Warmup #1 (Textbook Problem 6.5)

Solutions:

a. \( \{ t \mid \exists q \in r (q[A] = t[A]) \} \)

b. \( \{ t \mid t \in r \land t[B] = 17 \} \)

c. \( \{ t \mid \exists p \in r \exists q \in s (t[A] = p[A] \land t[B] = p[B] \land t[C] = p[C] \land t[D] = q[D] \land t[E] = q[E] \land t[F] = q[F]) \} \)

d. \( \{ t \mid \exists p \in r \exists q \in s (t[A] = p[A] \land t[F] = q[F] \land p[C] = q[D]) \} \)

Warmup #2

Solutions:

TRC:

1. TRC: \( \{ t \mid \exists s \in \text{works} (t[\text{person\_name}] = s[\text{person\_name}] \land s[\text{company\_name}] = \text{"First Bank Corporation"}) \} \)

2. TRC: \( \{ t \mid \exists r \in \text{employee} \exists s \in \text{works} (t[\text{person\_name}] = r[\text{person\_name}] \land r[\text{city}] = r[\text{city}] \land r[\text{person\_name}] = s[\text{person\_name}] \land s[\text{company\_name}] = \text{"First Bank Corporation"}) \} \)

3. TRC: \( \{ t \mid t \in \text{employee} \land (\exists s \in \text{works} (s[\text{person\_name}] = t[\text{person\_name}] \land s[\text{company\_name}] = \text{"First Bank Corporation"} \land s[\text{salary}] > 10000)) \} \)

4. TRC: \( \{ t \mid \exists e \in \text{employee} \exists w \in \text{works} \exists c \in \text{company} \land e[\text{person\_name}] = w[\text{person\_name}] \land e[\text{person\_name}] = w[\text{person\_name}] \land w[\text{company\_name}] = c[\text{company\_name}] \land e[\text{city}] = c[\text{city}] \} \)
SQL:

- a. SELECT person name FROM works WHERE company name = "First Bank Corporation"
- b. SELECT person name, city FROM (employee JOIN works ON employee.person name = works.person name) WHERE company name = First Bank Corporation
- c. SELECT person name, city, street FROM (employee JOIN works ON employee.person name = works.person name) WHERE company name = "First Bank Corporation" AND salary > 10,000
- d. SELECT person name FROM (employee JOIN (works JOIN company ON works.company name = company.company name) as t1 ON employee.person name = t1.person name) WHERE employee.city = t1.city

Warmup #3 (Textbook Problem 3.7)

3.7 The SQL like operator is case sensitive, but the lower() function on strings can be used to perform case insensitive matching. To show how, write a query that finds departments whose names contain the string “sci” as a substring, regardless of the case.

Answer:

```
select dept.name
from department
where lower(dept.name) like '%sci%'
```

Warmup #4 (Textbook Problem 3.7)

Answer: The query selects those values of p.a1 that are equal to some value of r1.a1 or r2.a1 if and only if both r1 and r2 are non-empty. If one or both of r1 and r2 are empty, the cartesian product of p, r1 and r2 is empty, hence the result of the query is empty. Of course if p itself is empty, the result is as expected, i.e. empty.

Problem 5

1. Which students graduating in 2015 have ever gotten an A in CS127?

- \{ t | \exists S \epsilon student \ (t[name] = S[name] \land S[gradyear] = 2015 \land \exists E \epsilon enrollment \ (S[name] = E[name] \land E[title] = "CS127" \land E[grade] = "A") \}

- SELECT name FROM student JOIN enrollment ON student.name = enrollment.name WHERE gradyear = 2015 AND title = "CS127" AND grade = "A"
2. Which of Professor Doeppner’s courses is Eliza taking this semester (2015F)?

- \{ t \mid \exists C \in \text{courses} \ (t[\text{title}] = C[\text{title}] \land C[\text{semester}] = “2015F” \land C[\text{instructor}] = “Doeppner” \land \exists E \in \text{enrollment} \ (C[\text{title}] = E[\text{title}] \land E[\text{name}] = “Eliza”) \}

- SELECT title FROM enrollment JOIN course ON enrollment.title = course.title WHERE name = “Eliza” AND Instructor = “Doeppner” AND Semester = “2015F”

3. TRC:

- \{ t \mid \exists C \in \text{courses} \land C[\text{semester}] = “2015F” \land \exists E \in \text{enrollment} \ (P(t, C, E)) \} such that:
  - P(t, C, E) \equiv t[\text{title}] = C[\text{title}] \land t[\text{semester}] = C[\text{semester}] \land t[\text{instructor}] = C[\text{instructor}] \land t[\text{grade}] = E[\text{grade}] \land E[\text{semester}] = C[\text{semester}] \land \exists S \in \text{student} \ (Q(t, C, E, S))
  - Q(t, C, E, S) \equiv t[\text{name}] = S[\text{name}] \land t[\text{gradyear}] = S[\text{gradyear}] \land t[\text{gpa}] = S[\text{gpa}] \land E[\text{name}] = S[\text{name}] \land S[\text{gpa}] > 3.5

- SELECT * FROM (courses NATURAL JOIN enrollment NATURAL JOIN student) WHERE semester = “2015F” AND gpa > 3.5

4. TRC

- \{ t \mid \exists S \in \text{student} \land S[\text{gradyear}] = 2015 \land t[\text{name}] = S[\text{name}] \land P(t, S) \}

- P(t, S) \equiv \forall Z \in \{ C \mid C \in \text{course} \land C[\text{semester}] = “2015F” \land C[\text{instructor}] = “Doeppner” \} \land \exists E \in \text{enrollment} \ (L(S, Z, E))

- L(S, Z, E) \equiv E[\text{title}] = Z[\text{title}] \land S[\text{name}] = E[\text{name}]

- SQL:

  - SELECT name FROM
    * students s NATURAL JOIN enrollment e
    * WHERE gradyear = “2015F” AND
    * NOT EXISTS
      · (SELECT * FROM courses WHERE semester = “2015F”
        AND instructor = “Doeppner”
        · EXCEPT (SELECT title FROM enrollment e2 WHERE e2.name = e2.name)
        )