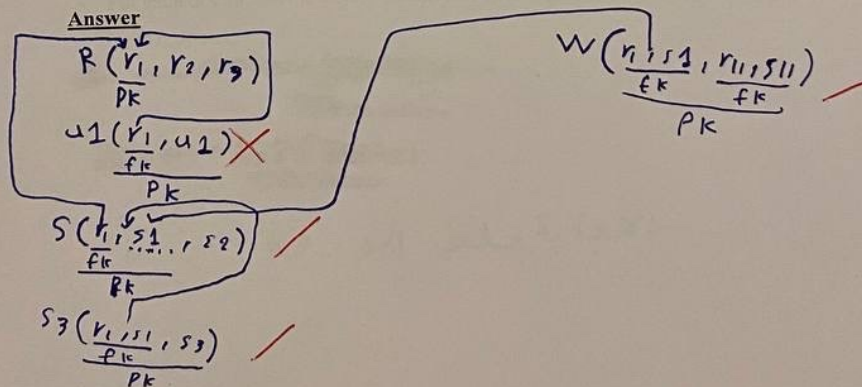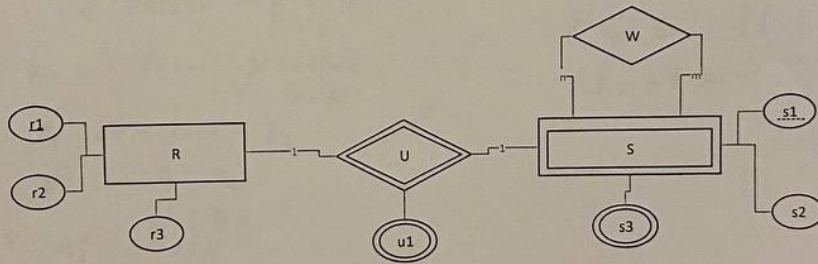# Question I

State whether each of the following statements is true (T) or false (F). If false, underline the false part and correct it to make the sentence a valid one. (2.5 points)

1. (___T___) The order of tuples in a relation is not important.

2. (___T___) Group functions in relational algebra do not ignore NULL values.

3. (___F___) The *project* operators commute. That is, $\pi_X(\pi_Y(R)) = \pi_Y(\pi_X(R))$, holds for

   every relation R and all sets of attributes X and Y.

4. (___T___) The result of A U B may have more tuples than the number of tuples in either

   A or B.

5. (___✗___) The union operation is not considered as one of the five basic operations in

   relational algebra.

Question II

Map the following ER diagram into a relational model schema diagram. Don't forget to use arrows to indicate references. (4 points)

Answer

$R(r_1, r_2, r_3)$
$\overline{Pk}$

$u1(r_1, u1)$ ✗
$\underline{fk}$
$\overline{Pk}$

$S(s_1, s1, s2)$
$\underline{fk}$
$\overline{Pk}$

$S3(r_1, s1, s_3)$
$\underline{fk}$
$\overline{Pk}$

$W(r_1, s1, r_{11}, s_{11})$
$\underline{fk}\quad\underline{fk}$
$\overline{Pk}$

3

Question III

Write in the relational algebra and in SQL the following queries. *(6.5 points)*

Consider the following relational database conceptual schema used to keep track of patient visits in a medical clinic. Note that a PERSON may be a doctor or a patient:

PERSON   (SSN, Name, DoB, Gender, PlaceOfBirth)
DOCTOR   (DSSN, Specialty)
PATIENT   (PSSN, InsuranceID, InsuranceProvider, MedicalRecordID)
MEDICALVISIT (Date, DSSN, PSSN, Diagnosis)

1. Find the name and gender of all doctors specializing in 'Dentistry'

$R_1 \leftarrow$ Person $\bowtie_{SSN=DSSN}$ Doctor

$R_2 \leftarrow \sigma_{Specialty\ Like\ \%Dentistry\%}(R_1)$

Result $\leftarrow \pi_{Name,\ Gender}(R_2)$

_____

SQL:

```
select Name, Gender
from Person innerjoin Doctor
where SSN = DSSN and specialty Like %Dentistry% ;
```

2. List the SSNs of PERSONs who are not doctors or patients.

$R_1 \leftarrow$ Person $\bowtie_{SSN=DSSN}$ Doctor

$R_2 \leftarrow$ Person $\bowtie_{SSN=PSSN}$ Patient

$A \leftarrow$ Person $- R_1$

$B \leftarrow A - R_2$

Result $\leftarrow \pi_{SSN}(B)$

السؤال SQL خلف الورقة

3. For each doctor, list the doctor's name and specialty and the total number of patients seen by that doctor.

الاجابة خلف الورقة

4

4. Get the number of female doctors.

$R_1 \leftarrow$ Person $\bowtie$ Doctor
$\qquad SSN = DSSN$

$R_2 \leftarrow \sigma_{Gender\ Like\ \%\ Female\ \%} (R_1)$

Result $\leftarrow f_{count\ SSN} (R_2)$

SQL: Select count(SSN)
$\qquad$ from Person InnerJoin Doctor
$\qquad$ where SSN = DSSN and Gender Like % Female % ;

5. Find the SSN of doctors specializing in 'Dentistry' who have seen patients on June 6 '15

~~$R \leftarrow$ Person $\bowtie$ Doctor~~
~~SSN = DSSN~~

~~$R \leftarrow$ Person $\bowtie$ Medical visit~~
~~SSN = PSSN~~

~~$R_2 \leftarrow R \bowtie Patient$~~
~~SSN = PSSN~~

~~$R_2 \leftarrow \bowtie Medical\ visit$~~

الاجابة خلف
الورقة

6. List the doctor who has the maximum number of patients

~~$R_1 \leftarrow$ Doctor~~ $R_1 \leftarrow$ Doctor $\bowtie$ Person
$\qquad\qquad\qquad$ DSSN = SSN

~~R_1~~ $R_1 \bowtie$ Medical visit
$R_2 \leftarrow$ DSSN = DSSN

$R_3 \leftarrow f_{max\ PSSN} (R_2)$

$\sigma (R_2)$

7. If the primary key were to be changed in MEDICALVISIT to (DSSN, PSSN), how would it affect the design of the database?

Some Patiants and Doctors may have null values

In date

5

Question IV

Consider the following relational schemas: R(A, B) T(B, C)   and their instances: *(2 points)*

R

A	B
a	b
a	c
c	d
b	e

T

B	C
b	e
d	h
b	f
a	d
a	e

What is the result of the following relational algebra expression:

$$\pi_{A,C} (R \bowtie T)$$

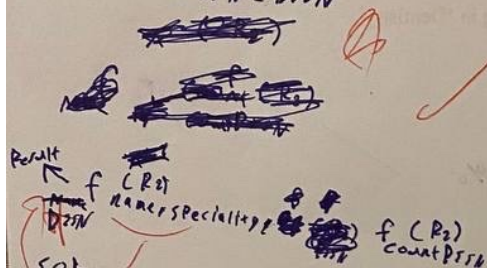| A	C			
a	e			
d	f			
a	null			
c	h			
b	null			

2

6

Q_2: SQL

(Select SSN
 from Person) Minus (Select DSSN from Doctor) Minus (Select PSSN from Patient);

Q_3:
RAL

$R_1 \leftarrow$ Person $\bowtie$ Doctor
$\qquad$ SSN = DSSN

$R_2 \leftarrow$ $R_1 \bowtie$ Medical Visit
$\qquad$ DSSN = DSSN

Result $\leftarrow$ f (R₂)
$\qquad$ Name, Specialty f (R₂)
DSSN $\qquad$ Count PSSN

SQL:

select DSSN, Name, Specialty, Count (PSSN)
from Person Inner Join Doctor Inner Join Medical Visit
where Person.SSN = DSSN and Doctor.DSSN = Medical Visit.DSSN
Group by (DSSN);

Q5:

RAL:

$R_1 \leftarrow \text{Person} \bowtie_{SSN = DSSN} \text{Doctor}$

$R_2 \leftarrow \sigma_{\text{Speacialty Like \% dentistry \%}} (R_1)$

$R_3 \leftarrow R_2 \bowtie_{DSSN = DSSN} \text{Medical Visit}$

$Ddoc \leftarrow \sigma_{\text{Date} = \text{June 6 '15}} (R_3)$

$P_1 \leftarrow \text{Person} \bowtie_{SSN = PSSN} \text{Patient}$

$P_2 \leftarrow P_1 \bowtie_{PSSN = PSSN} \text{Medical Visit}$

$Pat \leftarrow \sigma_{\text{Date} = \text{June 6 '15}} (P_2)$

$Res_1 \leftarrow Ddoc \;\widehat{=}\; pat$

$\pi_{DSSN} (Res_1)$

$\searrow$ Result

SQL:

```
Select DSSN
from Doctor inner Join Person inner Join Medical Visit
where SSN = Doctor.DSSN and Doctor.DSSN = Medical Visit.DSSN
and date = June'6'15
```