$

B
a

2) R1 - R2

A	B
1	a
3	e
4	a

3) $\sigma_{R1.A>3}\ (R1 \bowtie_{R1.A = R2.X} R2)$ $\bowtie$ is the inner join

A	B	X	Y
4	a	4	c
5	d	5	d

4) $R1 \supset\!\bowtie_{R1.B = R2.Y} R2$

A	B	X	Y
1	a	2	a
1	a	7	a
5	d	3	d
5	d	5	d
4	a	2	a
4	a	7	a
2	a	2	a
2	a	7	a
3	e	Null	Null

Q3-b) (40 Points) Using the ACTOR_PLAY database schema and formulate the following queries in relational algebra.

Actor(**actor_id**, name, salary, year_born)

Play(**play_id**, title, author, year_written)

Role(**actor_id, play_id,** character_name)

1) Write a relational algebra query equivalent to the following SQL query

SELECT DISTINCT *

FROM Actor, Play, Role

Actor x Play x Role

2) List the actor names and the characters they have played for plays written after 2018

$\Pi_{\text{name, character\_name}} (\sigma_{\text{year\_written} > 2018} (\text{Actor} * \text{Play} * \text{Role}))$

3) List the average salary for each play

$_{\text{play\_id}}\, g_{\text{avg(salary)}} (\text{Actor} * \text{Role})$

4) List all actors who played in the plays “Sunlight” and “Moonlight”

$(\Pi_{\text{actor\_id, name, salary, year\_born}} (\sigma_{\text{title} = \text{“Sunlight”}} (\text{Actor} * \text{Play} * \text{Role}))$

$\cap (\Pi_{\text{actor\_id, name, salary, year\_born}} (\sigma_{\text{title} = \text{“Moonlight”}} (\text{Actor} * \text{Play} * \text{Role})))$

5) Find the year_written of play “Al Ayam” written by author “Taha Hussan ”.

$T1 \leftarrow (\sigma_{\text{title} = \text{“Al Ayam”} \text{ AND } \text{author} = \text{“Taha Hussan”}} (\text{Play}))$

$\text{Results} \leftarrow \Pi_{\text{Year-Written}}(T1)$

6) Find the names of actors who did not play the character name “Sindibad”

$T1 \leftarrow (\Pi_{\text{actor\_id, name, salary, year\_born}} (\sigma_{\text{character\_name} = \text{“Sindibad”}} (\text{Actor} * \text{Role})))$

$\text{RESULT} \leftarrow \Pi_{\text{name}} (\text{Actor} - T1)$

Good Luck and Best