**Assignment 5 Drew Caldwell**

**CSCI-C442 4/9/2025**

1. **List the operations of relational algebra and the purpose of each.**

SELECT – σ

PROJECTION – *Π*

RENAME –

UNION -

INTERSECTION -

DIFFERENCE -

CARTESIAN PRODUCT -

DIVISION -

JOIN - ⋈

THETA JOIN - ⋈condition

LEFT SEMI JOIN - ⋉

RIGHT SEMI JOIN - ⋊

LEFT OUTER JOIN - ⟕

RIGHT OUTER JOIN - ⟖

FULL OUTER JOIN - ⟗

ANTI JOIN - ▷

LOGICAL AND – ∧

LOGICAL OR – ∨

LOGICAL NOT – ¬

NULL - ω

1. **Specify the following queries on the COMPANY relational database schema shown in figure 5.5 using the relational operators discussed in this chapter. Also show the result of each query as it would apply to the database state in Figure 5.6**

(b.) List the names of employees that have a dependent that has the same first name as themselves.

Π\_(FNAME, MINIT, LNAME)( σ\_(FNAME = DEPENDENT\_NAME)(EMPLOYEE ⋈\_(SSN = ESSN) DEPENDENT)

Expected Output:

|  |  |  |
| --- | --- | --- |
| FNAME | MINIT | LNAME |
| John | B | Smith |

(c.) Find the names of all employees who are directly supervised by “Franklin Wong”.

Π\_(FNAME, MINIT, LASTNAME)( σ\_(EMPLOYEE.SUPERSSN = FW\_EMPLOYEE.SSN)(EMPLOYEE (FW\_EMPLOYEE, σ\_(FNAME = ‘Franklin’ ∧ LNAME = ‘Wong’)(EMPLOYEE))

Expected Output:

|  |  |  |
| --- | --- | --- |
| FNAME | MINIT | LNAME |
| Jennifer | S | Wallace |
| Ramesh | K | Naryayan |
| Joyce | A | English |

(f.) Retrieve the names of all employees who work on every project.

Π(FNAME, MINIT, LASTNAME)( (Π\_(ESSN, PNO)(WORKS\_ON) Π\_(PNUMBER)(PROJECT)) ⋈\_(ESSN = SSN) EMPLOYEE

Expected Output:

|  |  |  |
| --- | --- | --- |
| FNAME | MINIT | LNAME |
| John | B | Smith |

**3. Consider the AIRLINE relational database schema shown in Figure 5.8, which was described in Exercise 5.12. Specify the following queries in relational algebra:**

(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.

FIRST\_LEGS σ\_(LEG\_NUMBER = 1)(FLIGHT\_LEG)

NOT\_LAST Π\_(L1.FLIGHT\_NUMBER, L1.LEG\_NUMBER)( σ\_(L1.FLIGHT\_NUMBER = L2.FLIGHT\_NUMBER ∧ L1.LEG\_NUMBER < L2.LEG\_NUMBER)( (L1, FLIGHT\_LEG) (L2, FLIGHT\_LEG )))

LAST\_LEGS Π\_(FLIGHT\_NUMBER, LEG\_NUMBER, ARRIVAL\_AIRPORT\_CODE)(FLIGHT\_LEG) NOT\_LAST

RESULT Π\_(f1.FLIGHT\_NUMBER, F1.DEPARTURE\_AIRPORT\_CODE, F2.ARRIVAL\_AIRPORT\_CODE)( (F1, FIRST\_LEG) ⋈\_(F1.FLIGHT\_NUMBER = F2.FLIGHT\_NUMBER) \_(F2, LAST\_LEG)

(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’).

LEGS σ\_(DEPARTURE\_AIRPORT\_CODE = ‘iah’ ∧ ARRIVAL\_AIRPORT\_CODE = ‘lax’)(FLIGHT\_LEG)

LEG\_INFO LEGS ⋈ (FLIGHT\_NUMBER, LEG\_NUMBER) LEG\_INSTANCE

RESULT Π(FLIGHT\_NUMBER, WEEKDAY(DATE))(LEG\_INFO)

(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.

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

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