Midterm Solutions

Question 1.

a. False. We don't always desire our DB to be in BCNF
b. False. Weak entities do not have a key. They depend on other entities.
c. True
d. False. In any table, each attribute functionally depends on the key.
e. True
f. True
g. True
h. False. TRC and DRC are stronger that RA

Question 2

a.

i) The ISA relationship must be **disjoint**.
B and C must have the same attributes.

ii) The ISA relationship must be **total**.

b. The set of the common attributes of R1 and R2 (A, D) is a key for R2.
Proof:

1.	A → C	given
2.	A, D → C, D	1, augmentation
3.	A, D → E	2, C, D → E, transitivity

c.

i) The company should be an attribute of the customer, assuming each customer works for a single company. We don't need to keep any information for each company.

ii) The loan should be a separate entity set associated with a customer through a relationship . Reasons:

- A customer may have more than one loans.
- A loan has additional information on its own.

Question 3

a.
1. phn
2. pname, address

b

Patient (phn, pname, address, illness, ward)

Test (testname, labtype, dname, specialization)

Test includes the Authorizes relationship set.

Doctor (dname, specialization)

Had (phn, testname, date, result)

c.

- The only table that is not in BCNF is the Patient table.
- FD illness → ward violates BCNF.
- We split the table into

Patient (phn, pname, address, illness)

IllnessWard (illness, ward)

Question 4

a.

$$\pi_{sId}\,(\sigma_{hCity = \text{“Vancouver”}}\,(\text{Hotel})) \;-\; \pi_{hId}\,(\,\sigma_{year = 2005}\,(\,\text{Booking}))$$

NOTE: The following is WRONG:

$$\pi_{sId}\,(\sigma_{hCity = \text{“Vancouver”} \,\wedge\, year \neq 2005}\,(\,\text{Booking} \bowtie \text{Hotel}))$$

Any hotel which has a booking for a year other than 2005 will be included in the result even if the same hotel HAS another booking for 2005!

b.

$\pi_{gId,\ hId}\ (\sigma_{type = \text{“suite”}}\ (Booking \bowtie Room\ ))\ /\ \pi_{hId}\ (\sigma_{hCity = \text{“Vancouver”}}\ (Hotel\ )\ )$

NOTE: Again, the following is WRONG:

$\pi_{gId}\ (\sigma_{type = \text{“suite”}\ \wedge hCity = \text{“Vancouver”}}\ (Booking \bowtie Room \bowtie Hotel\ )\ )$

This returns any guest who has booked a suite in some hotel in Vancouver.

c. **YOU ARE NOT RESPONSIBLE FOR THE MATERIAL IN THIS QUESTION, BUT DO KNOW HOW TO AT LEAST READ DOMAIN RELATIONAL CALCULUS QUERIES**

$\{\ t\ \mid\ \exists\ h \in Hotel\ (\ t.hId\ = h.hId\ \wedge\ t.hName\ = h.hName\ \wedge$

$\forall\ g \in Guest\ \exists\ b \in Booking\ (\ h.hId = b.hId\ \wedge\ g.gId = b.gId\ \wedge\ b.year = 2004\ )\ )\ \}$