Database schema for the exercise

- Professor(ssn, profname, status, salary)
- Course(crscode, crsname, credits)
- Taught(crscode, semester, ssn)

Assumption: (1) Each course has only one instructor in each semester; (2) all professors have different salaries; (3) all professors have different names; (4) all courses have different names; (5) status can take values from "Full", "Associate", and "Assistant".

1. Find those professors who have taught 'C1' but have never 'C2'.
   ANS: (101 Mr. Sham Sundar)
   $T\{101,104\} - T\{102,104\} = \{101\}$
   $\pi_{ssn}(\sigma_{ccode='C1'}(Taught)) - \pi_{ssn}(\sigma_{ccode='C2'}(Taught))$
   (SELECT ssn
   From Taught
   Where ccode = 'C1')
   EXCEPT
   (SELECT ssn
   From Taught
   Where ccode = 'C2'))

2. Find those professors who have taught both 'C2' and 'C3'.
   $T\{102,103\} \cap T\{102\}=$ {Mrs. Sarita Goyal, Mr. Manish Roy} $\cap$ { Mrs. Sarita Goyal}
   $\pi_{ssn}(\sigma_{ccode='C2' \wedge crscode='C3'}$ (Taught), wrong!
   $\pi_{ssn}(\sigma_{ccode='C2'}(Taught)) \cap \pi_{ssn}(\sigma_{ccode='C3'}(Taught))$, correct!
   SELECT T1.ssn
   From Taught T1, Taught T2,
   Where T1.crscode = 'CSC6710' AND T2.crscode='CSC7710' AND T1.ssn=T2.ssn

3. Find those professors who have never taught 'C2'.
   $P\{101,102,103,104,105\} - T\{102,103\} = \{101,104,105\}$
   $\pi_{ssn}(\sigma_{ccode<>'C2'}(Taught))$, wrong answer→{101,104} and not 105
   $\pi_{ssn}(Professor)-\pi_{ssn}(\sigma_{ccode='C2'}(Taught))$, correct answer!

(SELECT ssn
From Professor)
EXCEPT
(SELECT ssn
From Taught T
Where T.crscode = 'CSC7710')

4. Find those professors who taught 'C2' and 'C3' in the same semester.

T1.ccode	T1.sem	T1.ssn	T2.ccode	T2.sem	T2.ssn
C3	**O2009**	102	C2	**O2009**	102
C3	O2009	102	C2	E2009	103
C3	O2009	102	C2	E2009	104

$\pi_{ssn}(\sigma_{T1.ccode='C2' \wedge T2.ccode='C3' \wedge T1.ssn = T2.ssn \wedge T1.sem = T2.sem}$ (Taught T1 X Taught T2))

SELECT T1.ssn
From Taught T1, Taught T2,
Where T1.crscode = 'CSC6710' AND T2.crscode='CSC7710' AND T1.ssn=T2.ssn AND T1.semester=T2.semester

5. Find those professors who taught 'C1' or 'C2' but not both.

{101,102,103,104} - {104}

$\pi_{ssn}(\sigma_{crscode='C1' \vee crscode='C2'}(Taught))$ -

$(\pi_{ssn}(\sigma_{crscode='C1'}(Taught)) \cap \pi_{ssn}(\sigma_{crscode='C2'}(Taught)))$

(SELECT ssn
FROM Taught T
WHERE T.crscode='CSC6710' OR T.crscode='CSC7710')
Except
(SELECT T1.ssn
From Taught T1, Taught T2,
Where T1.crscode = 'CSC6710') AND T2.crscode='CSC7710' AND T1.ssn=T2.ssn)

6. Find those courses that have never been taught.

$\pi_{ccode}(Course) - \pi_{ccode}(Taught)$

```
(SELECT crscode
FROM Course)
EXCEPT
(SELECT distinct crscode
FROM TAUGHT)
```

7. Find those courses that have been taught at least in two semesters.

T1.ccode	**T1.sem**	**T1.ssn**	**T2.ccode**	**T2.sem**	**T2.ssn**
C1	O2010	101	C1	E2010	101
C1	O2010	101	C1	O2009	104
C1	E2010	101	C1	O2009	104
C2	O2009	102	C2	E2009	103
C2	O2009	102	C2	E2009	104

$\pi_{ssn}(\sigma_{T1.ccode = T2.ccode \wedge T1.sem <> T2.sem}$ (Taught T1 X Taught T2))

or

$\pi_{ssn}(\sigma_{T1.sem <> T2.sem}$ (Taught T1 |X| Taught T2))

```
SELECT T1.crscode
FROM Taught T1, Taught T2
WHERE T1.crscode=T2.crscode AND T1.semester <> T2.semester
```

8. Find the names of professors who ever taught 'C3'.
   {Mrs. Sarita Goyal}

$\pi_{profname}(\sigma_{ccode='c3'}(Taught)$ |X| Professor)

```
SELECT P.profname
FROM Professor P, Taught  T
WHERE P.ssn = T.ssn AND T.crscode = 'CSC6710'
```

9. Find the names of Assistant Professors who ever taught 'C2'.
   {Mrs. Bhoomi Desai}

$\pi_{profname}(\sigma_{ccode='C2'}(Taught)$ |X| $\sigma_{post='AP'}(Professor))$

```
SELECT P.profname
FROM Professor P, Taught  T
WHERE P.post = 'AP' AND P.ssn = T.ssn AND T.crscode = 'CSC6710'
```

10. Find the names of full time professors who ever taught at least two courses in one semester.
    { Mrs. Sarita Goyal with C2 and C3}

$\pi_{profname}(\pi_{ssn}(\sigma_{T1.code <> T2.ccode \wedge T1.ssn = T2.ssn \wedge T1.sem = T2.sem}$ (Taught T1 |X| Taught T2))) |X| $\sigma_{post='P'}$(Professor))

```
SELECT P.profname
FROM Professor P, Taught T1, Taught T2
WHERE P.status = 'Full' AND P.ssn = T1.ssn AND T1.ssn = T2.ssn
AND T1.crscode <> T2.crscode AND T1.semester = T2.semester
```

11. List all the course names that professor 'Mrs. Bhoomi Desai' taught in Even sem of 2009.
    {C2 and C4 i.e OS and PLCC}

$\pi_{cname}(\sigma_{profname='Bhoomi'}$(Professor) |X| $\sigma_{semester='E2009'}$(Taught) |X| Course)

```
SELECT crsname
FROM Professor P, Taught T, Course C
WHERE P.profname = 'Smith' AND P.ssn = T.ssn AND T.semester = 'F2007' AND T.crscode =
C.crscode
```

12. List those courses that have been taught ONLY by Assistant professors.

$\pi_{crscode}$(Course) - $\pi_{crscode}$ ($\sigma_{post <> 'AP'}$(Professor) |X| Taught)

```
SELECT crscode
FROM  Course C
WHERE c.crscode NOT IN(
     (SELECT crscode
      FROM Taught T, Professor P
      WHERE T.ssn = P.ssn AND P.status!='AP')
```