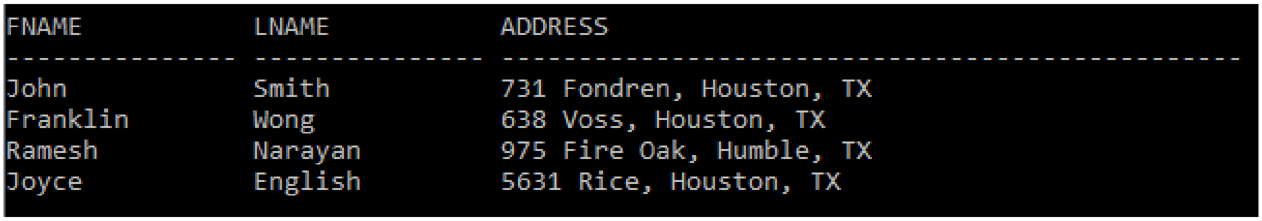
Assignment 2 Key

8.15 Show the result of each of the sample queries in Section 8.5 as it would apply

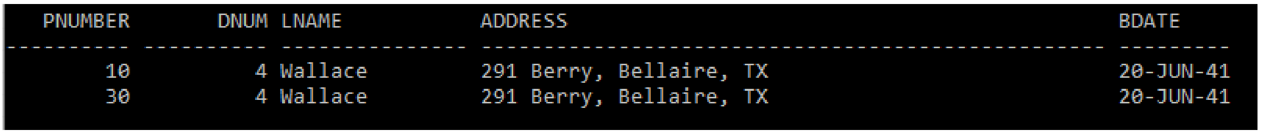
to the database state in Figure 5.6

Q1. Find the name and address of all employees who work for the 'Research' department.



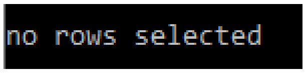
```
FNAME           LNAME           ADDRESS
--------------- --------------- ------------------------------------------------
John            Smith           731 Fondren, Houston, TX
Franklin        Wong            638 Voss, Houston, TX
Ramesh          Narayan         975 Fire Oak, Humble, TX
Joyce           English         5631 Rice, Houston, TX
```

Q2. For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birth date.



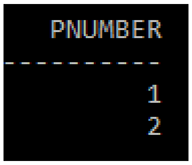
```
   PNUMBER       DNUM LNAME           ADDRESS                                                BDATE
---------- ---------- --------------- -------------------------------------------------- ---------
        10          4 Wallace         291 Berry, Bellaire, TX                            20-JUN-41
        30          4 Wallace         291 Berry, Bellaire, TX                            20-JUN-41
```

Q3. Find the names of all employees who work on all the projects controlled by department number 5.



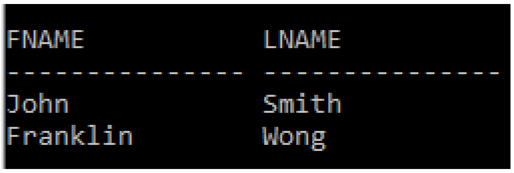
```
no rows selected
```

Q4. Make a list of project numbers for projects that involve an employee whose last name is 'Smith' as a worker or as a manager of the department that controls the project.



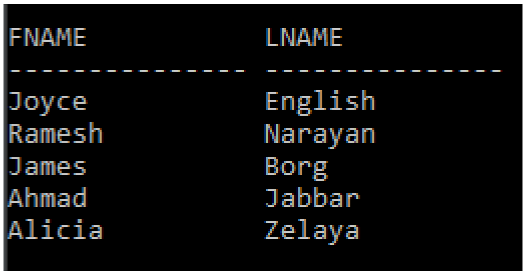
```
   PNUMBER
----------
         1
         2
```

Q5. List the names of all employees with two or more dependents.



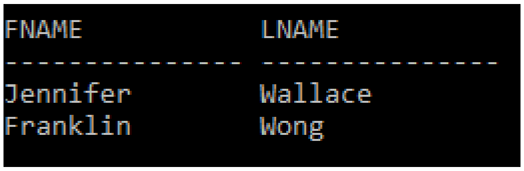
```
FNAME           LNAME
--------------- ---------------
John            Smith
Franklin        Wong
```

Q6. List the names of employees who have no dependents.



```
FNAME           LNAME
--------------- ---------------
Joyce           English
Ramesh          Narayan
James           Borg
Ahmad           Jabbar
Alicia          Zelaya
```

Q7. List the names of managers who have at least one dependent.



```
FNAME           LNAME
--------------- ---------------
Jennifer        Wallace
Franklin        Wong
```

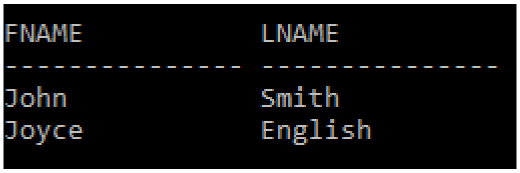
8.16

a. Retrieve the names of all employees in department 5 who work more than 10 hours per week on the ProductX project.

$\text{WORK\_X} \leftarrow (\sigma_{\text{PNAME='ProductX'}}\ (\text{PROJECT})) \bowtie_{\text{PNUMBER=PNO}} (\text{WORKS\_ON})$

$\text{WORK\_10} \leftarrow (\text{EMPLOYEE}) \bowtie_{\text{SSN=ESSN}} (\sigma_{\text{HOURS>10}}\ (\text{WORK\_X}))$

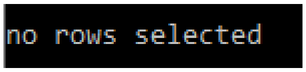
$\text{RESULT} \leftarrow \pi_{\text{FNAME, LNAME}}\ (\sigma_{\text{DNO=5}}\ (\text{WORK\_10}))$



```
FNAME           LNAME
--------------- ---------------
John            Smith
Joyce           English
```

b. List the names of all employees who have a dependent with the same first name as themselves.

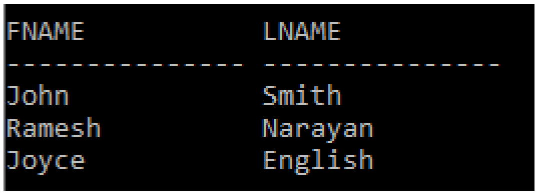
$\pi_{\text{FNAME, LNAME}}\ ((\text{EMPLOYEE}) \bowtie_{\text{SSN=ESSN AND FNAME=DEPENDENT\_NAME}} (\text{DEPENDENT}))$



```
no rows selected
```

c. Find the names of all employees who are directly supervised by 'Franklin Wong'.

$\pi_{\text{FNAME, LNAME}}\ ((\text{EMPLOYEE}) \bowtie_{\text{SUPERSSN=SSN}} (\pi_{\text{SSN}}\ (\sigma_{\text{FNAME='Franklin' AND LNAME='Wong'}}\ (\text{EMPLOYEE}))))$



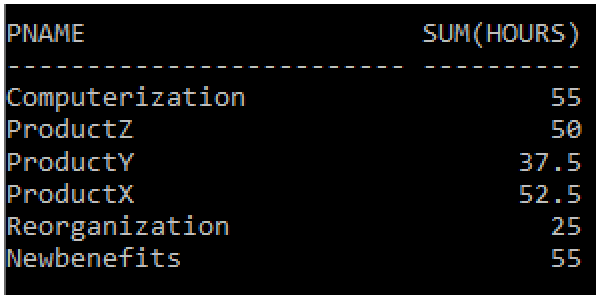
```
FNAME           LNAME
--------------- ---------------
John            Smith
Ramesh          Narayan
Joyce           English
```

d. For each project, list the project name and the total hours per week (by all employees) spent on that project.

$\text{PROJ\_HOURS (PNO, TOTAL\_HRS)} \leftarrow {}_{\text{PNO}}\mathfrak{I}_{\text{SUM(HOURS)}}\ (\text{WORKS\_ON})$

$\text{RESULT} \leftarrow \pi_{\text{PNAME, TOTAL\_HRS}}\ ((\text{PROJ\_HOURS}) \bowtie_{\text{PNO=PNUMBER}} (\text{PROJECT}))$

* You can use operations like count, sum, average, max, min etc. Usage: ${}_{G}\mathfrak{I}_{\text{Aggregate-function}}(A)$, you can see an example in above solution.



```
PNAME                     SUM(HOURS)
------------------------- ----------
Computerization                   55
ProductZ                          50
ProductY                        37.5
ProductX                        52.5
Reorganization                    25
Newbenefits                       55
```

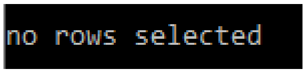
e. Retrieve the names of all employees who work on every project.

PE (PNO, SSN) $\leftarrow \pi_{PNO, ESSN}$ (WORKS_ON)

ALL_PROJECTS(PNO) $\leftarrow \pi_{PNUMBER}$ (PROJECT)

EMPS_ALL_PROJS $\leftarrow$ PE $\div$ ALL_PROJECTS

RESULT $\leftarrow \pi_{FNAME, LNAME}$ (EMPLOYEE * EMP_ALL_PROJS)

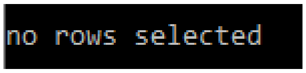


```
no rows selected
```

f. Retrieve the names of all employees who do not work on any project.

NON_WORKING $\leftarrow$ (π_{SSN} (EMPLOYEE)) – (π_{ESSN} (WORKS_ON))

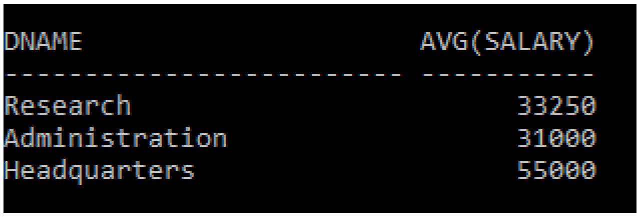
RESULT $\leftarrow \pi_{FNAME, LNAME}$ (EMPLOYEE * NON_WORKING)



```
no rows selected
```

g. For each department, retrieve the department name and the average salary of all employees working in that department.

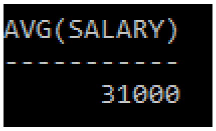
$\pi_{DNAME, AVG}$ (($_{DNAME} \Im_{AVG (SALARY)}$ (EMPLOYEE)) $\bowtie_{DNO=DNUMBER}$ (DEPARTMENT))



```
DNAME                     AVG(SALARY)
------------------------- -----------
Research                        33250
Administration                  31000
Headquarters                    55000
```

h. Retrieve the average salary of all female employees.

$\Im_{AVG (SALARY)}$ ($\sigma_{SEX='F'}$ (EMPLOYEE)))



```
AVG(SALARY)
-----------
      31000
```

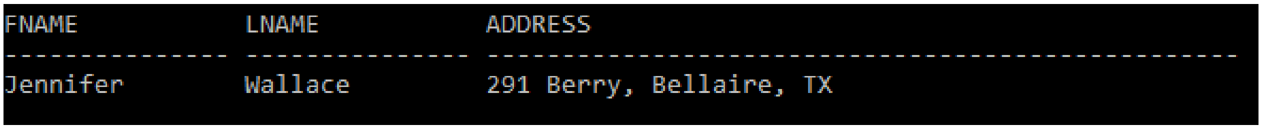
i. Find the names and addresses of all employees who work on at least one project located in Houston but whose department has no location in Houston.

$\text{HOUSTON\_PROJS(SSN)} \leftarrow \pi_{\text{ESSN}} \text{ (WORKS\_ON } \bowtie_{\text{PNO=PNUMBER}} \text{ (}\sigma_{\text{PLOCATION='Houston'}} \text{ (PROJECT)))}$

$\text{NO\_HOUST\_DEPS} \leftarrow \pi_{\text{DNUMBER}} \text{ (DEPARTMENT) - } \pi_{\text{DNUMBER}} \text{ (}\sigma_{\text{DLOCATION='Houston'}} \text{ (DEPARTMENT))}$

$\text{NO\_HOUST\_EMP\_DEPS} \leftarrow \pi_{\text{SSN}} \text{ (EMPLOYEE } \bowtie_{\text{DNO=DNUMBER}} \text{ (NO\_HOUST\_DEPS))}$

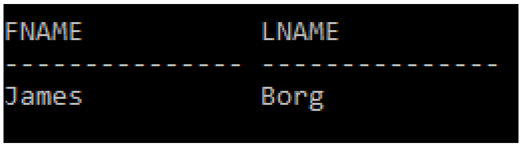
$\text{RESULT} \leftarrow \pi_{\text{FNAME, LNAME, ADDRESS}} \text{ (EMPLOYEE * (HOUSTON\_PROJS - NO\_HOUST\_EMP\_DEPS))}$



```
FNAME           LNAME           ADDRESS
--------------- --------------- ---------------------------------------------
Jennifer        Wallace         291 Berry, Bellaire, TX
```

j. List the last names of all department managers who have no dependents.

$\pi_{\text{FNAME, LNAME}} \text{ (EMPLOYEE * (}\pi_{\text{MGRSSN}} \text{ (DEPARTMENT) - } \pi_{\text{ESSN}} \text{ (DEPENDENT)))}$



```
FNAME           LNAME
--------------- ---------------
James           Borg
```

8.17

a. For each flight, list the flight number, the departure airport for the first leg of the flight, and the arrival airport for the last leg of the flight.

$\text{DEP <- } \pi_{\text{Flight\_number, Dep\_airport\_code}}(_{\text{Flight\_number}} \Im_{\text{MIN(Leg\_number)}}\text{(FLIGHT\_LEG)) * FLIGHT\_LEG}$

$\text{ARR <- } \pi_{\text{Flight\_number, Arr\_airport\_code}}(_{\text{Flight\_number}} \Im_{\text{MAX(Leg\_number)}}\text{(FLIGHT\_LEG)) * FLIGHT\_LEG}$

$\text{RESULT <- DEP * ARR}$

b. List the flight numbers and weekdays of all flights or flight legs that depart from Houston Intercontinental Airport (airport code ‘iah’) and arrive in Los Angeles International Airport (airport code ‘lax’).

$\pi_{\text{Flight\_number, Weekdays}} \text{ ((}\sigma_{\text{Dep\_airport\_code= ‘iah’}}\text{(FLIGHT\_LEG) * } \sigma_{\text{Arr\_airport\_code= ‘lax’}}\text{(FLIGHT\_LEG)) *FLIGHT)}$

c. List the flight number, departure airport code, scheduled departure time, arrival airport code, scheduled arrival time, and weekdays of all flights or flight legs that depart from some airport in the city of Houston and arrive at some airport in the city of Los Angeles.

$\text{HOUSTON\_LA <- } \sigma_{\text{Dep\_airport\_code= ‘iah’}}\text{(FLIGHT\_LEG) * } \sigma_{\text{Arr\_airport\_code= ‘lax’}}\text{(FLIGHT\_LEG)}$

$\text{RESULT <- } \pi_{\text{Flight\_number, Dep\_airport\_code, Sched\_dep\_time, Arr\_airport\_code, Sched\_arrival\_time, Weekday}} \text{ (HOUSTON\_LA * FLIGHT)}$

d. List all fare information for flight number ‘co197’.

$\sigma_{\text{Flight\_number = 'co197'}} \text{ (FARE)}$

e. Retrieve the number of available seats for flight number ‘co197’ on ‘2009-10-09’.

$\pi_{\text{Number\_of\_available\_seats}} (\sigma_{\text{Flight\_number='CO197' AND Date='1999-10-09'}}(\text{LEG\_INSTANCE}))$

8.18

a. How many copies of the book titled *The Lost Tribe* are owned by the library branch whose name is ‘Sharpstown’?

$\pi_{\text{No\_of\_copies}} (\text{Book\_Copies} * (\pi_{\text{Branch\_id}}(\sigma_{\text{Branch\_name='Sharpstown'}}(\text{Library\_Branch}))) * \pi_{\text{Book\_id}} (\sigma_{\text{Title='The Lost Tribe'}}(\text{Book})))$

b. How many copies of the book titled *The Lost Tribe* are owned by each library branch?

$\pi_{\text{BranchID, No\_of\_copies}} ((\sigma_{\text{Title='The Lost Tribe'}}(\text{BOOK})) * \text{BOOKCOPIES}$

c. Retrieve the names of all borrowers who do not have any books checked out.

$\pi_{\text{Name}} (\text{Borrower} * (\pi_{\text{Card\_no}} (\text{Borrower}) – \pi_{\text{Card\_no}} (\text{Book Loans})))$

d. For each book that is loaned out from the Sharpstown branch and whose Due_date is today, retrieve the book title, the borrower’s name, and the borrower’s address.

$\text{ST <-- } \pi_{\text{BranchId}} (\sigma_{\text{BranchName='Sharpstown'}}(\text{LIBRARY\_BRANCH}))$
$\text{BORROWED\_ST <-} \pi_{\text{BookId, CardNo}} ((\sigma_{\text{DueDate=today}} (\text{BOOKLOANS})) * \text{ST})$
$\text{RESULT <-- } \pi_{\text{Title, Name, Address}} (\text{BOOK} * \text{BORROWER} * \text{BORROWED\_ST}))$

e. For each library branch, retrieve the branch name and the total number of books loaned out from that branch.

$\text{TEMP (BranchId, Total) <-}_{\text{BranchId}} \mathfrak{I}_{\text{COUNT (BookId, CardNo)}} (\text{BOOK\_LOANS})$
$\text{RESULT <-}\pi_{\text{BranchName, Total}} (\text{TEMP} * \text{LIBRARY\_BRANCH}))$

f. Retrieve the names, addresses, and number of books checked out for all borrowers who have more than five books checked out.

$\text{TEMP (CardNo, NumofBooks) <- }_{\text{CardNo}} \mathfrak{I}_{\text{COUNT(BookId)}} (\text{BOOK\_LOANS})$
$\text{RESULT <-}\pi_{\text{Name, Address, NumofBooks}} ((\sigma_{\text{NumofBooks} > 5}(\text{TEMP})) * \text{BORROWER})$

g. For each book authored (or coauthored) by Stephen King, retrieve the title and the number of copies owned by the library branch whose name is Central.

$\text{STEPHEN (BookId, Title) <- } (\sigma_{\text{AuthorName='Stephen King'}} (\text{BOOK\_AUTHORS})) * \text{BOOK}$
$\text{CENTRAL(BranchId) <- } \sigma_{\text{BranchName='Central'}} (\text{LIBRARY\_BRANCH})$
$\text{RESULT <-- } \pi_{\text{Title, No\_of\_copies}} (\text{STEPHEN} * \text{BOOKCOPIES} * \text{CENTRAL})$