ASSIGNMENT 6 – These problems are to be done by hand.
Hand-write and scan in, or type your solutions where indicated on these pages.

In this assignment you will use the following tables (relations):

JUNIORS:

sid	sname	creditsSoFar	gpa
301	Adam	85	4
302	Betty	90	3.8
303	Charlie	95	3.9

SENIORS:

sid	sname	creditsSoFar	gpa
401	Debbie	120	3.9
402	Elaine	130	3.7
403	Frank	130	3.5
404	George	135	3.3

CLASSES:

cid	cname	ctype
501	465	CMPSC
502	202C	ENG
503	464	CMPSC
504	201	CMPSC
505	15	ENG
506	211	PHYS

TAKEN:

sid	cid	grade
302	502	A
302	501	A-
303	501	B+
401	501	B
401	506	B-
401	502	C+
404	503	D
404	501	F

SYMBOLS: σ (Selection) Π (Projection) $\bowtie$ (Join) ^ (And)

PROBLEM 1:

Using the given tables & data, show, in table form, the results of the following algebra query:

$$\Pi \text{ sid, gpa (SENIORS)}$$

ANSWER:

sid	gpa
401	3.9
402	3.7
403	3.5
404	3.3

What is the SQL statement you would use to do this?

ANSWER:

```
SELECT sid, gpa from SENIORS;
```

PROBLEM 2:

Using the given tables & data, show, in table form, the results of the following algebra query:

$$\Pi_{\text{creditsSoFar}}(\text{SENIORS})$$

ANSWER:

creditsSoFar
120
130
130
135

QUESTION: Do you have three rows or four? Why?
ANSWER:

4, because it's projecting columns from the SENIORS table.

What is the SQL statement you would use to do this?
ANSWER:

```
SELECT crededitsSoFar from SENIORS;
```

PROBLEM 3:

Show, in table form, the results of the following algebra query:

$$\text{JUNIORS} \cup \text{SENIORS}$$

ANSWER:

sid	sname	creditsSoFar	gpa
301	Adam	85	4
302	Betty	90	3.8
303	Charlie	95	3.9
401	Debbie	120	3.9
402	Elaine	130	3.7
403	Frank	130	3.5
404	George	135	3.3

What is the SQL statement you would use to do this?
ANSWER:

```
SELECT sid, sname, creditsSoFar, gpa FROM JUNIORS UNION SELECT sid, sname,
creditsSoFar, gpa from SENIORS;
```

PROBLEM 4:

Show, in table form, the results of the following algebra query:

$$\sigma_{\text{gpa} > 3.5}(\text{SENIORS})$$

ANSWER:

sid	sname	creditsSoFar	gpa
401	Debbie	120	3.9
402	Elaine	130	3.7

What is the SQL statement you would use to do this?

ANSWER:

```
SELECT S.sid, S.sname, S.creditsSoFar, S.gpa FROM SENIORS S WHERE S.gpa > 3.5;
```

PROBLEM 5:

Problem 5A:
Show, in table form, the results of the following algebra query:

$$\text{SENIORS} \bowtie_{\text{s.sid = t.sid}} \text{TAKEN}$$

ANSWER:

S.sid = T.sid	sname	creditsSoFar	gpa	cid	grade
401	Debbie	120	3.9	501	B
401	Debbie	120	3.9	506	B-
401	Debbie	120	3.9	502	C+
404	George	135	3.3	503	D
404	George	135	3.3	501	F

What is the SQL statement you would use to do this?
ANSWER:

```
SELECT * FROM SENIORS S, TAKEN T WHERE S.sid = T.sid;
```

Problem 5B:
Show, in table form, the results of the following algebra query:

$$\text{JUNIORS} \bowtie_{s.sid = t.sid} \text{TAKEN}$$

ANSWER:

S.sid = T.sid	sname	creditsSoFar	gpa	cid	grade
302	Betty	90	3.8	502	A
302	Betty	90	3.8	501	A-
303	Charlie	95	3.9	501	B+

What is the SQL statement you would use to do this?
ANSWER:

```
SELECT * FROM JUNIORS S, TAKEN T WHERE S.sid = T.sid;
```

PROBLEM 6:

Show, in table form, the results of the following algebra query:

SENIORS $\bowtie$ s.sid = t.sid TAKEN
UNION
JUNIORS $\bowtie$ s.sid = t.sid TAKEN

ANSWER:

S.sid = T.sid	sname	creditsSoFar	gpa	cid	grade
401	Debbie	120	3.9	501	B
401	Debbie	120	3.9	506	B-
401	Debbie	120	3.9	502	C+
404	George	135	3.3	503	D
404	George	135	3.3	501	F
302	Betty	90	3.8	502	A
302	Betty	90	3.8	501	A-
303	Charlie	95	3.9	501	B+

What is the SQL statement you would use to do this?
ANSWER:

```
SELECT * FROM SENIORS S, TAKEN T WHERE S.sid = T.sid UNION SELECT * FROM
JUNIORS S, TAKEN T WHERE S.sid = T.sid;
```

PROBLEM 7:

Write the algebra query for this statement: Find the names of students who have taken the course with the id number of 502.
ANSWER:

$$\Pi_{sname}\ (\sigma_{t.cid=502}\ (SENIORS \bowtie TAKEN))$$
$$\cup$$
$$\Pi_{sname}\ (\sigma_{t.cid=502}\ (JUNIORS \bowtie TAKEN))$$

Show the results in tabular form:
ANSWER:

```
+--------+
| sname  |
+--------+
| Debbie |
| Betty  |
+--------+
```

What is the SQL statement you would use to do this?
ANSWER:

```
SELECT S.sname FROM SENIORS S, TAKEN T WHERE T.cid = 502 UNION SELECT S.sname
FROM JUNIORS J, TAKEN T WHERE T.cid = 502;
```

1 point extra credit: Can you think of a different way to do this (just switching order does not count):

ALTERNATIVE ANSWER:

Nested Queries ?

```
SELECT S.sname FROM SENIOR S, TAKEN T WHERE T.cid = 502 AND T.cid IN (SELECT
S2.sname FROM JUNIORS S2, TAKEN T2 WHERE T2.cid = 502);
```

PROBLEM 8:

Write the algebra query for this statement: Find the names of students who have taken CMPSC 465.

ANSWER:

$\Pi_{sname}\ (\sigma_{ctype=CMPSC\ \wedge\ cname\ =\ 465}(CLASSES \bowtie TAKEN \bowtie (JUNIOR\ U\ SENIOR)))$

Show the results in tabular form:
ANSWER:

```
+--------+
| sname  |
+--------+
| Betty  |
| Charlie|
| Debbie |
| George |
+--------+
```

What is the SQL statement you would use to do this?
ANSWER:

```
SELECT sname FROM (( SELECT * FROM JUNIOR UNION SELECT * FROM SENIOR) NATURAL JOIN CLASSES NATURAL JOIN TAKEN) WHERE ctype = CMPSC AND cname = 465;
```

Note: Not sure about this.

PROBLEM 9:

Write the algebra query for this statement: Find the courses (e.g., ENGL 202C) taken by anyone with a GPA greater than or equal to 3.9

ANSWER:

$\Pi_{ctype,cname}\ (\sigma_{gpa >= 3.9}$ (JUNIOR U SENIOR) ⋈ CLASSES ⋈ TAKEN)

Show the results in tabular form:
ANSWER:

ctype	cname
CMPSC	465
PHYS	211

What is the SQL statement you would use to do this?
ANSWER:

```
SELECT ctype, cname FROM (( SELECT * FROM JUNIOR) UNION ( SELECT * FROM
SENIOR) NATURAL JOIN (CLASSES NATURAL JOIN TAKEN)) WHERE gpa >= 3.9;
```

PROBLEM 10:

Write the algebra query for this statement: Find the name of all students who have taken at least one class.

ANSWER:

Π_{sname} (TAKEN ⋈ (JUNIOR U SENIOR))

Show the results in tabular form:
ANSWER:

```
+--------+
| sname  |
+--------+
| Betty  |
| Charlie|
| Debbie |
| George |
+--------+
```

What is the SQL statement you would use to do this?
ANSWER:

```
SELECT sname FROM ( SELECT * FROM JUNIOR UNION SELECT * FROM SENIOR NATURAL
JOIN TAKEN);
```

ONE POINT EXTRA CREDIT - PROBLEM 11:

Write the algebra query for this statement: Find the name of students who have taken at least one of ENG 202C, PHYS 211.

ANSWER:

$$\Pi_{sname}\ (\sigma_{ctype = PHYS\ \wedge\ cname = 211\ \vee\ ctype = ENG\ \wedge\ cname = 202C}(\ TAKEN \bowtie CLASSES \bowtie (JUNIOR\ \cup\ SENIOR)))$$

Show the results in tabular form:
ANSWER:

sname
Betty
Debbie

What is the SQL statement you would use to do this?
ANSWER:

```
SELECT sname FROM ( SELECT * FROM JUNIOR UNION SELECT * FROM SENIOR NATURAL
JOIN TAKEN NATURAL JOIN CLASSES) WHERE (ctype = PHYS AND cname = 211) OR
(ctype = ENG AND cname = 202C);
```

Note: Not sure about this either.