Marcus Domingo
HW3 Due Date: 3/22/2017

6.16)

a. $EMP\_WORKS10 \leftarrow (EMPLOYEE \bowtie_{Ssn=Essn} (\sigma_{Hours>10}(WORKS\_ON))$
$EMP\_WORKS10\_PRODX \leftarrow (\sigma_{Pname='ProductX'}(PROJECT)) \bowtie_{Pnumber=Pno} (EMP\_WORKS10)$
$RESULT \leftarrow (\pi_{Fname,Lname}(\sigma_{Dno=5}(EMP\_WORKS10\_PRODX))$

Fname	Lname
John	Smith
Joyce	English

b. $EMP\_W\_DEP \leftarrow (EMPLOYEE \bowtie_{Ssn=} Essn(DEPENDENT))$
$RESULT \leftarrow (\pi_{Fname,Lname}(\sigma_{Fname=Dependent\_name}(EMP\_W\_DEP))$

Fname	Lname

c. $WONG\_SSN \leftarrow \pi_{Ssn}(\sigma_{Fname='Franklin',Lname='Wong'}(EMPLOYEE))$
$RESULT \leftarrow \pi_{Fname,Lname}(EMPLOYEE \bowtie_{Superssn=Ssn}(WONG\_SSN))$

Fname	Lname
John	Smith
Ramesh	Narayan
Joyce	English

d. $PROJ\_SUM\_HOURS \leftarrow \rho_{R(Pno,Total\_hours)}({}_{Pno}\Im_{SUM\ Hours}(WORKS\_ON))$
$RESULT \leftarrow \pi_{Pname,Total\_hours}(PROJ\_SUM\_HOURS \bowtie_{Pnumber=Pno}(PROJECT))$

Pname	Total_hours
ProductX	52.5
ProductY	37.5
ProductZ	50.0
Computerization	55.0
Reorganization	25.0
Newbenefits	55.0

e. $EMP\_PNOS \leftarrow \rho_{R(Pno,Ssn)}(\pi_{Pno,Essn}(WORKS\_ON))$
$ALL\_PNOS \leftarrow \rho_{R(Pno)}(\pi_{Pnumber}(PROJECT))$
$EMP\_ALL\_PNOS \leftarrow EMP\_PNOS \div ALL\_PNOS$
$RESULT \leftarrow \pi_{Fname,Lname}(EMP\_ALL\_PNOS * EMPLOYEE)$

Fname	Lname

f. $EMPS \leftarrow \pi_{Ssn}(EMPLOYEE)$
$EMPS\_WORK \leftarrow \rho_{R(Ssn)}(\pi_{Essn}(WORKS\_ON))$
$RESULT \leftarrow \pi_{Fname,Lname}(EMPLOYEE * (EMPS - EMPS\_WORK))$

Fname	Lname

g. DEPT_AVG ← $\rho_{R(Dnumber,Avg\_sal)}({}_{Dno}\Im_{AVG\ Salary}(EMPLOYEE))$
RESULT ← $\pi_{Dname,Avg\_sal}(DEPARTMENT * DEPT\_AVG)$

Dname	Avg_sal
Research	33250
Administration	31000
Headquarters	55000

h. RESULT ← $\rho_{R(Avg\_sal)}(\Im_{AVG\ Salary}(\sigma_{Sex='F'}EMPLOYEE))$

Avg_sal
31000

i. HOUSTON_PROJ ← $\rho_{R(Pname,Pno,Plocation,Dnum)}(\sigma_{Plocation='Houston'}(PROJECT))$
EMP_HOUSTON_PROJ ← $\rho_{R(Ssn)}(\pi_{Essn}(WORKS\_ON * HOUSTON\_PROJ))$
DEPT_NOT_HOUSTON ← $\rho_{R(Dno)}(\pi_{Dnumber}(\sigma_{Dlocation<>'Houston'}(DEPARTMENT)))$
EMP_NOT_HOUSTON ← $\pi_{Ssn}(EMPLOYEE * DEPT\_NOT\_HOUSTON)$
RESULT ← $\pi_{Fname,Lname,Address}(EMPLOYEE * (EMP\_HOUSTON\_PROJ - EMP\_NOT\_HOUSTON))$

Fname	Lname	Address
Jennifer	Wallace	291 Berry, Bellaire, TX

j. DEPT_MANG ← $\rho_{R(Ssn)}(\pi_{Mgrssn}(DEPARTMENT))$
EMP_W_DEP ← $\rho_{R(Ssn)}(\pi_{Essn}(DEPENDENT))$
RESULT← $\pi_{Fname,Lname}(EMPLOYEE * (DEPT\_MANG - EMP\_W\_DEP))$

Fname	Lname
James	Borg

6.17)

a) DEPART← ${}_{Flight\_number}\Im_{MIN\ Leg\_number}(FLIGHT\_LEG)$
ARRIVE← ${}_{Flight\_number}\Im_{MAX\ Leg\_number}(FLIGHT\_LEG)$
DEPART_AIRPORT← $\pi_{Flight\_number,Departure\_airport\_code}(DEPART * FLIGHT\_LEG)$
ARRIVE_AIRPORT← $\pi_{Flight\_number,Arrival\_airport\_code}(ARRIVE * FLIGHT\_LEG)$
RESULT ←(DEPART * ARRIVE)

b) DEPART_HOUSTON ← $\sigma_{Departure\_airport\_code='IAH'}(FLIGHT\_LEG)$
ARRIVE_LA ← $\sigma_{Arrival\_airport\_code='LAX'}(FLIGHT\_LEG)$
RESULT ← $\pi_{Flight\_number,Weekdays}(FLIGHT * (DEPART\_HOUSTON * ARRIVE\_LA))$

c) DEPART_HOUSTON ← $\sigma_{Departure\_airport\_code='IAH'}(FLIGHT\_LEG)$
ARRIVE_LA ← $\sigma_{Arrival\_airport\_code='LAX'}(FLIGHT\_LEG)$
RESULT ← $\pi_{Flight\_number,Departure\_airport\_code,Scheduled\_departure\_time,Arrival\_airport\_code,Scheduled\_arrival\_time,Weekdays}(FLIGHT * (DEPART\_HOUSTON * ARRIVE\_LA))$

d) RESULT ← $\sigma_{Flight\_number='CO197'}(FARE)$

e) RESULT ← $\pi_{\text{Number\_of\_available\_seats}}(\sigma_{\text{Flight\_number='CO197' AND Date='2009-10-09'}}(\text{LEG\_INSTANCE}))$

6.18)

a) LOST_TRIBE ← $\sigma_{\text{Title='The Lost Tribe'}}(\text{BOOK})$
SHARPSTOWN ← $\sigma_{\text{Branch\_name='Sharpstown'}}(\text{LIBRARY\_BRANCH})$
RESULT ← $\pi_{\text{No\_of\_copies}}((\text{LOST\_TRIBE} * \text{BOOK\_COPIES}) * \text{SHARPSTOWN})$

b) LOST_TRIBE ← $\sigma_{\text{Title='The Lost Tribe'}}(\text{BOOK})$
RESULT← $\pi_{\text{Title,Brance\_name,No\_of\_copies}}((\text{LOST\_TRIBE} * \text{BOOK\_COPIES}) * \text{LIBRARY\_BRANCH})$

c) LOANED ← $\pi_{\text{Card\_no}}(\text{BOOK\_LOANS})$
MEMBERS← $\pi_{\text{Card\_no}}(\text{BORROWER})$
RESULT ← $\pi_{\text{Name}}(\text{BORROWER} * (\text{MEMBERS} - \text{LOANED})$

This relational algebra is assuming that you can sign-up to be a borrower but not have borrowed a book and that after books are returned the entry is removed from BOOK_LOAN.

d) SHARPSTOWN ← $\sigma_{\text{Branch\_name='Sharpstown'}}(\text{LIBRARY\_BRANCH})$
DUE_TODAY ← $\sigma_{\text{Due\_date='2017-03-22'}}(\text{BOOK\_LOANS})$
DUE_TODAY_SHARPSTOWN ←((SHARPSTOWN * DUE_TODAY) * BOOK)
RESULT ← $\pi_{\text{Title,Name,Address}}(\text{DUE\_TODAY\_SHARPSTOWN} * \text{BORROWER})$

This relational algebra is using today's actual date (03/22/2017) as the Due_date of today and the date format is assumed from 6.17) e).

e) LOAN_COUNT ← $\rho_{R(\text{Brancg\_id,Loan\_count})}(_{\text{Branch\_id}}\Im_{\text{COUNT Book\_id}}(\text{BOOK\_LOANS}))$
RESULT ← $\pi_{\text{Branch\_name, Loan\_count}}(\text{LOAN\_COUNT} * \text{LIBRARY\_BRANCH})$

f) LOAN_COUNT ← $\rho_{R(\text{Card\_no,Loan\_count})}(_{\text{Card\_no}}\Im_{\text{COUNT Book\_id}}(\text{BOOK\_LOANS}))$
LOAN_COUNT_5 ← $\sigma_{\text{Loan\_count}>5}(\text{LOAN\_COUNT})$
RESULT ← $\pi_{\text{Name,Address,Loan\_count}}(\text{BORROWER} * \text{LOAN\_COUNT\_5})$

g) CENTRAL ← $\sigma_{\text{Branch\_name='Central'}}(\text{LIBRARY\_BRANCH})$
KING ← $\sigma_{\text{Author\_name='Stephen King'}}(\text{BOOK\_AUTHORS})$
KING_BOOKS ←KING * BOOK
RESULT← $\pi_{\text{Title,No\_of\_copies}}((\text{BOOK\_COPIES} * \text{CENTRAL}) * \text{KING\_BOOKS})$

6.21)

a) SMITH← $\pi_{\text{Ssn}}(\sigma_{\text{Name='John Smith'}}(\text{STUDENT}))$
SMITH_COURSES ←SMITH * ENROLL
SMITH_COURSE_COUNT ← $\rho_{R(\text{Quarter,Course\_count})}(_{\text{Quarter}}\Im_{\text{COUNT Course\#}}(\text{SMITH\_COURSES}))$
RESULT ← $\pi_{\text{Course\_count}}(\sigma_{\text{Quarter='W09'}}(\text{SMITH\_COURSE\_COUNT}))$

b) CS_COURSES ← $\sigma_{\text{Dept='CS'}}(\text{COURSE})$
CS_COURSES_BOOKS ←((CS_COURSES * BOOK_ADOPTION) * TEXT)
CS_BOOKS_COUNT ← $\rho_{R(\text{Course\#,Book\_title,Book\_Count})}(_{\text{Course\#,Book\_title}}\Im_{\text{COUNT Book\_isbn}}(\text{CS\_COURSES\_BOOKS}))$
CS_BOOKS_COUNT_INFO ←CS_BOOKS_COUNT * TEXT
RESULT ← $\pi_{\text{Course\#,Book\_isbn,Book\_title}}(\sigma_{\text{Book\_count}>2}(\text{CS\_BOOKS\_COUNT\_INFO})$

c) NOT_PEARSON ← $\sigma_{\text{Publisher<>'Pearson Publishing'}}$(TEXT)
NOT_PEARSON_DEPT ← π_{Dept}((PEARSON * BOOK_ADOPTION) * COURSE)
ALL_DEPT ← π_{Dept}(BOOK_ADOPTION * COURSE)
RESULT ←ALL_DEPT – NOT_PEARSON_DEPT

6.23)

a) JANE ← $\sigma_{\text{Name='Jane Doe'}}$(SALESPERSON)
RESULT← $\pi_{\text{Serial\#,Manufacturer,Sale\_price}}$((JANE * SALE) * CAR)

b) CAR_W_OPTIONS ← $\pi_{\text{Serial\#,Model}}$(CAR * OPTION)
ALL_CARS ← $\pi_{\text{Serial\#,Model}}$(CAR)
RESULT ←ALL_CARS – CAR_W_OPTIONS

c) The left outer join (SALESPERSON ⟕ SALE) will result in any SALESPERSON that didn't make a sale to be padded for Serial_no, Date, Sale_price.

EXAMPLE:

Salesperson_id	Name	Phone	Serial_no	Date	Sale_price
1	John Smith	4445556666	01	2016-04-10	30000
2	Jane Doe	2223334444	NULL	NULL	NULL

d) SALESPERSON_SALE ← $\pi_{\text{Serial\_no}}$(SALESPERSON * SALE)
CAR_W_OPTIONS ← $\pi_{\text{Serial\_no}}$(CAR * OPTION)
RESULT ←SALESPERSON_SALE ∩ CAR_W_OPTIONS

English: List all the Cars that were sold that had options.

6.32)

A. RESULT ← $\pi_{\text{Fname,Lname}}(\sigma_{\text{Dno=}}$ (EMPLOYEE))
($\pi_{\text{Dno}}(\sigma_{\text{Salary=}}$ (EMPLOYEE)))
($\Im_{\text{MAX Salary}}$(EMPLOYEE))

B. RESULT ← $\pi_{\text{Fname,Lname}}(\sigma_{\text{Superssn=}}$ (EMPLOYEE))
($\pi_{\text{Ssn}}(\sigma_{\text{Superssn='888665555'}}$(EMPLOYEE)))

C. RESULT ← $\pi_{\text{Fname,Lname}}(\sigma_{\text{Salary>=1000 +}}$ (EMPLOYEE))
($\pi_{\text{Salary}}(\sigma_{\text{Salary=}}$ (EMPLOYEE)))
($\Im_{\text{MIN Salary}}$(EMPLOYEE))