CS3743 Hwk 5 Relational Calculus (40 pts) - due Mar 22, 2018 ∀f ∃r

Flight(flightId, flightNm, airline, orig, dest, schedDt, depTm, maxSeats, numSeatsSold)

* flightId is the unique primary key. The combination of flightNm and schedDt is also unique.

Customer(custNr, name, preferAirline, gender, birthDt)

Reservation(custNr, flightId, reqSeatQty)

To make it easier for the grader, use the following tuple variables: Flight – f, Customer – c, Reservation – r. There may be cases where you need multiple tuple variables for the same relation; please use something meaningful (e.g., rRD).

Please show appropriate relational calculus RANGE statements and a **single GET** statement to answer each of the following.

Sample Data:

- - Fights

+----------+----------+------+------+------------+

| flightId | airline | orig | dest | schedDt |

+----------+----------+------+------+------------+

| 331 | PoDunk | SAT | MCO | 2018-03-03 |

| 341 | PoDunk | SAT | MCO | 2018-03-04 |

| 411 | American | HOU | CDG | 2018-04-01 |

| 412 | American | HOU | FLL | 2018-04-01 |

| 441 | Spirit | IHC | FLL | 2018-04-04 |

| 442 | Spirit | IHC | FLL | 2018-04-04 |

| 460 | Spirit | FLL | IHC | 2018-04-11 |

| 462 | Spirit | FLL | IHC | 2018-04-12 |

| 510 | American | SAT | MCO | 2018-05-10 |

| 519 | PoDunk | SAT | MCO | 2018-05-19 |

| 532 | PoDunk | HOU | SEG | 2018-05-03 |

| 604 | American | HOU | FLL | 2018-06-04 |

| 705 | Clampett | SAT | MCO | 2018-07-05 |

| 706 | PoDunk | HOU | SEG | 2018-07-06 |

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- - Customers

+--------+---------------+---------------+------------+--------+

| custNr | name | preferAirline | birthDt | gender |

+--------+---------------+---------------+------------+--------+

| 111 | Perry Noid | Spirit | 2000-04-01 | M |

| 222 | Melba Toast | American | 1990-09-11 | F |

| 333 | Pete Moss | Clampett | 1992-03-03 | M |

| 444 | Bill Board | American | 1985-04-04 | M |

| 480 | Anita Vacay | Spirit | 1975-06-01 | F |

| 555 | Jerry Tall | PoDunk | 1927-04-15 | M |

| 666 | Tom E Gunn | Clampett | 1976-06-06 | M |

| 777 | Bob Wire | PoDunk | 1973-07-07 | M |

| 888 | Ron DeVoux | American | 1990-08-08 | M |

| 890 | Ann T Freeze | American | 1992-08-09 | F |

| 901 | Peg Board | Delta | 1987-04-04 | F |

| 902 | Al B Tross | American | 1957-07-12 | M |

| 903 | B B Gunn | PoDunk | 1976-09-09 | F |

| 904 | Sally Mander | Delta | 1995-09-04 | F |

| 999 | Marcus Absent | Delta | 1999-09-09 | M |

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- - Reservations

|  |  |
| --- | --- |
| +--------+----------+------------+  | custNr | flightId | reqSeatQty |  +--------+----------+------------+  | 111 | 341 | 10 |  | 111 | 441 | 2 |  | 111 | 519 | 2 |  | 222 | 331 | 12 |  | 222 | 341 | 11 |  | 222 | 441 | 2 |  | 222 | 705 | 2 |  | 333 | 441 | 2 |  | 444 | 412 | 5 |  | 444 | 441 | 2 |  | 444 | 510 | 5 |  | 444 | 519 | 5 |  | 444 | 532 | 2 |  | 444 | 705 | 2 |  | 444 | 706 | 2 |  | 444 | FXXXXX | 2 |  | 480 | 331 | 2 |  | 480 | 441 | 2 |  | 555 | 341 | 3 |  | 555 | 411 | 30 |  | 555 | 412 | 20 |  | 555 | 510 | 20 |  | 555 | 519 | 1 |  | 555 | 706 | 2 |  | 555 | FXXXXX | 8 |  | 666 | 705 | 3 | | +--------+----------+------------+  | custNr | flightId | reqSeatQty |  +--------+----------+------------+  | 777 | 442 | 1 |  | 777 | 460 | 1 |  | 777 | 510 | 1 |  | 888 | 341 | 1 |  | 888 | 519 | 1 |  | 888 | 604 | 1 |  | 890 | 341 | 1 |  | 890 | 510 | 2 |  | 890 | 519 | 1 |  | 890 | 604 | 1 |  | 901 | 341 | 20 |  | 901 | 412 | 8 |  | 901 | 532 | 1 |  | 901 | 706 | 4 |  | 902 | 412 | 5 |  | 903 | 412 | 3 |  | 904 | 412 | 2 |  | 904 | 519 | 5 |  | 999 | 341 | 14 |  | 999 | 412 | 10 |  | 999 | 510 | 15 |  | 999 | 519 | 14 |  | 999 | 532 | 1 |  | 999 | 706 | 5 |  +--------+----------+------------+ |

1. (1 pt) Find the flightId, airline, and departure time for flights departing from SAT for MCO.

RANGE Flight f

GET W (f.flightId, f.airline, f.depTm): orig="SAT" and dest="MCO"

2. (2 pts) Find the flightNm, departure time, and origin for flights on which the customer named Perry Noid has a reservation.

RANGE Flight f

RANGE Customer c

RANGE Reservation r

GET w (f.flightNm, f.depTm, f.orig): ∃r∃c (r.flightId = f.flightId

^ r.custNr = c.custNr ^ c.name="Perry Noid")

3. (4 pts) Find the airline of flights departing "SAT" on "2018-03-03" for the customer named "Anita Vacay".

RANGE Flight f

RANGE Customer c

RANGE Reservation r

GET w (f.airline): ∃r∃c (r.flightId = f.flightId

^ f.orig="SAT" ^ f.schedDt="2018-03-03"

^ r.custNr = c.custNr ^ c.name="Anita Vacay")

4. (6 pts) Find the customer numbers and names of customers who have a reservation on a flight leaving on April 4th of 2018 on which customer #444 also has a reservation. Do not include #444 in your result. Hint: you will have to use one of the relations twice.

RANGE Flight f

RANGE Customer c

RANGE Reservation r

RANGE Reservation r4

GET W (c.custNr, c.name): c.custNr <> "444"

^ ∃r4∃r∃f (r4.custNr="444" ^ r4.flightId = f.flightId

^ f.schedDt="2018-04-04" ^ r4.flightId = r.flightId

^ c.custNr=r.custNr)

-- 444's flights

+----------+------------+

| flightId | schedDt |

+----------+------------+

| 412 | 2018-04-01 |

| 441 | 2018-04-04 |

| 510 | 2018-05-10 |

| 519 | 2018-05-19 |

| 532 | 2018-05-03 |

| 705 | 2018-07-05 |

| 706 | 2018-07-06 |

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-- customers on flight 441

+--------+----------+------------+

| custNr | flightId | reqSeatQty |

+--------+----------+------------+

| 111 | 441 | 2 |

| 222 | 441 | 2 |

| 333 | 441 | 2 |

| 444 | 441 | 2 |

| 480 | 441 | 2 |

+--------+----------+------------+

-- result

+--------+-------------+

| custNr | name |

+--------+-------------+

| 111 | Perry Noid |

| 222 | Melba Toast |

| 333 | Pete Moss |

| 480 | Anita Vacay |

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5. (4 pts) Find the customer number of customers who are flying on all of the flights having a destination of "SEG".

RANGE Flight f

RANGE Reservation r

RANGE Customer c

Get w (c.customerNr): ∀f (f.dest="SEG" 🡪 ∃r(r.flightId = f.flightId ^ r.custNr = c.CustNr))

-- flights with dest = "SEG"

+----------+---------+------+------+------------+

| flightId | airline | orig | dest | schedDt |

+----------+---------+------+------+------------+

| 532 | PoDunk | HOU | SEG | 2018-05-03 |

| 706 | PoDunk | HOU | SEG | 2018-07-06 |

+----------+---------+------+------+------------+

-- some reservations

+--------+----------+

| custNr | flightId |

+--------+----------+

| 444 | 412 |

| 444 | 441 |

| 444 | 510 |

| 444 | 519 |

| 444 | 532 |

| 444 | 705 |

| 444 | 706 |

| 444 | FXXXXX |

| 901 | 341 |

| 901 | 412 |

| 901 | 532 |

| 901 | 706 |

| 999 | 341 |

| 999 | 412 |

| 999 | 510 |

| 999 | 519 |

| 999 | 532 |

| 999 | 706 |

| 555 | 341 |

| 555 | 411 |

| 555 | 412 |

| 555 | 510 |

| 555 | 519 |

| 555 | 706 |

| 555 | FXXXXX |

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6. (6 pts) Find the name, gender, and birth date of customers who only have reservations on flights with Spirit airlines. State whether your answer includes customers that don't have any associated reservations.

RANGE Flight f

RANGE Reservation r

RANGE Customer c

Get w (c.name, c.gender, c.birthDt): ∀r (r.custNr=c.custNr 🡪

∃f(f.flightId = r.flightId ^ f.airline="Spirit"))

Includes customers that have no reservations.

- - Fights

+----------+----------+

| flightId | airline |

+----------+----------+

| 331 | PoDunk |

| 341 | PoDunk |

| 411 | American |

| 412 | American |

| 441 | Spirit |

| 442 | Spirit |

| 460 | Spirit |

| 462 | Spirit |

| 510 | American |

| 519 | PoDunk |

| 532 | PoDunk |

| 604 | American |

| 705 | Clampett |

| 706 | PoDunk |

+----------+----------+

-- some reservations

+--------+----------+----------+

| custNr | flightId | airline |

+--------+----------+----------+

| 111 | 341 | PoDunk |

| 111 | 441 | Spirit |

| 111 | 519 | PoDunk |

| 222 | 331 | PoDunk |

| 222 | 341 | PoDunk |

| 222 | 441 | Spirit |

| 222 | 705 | Clampett |

| 333 | 441 | Spirit |

| 444 | 412 | American |

| 444 | 441 | Spirit |

| 444 | 510 | American |

| 444 | 519 | PoDunk |

| 444 | 532 | PoDunk |

| 444 | 705 | Clampett |

| 444 | 706 | PoDunk |

| 480 | 331 | PoDunk |

| 480 | 441 | Spirit |

| 777 | 442 | Spirit |

| 777 | 460 | Spirit |

| 777 | 510 | American |

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7. (3 pts) Find the flightNm and scheduled dates for flights on which only customer #777 has a reservation. State whether your answer includes flights that don't have any associated reservations.

RANGE Flight f

RANGE Reservation r

GET w (f.flightNm, f.schedDt): ∀r (r.flightId=f.flightId 🡪 r.custNr = "777")

Includes flights that have no reservations.

-- some reservations

+----------+--------+

| flightId | custNr |

+----------+--------+

| 442 | 777 |

| 460 | 777 |

| 510 | 444 |

| 510 | 555 |

| 510 | 777 |

| 510 | 890 |

| 510 | 999 |

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8. (8 pts) Find the names of customers who are on **all** the flights which Ron DeVoux has reservations. State whether you included Ron DeVoux in your answer.

Hint: obtain the custNr for Ron DeVoux before attempting the universal quantifier.

RANGE Customer c

RANGE Reservation r

RANGE Reservation rRD

RANGE Customer cRD

Get w (c.name): c.name <> "Ron DeVoux" ^ ∃cRD(cRD.name="Ron DeVoux"

^ ∀rRD (cRD.custNr =rRD.custNr 🡪

∃r(r.flightId = rRD.flightId ^ r.custNr = c.CustNr)))

"Ron DeVoux" was not included in this answer.

- - Fights for Ron Devoux

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| flightId | orig | dest |

+----------+------+------+

| 341 | SAT | MCO |

| 519 | SAT | MCO |

| 604 | HOU | FLL |

+----------+------+------+

- people on at least one of those flights

+----------+--------+---------------+

| flightId | custNr | name |

+----------+--------+---------------+

| 341 | 111 | Perry Noid |

| 341 | 222 | Melba Toast |

| 341 | 555 | Jerry Tall |

| 341 | 888 | Ron DeVoux |

| 341 | 890 | Ann T Freeze |

| 341 | 901 | Peg Board |

| 341 | 999 | Marcus Absent |

| 519 | 111 | Perry Noid |

| 519 | 444 | Bill Board |

| 519 | 555 | Jerry Tall |

| 519 | 888 | Ron DeVoux |

| 519 | 890 | Ann T Freeze |

| 519 | 904 | Sally Mander |

| 519 | 999 | Marcus Absent |

| 604 | 888 | Ron DeVoux |

| 604 | 890 | Ann T Freeze |

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9. (6 pts) Find the customer number, names, and preferred airlines for customers who do not have reservations on a flight which Clampett is the airline.

RANGE Customer c

RANGE Reservation r

RANGE Flight f

get w (c.custNr, c.name, c.preferAirline): ∀r (r.custNr=c.custNr 🡪

∃f (f.flightId=r.flightId ^ f.airline <> "Clampett"))

Includes customers that have no reservations.

- - Fights

+----------+----------+

| flightId | airline |

+----------+----------+

| 331 | PoDunk |

| 341 | PoDunk |

| 411 | American |

| 412 | American |

| 441 | Spirit |

| 442 | Spirit |

| 460 | Spirit |

| 462 | Spirit |

| 510 | American |

| 519 | PoDunk |

| 532 | PoDunk |

| 604 | American |

| 705 | Clampett |

| 706 | PoDunk |

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- - Reservations

|  |  |
| --- | --- |
| +--------+----------+------------+  | custNr | flightId | reqSeatQty |  +--------+----------+------------+  | 111 | 341 | 10 |  | 111 | 441 | 2 |  | 111 | 519 | 2 |  | 222 | 331 | 12 |  | 222 | 341 | 11 |  | 222 | 441 | 2 |  | 222 | 705 | 2 |  | 333 | 441 | 2 |  | 444 | 412 | 5 |  | 444 | 441 | 2 |  | 444 | 510 | 5 |  | 444 | 519 | 5 |  | 444 | 532 | 2 |  | 444 | 705 | 2 |  | 444 | 706 | 2 |  | 444 | FXXXXX | 2 |  | 480 | 331 | 2 |  | 480 | 441 | 2 |  | 555 | 341 | 3 |  | 555 | 411 | 30 |  | 555 | 412 | 20 |  | 555 | 510 | 20 |  | 555 | 519 | 1 |  | 555 | 706 | 2 |  | 555 | FXXXXX | 8 |  | 666 | 705 | 3 | | +--------+----------+------------+  | custNr | flightId | reqSeatQty |  +--------+----------+------------+  | 777 | 442 | 1 |  | 777 | 460 | 1 |  | 777 | 510 | 1 |  | 888 | 341 | 1 |  | 888 | 519 | 1 |  | 888 | 604 | 1 |  | 890 | 341 | 1 |  | 890 | 510 | 2 |  | 890 | 519 | 1 |  | 890 | 604 | 1 |  | 901 | 341 | 20 |  | 901 | 412 | 8 |  | 901 | 532 | 1 |  | 901 | 706 | 4 |  | 902 | 412 | 5 |  | 903 | 412 | 3 |  | 904 | 412 | 2 |  | 904 | 519 | 5 |  | 999 | 341 | 14 |  | 999 | 412 | 10 |  | 999 | 510 | 15 |  | 999 | 519 | 14 |  | 999 | 532 | 1 |  | 999 | 706 | 5 |  +--------+----------+------------+ |