HW2

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Problem 1

First, look at what the primary keys are:
SALESPERSON: Ssn
TRIP: Trip_id
EXPENSE:Trip_id,Account#

Next, the definition of an FK:
FK in schema R1 is a foreign key of R1 referencing R2 if
- the attributes in FK have the same domain(s) as the primary key attributes PK in R2
- A value FK either occurs as a value of PK where t1FK = t2PK or is NULL

TRIP.Ssn is an FK, because it occurs as a PK in SALESPERSON.
I assume they have the same domain and TRIP tuples reference SALESPERSON tuples by SSN,
since SALESPERSON has a one to many relation with TRIP.

EXPENSE.Trip_id is an FK because it occurs as a PK in TRIP.
I again assume the domain is the same and that EXPENSE tuples reference TRIP tuples by Trip_id,
since TRIP has a one to many relationship with EXPENSE.

Problem 2

a)

$\rho_A\left(\pi_{\text{Flight\_number, Arrival\_airport\_code}}\left((\text{FLIGHT\_LEG}) \bowtie_{\text{Leg\_number = Count\_Lef\_number}}\left(\text{Flight\_number}\,\mathcal{F}_{\text{COUNT Leg\_number}}\right)\right)\right)$
Relation A is the flight number and arrival code for all final legs.

$\rho_D\left(\pi_{\text{Flight\_number, Departure\_airport\_code}}\left(\sigma_{\text{Leg\_number = 0}}(\text{FLIGHT\_LEG})\right)\right)$
Relation D is the flight number and departure code for all first legs.

$A * D$ Will then give Flight_number, Departure_airport_code for the first leg, and Arrival_airport_code for the last leg.

b)

$\rho_{\text{IAHtoLAX}}\left(\pi_{\text{Flight\_number, Leg\_number}}\left(\sigma_{\text{Departure\_airport\_code = IAH AND Arrival\_airport\_code = LAX}}(\text{FLIGHT\_LEG})\right)\right)$
IAHtoLAX gives flight and leg numbers for all legs from IAH to LAX

$\pi_{\text{Flight\_number, Weekdays}}(\text{FLIGHT} * \text{IAHtoLAX})$
The natural join matches FLIGHT with IAHtoLAX on Flight_number equality.
We then project out the three attributes that we want.

c)
First we want to get all flights and legs that depart somewhere in Houston and arrive somewhere in LA.

$\rho_{\text{D\_AIR (D\_AIR.Airport\_code, D\_City)}}\left(\pi_{\text{Airport\_code, City}}(\text{AIRPORT})\right)$, $\rho_{\text{A\_AIR (A\_AIR.Airport\_code, A\_City)}}\left(\pi_{\text{Airport\_code, City}}(\text{AIRPORT})\right)$

$\rho_{\text{D\_LEGS}}\left(\text{FLIGHT\_LEG} \bowtie_{\text{Departure\_airport\_code = D\_AIR.Airport\_code}} \text{D\_AIR}\right)$

$\rho_{\text{D\_A\_LEGS}}\left(\text{D\_LEGS} \bowtie_{\text{Arrival\_airport\_code = A\_AIR.Airport\_code}} \text{A\_AIR}\right)$

$\rho_{\text{HOUtoLA}}\left(\sigma_{\text{D\_City = Houston AND A\_City = Los Angeles}}(\text{D\_A\_LEGS})\right)$

Now we project out what we want:

$\pi_{\text{Flight\_number, Departure\_airport\_code, Scheduled\_departure\_time, Arrival\_airport\_code, Scheduled\_arrival\_time, Weekdays}}(\text{HOUtoLA})$

d)

$\sigma_{\text{Flight\_number = CO197}}(\text{FARE})$

e)

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

Problem 3

a)

C.number	C.name	level	salesperson	S.number	S.name	office
1	Jagger	5	101	101	Page	23
2	Richards	7	101	101	Page	23
3	Watts	10	103	NULL	NULL	NULL

b)

C.number	C.name	level	salesperson	S.number	S.name	office
1	Jagger	5	101	101	Page	23
2	Richards	7	101	101	Page	23
NULL	NULL	NULL	NULL	102	Plant	26

c)

C.number	C.name	level	salesperson	S.number	S.name	office
1	Jagger	5	101	101	Page	23
2	Richards	7	101	101	Page	23
3	Watts	10	103	NULL	NULL	NULL
NULL	NULL	NULL	NULL	102	Plant	26

Problem 4

a)

T1

pilotID
Lennon
McCartney
Harrison
Starr

T2

pilotID
Starr

T

pilotID
Lennon
McCartney
Harrison

b)

T1

pilotID
Lennon
McCartney
Harrison
Starr

T2

pilotID
McCartney
Starr

T

pilotID
Lennon
Harrison

c)

The result of a division operation A/B is the restriction of tuples in A to the attributes unique to A for which all combinations with the tuples in B are in A.

For a, this means the pilots who are certified to fly all of the planes at Midway, which in this case is only the 707.

For b, this is the pilots who are qualified to fly all of the planes at O'Hare, which in this case is the 707, 727, and 747.