**Q1 Answers:**

CREATE TABLE city

(

id INTEGER,

city CHAR(20),

state CHAR(20),

country CHAR(20),

PRIMARY KEY (id)

)

CREATE TABLE planes

(

plane-number CHAR(10),

model CHAR(20),

capacity INTEGER,

create-year INTEGER,

PRIMARY KEY (plane-number)

)

CREATE TABLE pilot

(

ssn INTEGER,

home-city INTEGER,

fullname CHAR(20),

day-of-birth DATE,

month-of-birth INTEGER,

year-of-birth INTEGER,

salary DOUBLE,

PRIMARY KEY (ssn),

FOREIGN KEY (home-city) REFERENCES city

)

CREATE TABLE flight

(

flight-number CHAR(10),

captain-ssn INTEGER,

plane-number CHAR(10),

takeoff-city INTEGER,

landing-city INTEGER,

time-takeoff DATE TIME,

time-landing DATE TIME,

PRIMARY KEY (flight-number),

FOREIGN KEY (captain-ssn) REFERENCE pilot,

FOREIGN KEY (plane-number) REFERENCE planes,

FOREIGN KEY (takeoff-city, landing-city) REFERENCE city

)

**Q2 Answer:**

1. Relational algebra equation:
2. SQL query:

SELECT id, city

FROM city

WHERE country = ‘Germany’

**Q3 Answer:**

1. Relational algebra equation:

1. SQL query:

SELECT p.fullname

FROM city c, pilot p

WHERE c.id = p.home-city AND c.country = ‘Germany’

**Q4 Answer:**

1. Relational algebra equation:

1. SQL query:

SELECT p.fullname

FROM city c, pilot p, flight f

WHERE c.id = f.takeoff-city AND c.country = ‘Germany’ AND f.captain-ssn = p.ssn

UNION

SELECT p.fullname

FROM city c, pilot p, flight f

WHERE c.id = f.landing-city AND c.country = ‘Germany’ AND f.captain-ssn = p.ssn

**Q5 Answer:**

1. Relational algebra equation:

1. SQL query:

SELECT p.model

FROM flight f, planes p

WHERE p.plane-number = f.plane-number

AND f.takeoff-city IN (SELECT id FROM city c1 WHERE c1.country = ‘US’)

AND f.landing-city IN (SELECT id FROM city c1 WHERE c1.country = ‘US’)

AND p.model NOT IN (

SELECT p.model

FROM flight f, planes p

WHERE p.plane-number = f.plane-number

AND (f.takeoff-city IN (SELECT id FROM city c3 WHERE c3.country <> ‘US’) OR f.landing-city IN (SELECT id FROM city c4 WHERE c4.country <> ‘US’)) )

**Q6 Answer:**

1. Relational algebra equation:

1. SQL query:

SELECT p.model

FROM flight f, planes p

WHERE p.plane-number = f.plane-number

AND (f.takeoff-city IN (SELECT id FROM city c1 WHERE c1.country = ‘US’)

OR f.landing-city IN (SELECT id FROM city c1 WHERE c1.country = ‘US’))

INTERSECT

SELECT p.model

FROM flight f, planes p

WHERE p.plane-number = f.plane-number

AND (f.takeoff-city IN (SELECT id FROM city c1 WHERE c1.country <> ‘US’)

OR f.landing-city IN (SELECT id FROM city c1 WHERE c1.country <> ‘US’))

**Q7 Answer:**

1. Return the name of pilot and the country where he or she is from

Answer is b and c

1. Expressions from question that are equivalent

Answer: a and d is equivalent, and b and c is equivalent.

**Q8 Answer:**

1. 15
2. Return the whole information of flights which will takeoff from Pittsburgh
3. Rewrite expression

1. Translate into SQL

SELECT \*

FROM city c, flight f, planes p

WHERE c.city = ‘pittsburgh’ AND f.takeoff-city = c.id

SELECT \*

FROM flight f

JOIN planes p

ON f.plane-number = p.plane-number

JOIN

(SELECT \* FROM city temp WHERE temp.city = ‘pittsburgh’) c

ON f.takeoff-city = c.id