Solution to Odd Numbered Question to Supply DB Query Exercise

1. Show all information of suppliers in the city Houston.

TORC: {s | s ∈ Supplier, s.scity = 'Houston'}

DORC: {(snum, sname, scity, status) | (snum, sname, scity, status) ∈ Supplier, scity = 'Houston'}

RA: $\sigma_{scity = 'Houston'}$(Supplier)

RA interpreter:

SELECT [SCITY = 'Houston'] (SUPPLIER);

SQL:

```
SELECT DISTINCT *
FROM Supplier
WHERE SCity = 'Houston';
```

2. Show all information of parts with the color Red.

TORC:

DORC:

RA:

RA interpreter:

SQL:

3. Show all information of suppliers with a status greater than 5.

TORC: {s | s ∈ Supplier, status > 5}

DORC: {(snum, sname, scity, status) | (snum, sname, scity, status) ∈ Supplier, status > 5}

RA: $\sigma_{status > 5}$(Supplier)

RA interpreter:

SELECT [STATUS > 5] (SUPPLIER);

SQL:

```
SELECT DISTINCT *
FROM Supplier
WHERE Status > 5;
```

4. Show all information of parts with a color of Red and weight more than 5 lbs.

TORC:

DORC:

RA:

RA interpreter:

SQL:

5. Show all information of parts with a color of Red or Blue.

TORC: {p | p ∈ Part, (p.Color='Red' V p.Color='Blue')}

DORC: {(pnum, pname, color, weight) | (pnum, pname, color, weight) ∈ Part, (Color='Red' V Color='Blue')}

RA: $\sigma_{color = 'Red' \text{ V } color = 'Blue'}(Part)$

RA interpreter:

```
#   Note that the RA interpreter does not support OR condition.
SELECT [COLOR = 'Red'] (PART)
UNION
SELECT [COLOR = 'Blue'] (PART);
```

SQL:

```
SELECT DISTINCT *
FROM Part
WHERE Color = 'Red'
OR Color = 'Blue';
```

6. List all supplier names.

TORC:

DORC:

RA:

RA interpreter:

SQL:

7. List all part numbers.

TORC: {(p.pnum) | p ∈ Part}

DORC: {(pnum) | (pnum,_,_,_) ∈ Part}

RA: $\pi_{pnum}(Part)$

RA interpreter:

PROJECT [PNUM] (PART);

SQL:

```
SELECT DISTINCT pnum
FROM Part;
```

8. List all part colors.

TORC:

DORC:

RA:

RA interpreter:

SQL:

9. Show all supplier names in the city Houston.

TORC: {(s.name) | s ∈ Supplier, s.scity = 'Houston'}

DORC: {(sname) | (_, sname, 'Houston', _) ∈ Supplier}

RA: $\pi_{sname}(\sigma_{scity = \text{'Houston'}}(Supplier))$

RA interpreter:

PROJECT [SNAME] (SELECT [SCITY = 'Houston'] (SUPPLIER));

SQL:

```
SELECT DISTINCT s.sname
FROM Supplier AS s
WHERE s.SCity = 'Houston';
```

10. Show all supplier numbers that represent suppliers supplying part P2.

TORC:

DORC:

RA:

RA interpreter:

SQL:

11. Show all supplier numbers that represent suppliers supplying more than 20 of part P2.

TORC: {(s.num) | s ∈ Supply, s.quantity > 20, s.pnum = ‘P2’}

DORC: {(snum) | (snum, ‘P2’, quantity) ∈ Supply, quantity > 20}

RA: $\pi_{snum}(\sigma_{quantity>20,\ pnum = 'P2'}(Supply))$

RA interpreter:

PROJECT [SNUM] (SELECT [PNUM = 'P2' and Quantity > 20] (SUPPLY));

SQL:

```
SELECT DISTINCT s.SNum
FROM Supply AS s
WHERE s.PNum = 'P2'
AND s.Quantity > 20;
```

12. Show the part numbers and weights of all parts with color Red.

TORC:

DORC:

RA:

RA interpreter:

SQL:

13. Show the part numbers and weights of all parts with weights more than 5 lbs.

TORC: {(p.pnum, p.weight) | p ∈ Part, p.weight > 5}

DORC: {(pnum, weight) | (pnum, _, _, weight) ∈ Part, weight > 5}

RA: $\pi_{pnum,\ weight}(\sigma_{weight>5}(Part))$

RA interpreter:

PROJECT [PNUM, WEIGHT] (SELECT [WEIGHT > 5] (PART));

SQL:

```
SELECT DISTINCT p.PNum, p.weight
FROM Part AS p
WHERE weight > 5;
```

14. Show all supplier status of all suppliers in Houston.

TORC:

DORC:

RA:

RA interpreter:

SQL:

15. Show all information of suppliers that supplies part P1.

TORC: {s | s ∈ Supplier, u ∈ Supply, u.pnum = 'P1', u.snum=s.snum}

DORC: {(snum, sname, scity, status) | (snum, sname, scity, status) ∈ Supplier, (snum, 'P1', _) ∈ Supply}

RA: $\pi_{snum, sname, scity, status}$ (Supplier |x| $\sigma_{pnum='P1'}$ (Supply))

RA interpreter:

SUPPLIER JOIN (PROJECT [SNUM] (SELECT [PNUM = 'P1'] (SUPPLY)));

SQL:

```
SELECT DISTINCT s.*
FROM Supplier AS s INNER JOIN Supply AS u ON (s.snum = u.snum)
WHERE u.pnum = 'P1';
```

16. Show all information of parts supplied by supplier S1.

TORC:

DORC:

RA:

RA interpreter:

SQL:

17. Show all information of parts supplied by supplier S1 or S2.

TORC: {p | p ∈ part, u ∈ Supply, u.pnum=p.pnum, (u.snum = 'S1' V u.snum='S2')}

DORC: {(pnum, pname, color, weight) | (pnum, pname, color, weight) ∈ Part, (snum, pnum, _) ∈ Supply, (snum = 'S1' V snum='S2')}

RA: Part |x| π_{pnum} ($\sigma_{snum='S1' V snum='S2'}$ (Supply))

RA interpreter:

(PART JOIN (PROJECT [PNUM] (SELECT [SNUM = 'S1'] (SUPPLY))))

UNION
(PART JOIN (PROJECT [PNUM] (SELECT [SNUM = 'S2'] (SUPPLY))));

SQL:

```
SELECT DISTINCT p.*
FROM Part AS p INNER JOIN Supply AS u ON (p.pnum = u.pnum)
WHERE u.snum = 'S1'
OR u.snum = 'S2';
```

18. Show all supplier names of suppliers supplying part P1.

TORC:

DORC:

RA:

RA interpreter:

SQL:

19. Show all information of parts supplied by supplier S1 and S2.

TORC: {p | p ∈ Part, u1 ∈ Supply, u1.pnum=p.pnum, u1.snum = 'S1', u2 ∈ Supply, u2.pnum=p.pnum, u2.snum = 'S2'}

DORC: {(pnum, pname, color, weight) | (pnum, pname, color, weight) ∈ Part, ('S1', pnum, _) ∈ Supply, ('S2', pnum, _) ∈ Supply}

RA: Part |x| ($\pi_{pnum}(\sigma_{snum='S1'}(Supply)) \cap \pi_{pnum}(\sigma_{snum='S2'}(Supply))$)

RA interpreter:

(PART JOIN (PROJECT [PNUM] (SELECT [SNUM = 'S1'] (SUPPLY))))
INTERSECT
(PART JOIN (PROJECT [PNUM] (SELECT [SNUM = 'S2'] (SUPPLY))));

SQL:

```
SELECT DISTINCT p.*
FROM Part AS p INNER JOIN Supply AS u1 ON (p.pnum = u1.pnum)
        INNER JOIN Supply AS u2 ON (p.pnum = u2.pnum)
WHERE u1.snum = 'S1'
AND u2.snum = 'S2';
```

20. Show all part numbers representing parts supplied by supplier S3 or S4.

TORC:

DORC:

RA:

RA interpreter:

SQL:

21. Show all cities with suppliers supplying part P3.

TORC: {(s.scity) | s ∈ Supplier, u ∈ Supply, u.pnum = 'P3', u.snum=s.snum}

DORC: {(scity) | (snum, _, scity, _) ∈ Supplier, (snum, 'P3', _) ∈ Supply}

RA: π_{scity} (Supplier |x| $\sigma_{pnum='P3'}$ (Supply))

RA interpreter:

PROJECT [SCITY] (SUPPLIER JOIN (SELECT [PNUM = 'P3'] (SUPPLY)));

SQL:

```
SELECT DISTINCT s.scity
FROM Supplier AS s INNER JOIN Supply AS u
        ON (s.snum = u.snum)
WHERE u.pnum = 'P3';
```

22. Show all status with active suppliers (a supplier is active if it supplies at least one part).

TORC:

DORC:

RA:

RA interpreter:

SQL:

23. Show all information of parts that are supplied by a supplier in the city Houston.

TORC: {p | p ∈ part, u ∈ Supply, s ∈ Supplier, u.pnum=p.pnum, s.snum=u.snum, s.scity='Houston'}

DORC: {(pnum, pname, color, weight) | (pnum, pname, color, weight) ∈ Part, (snum, pnum, _) ∈ Supply, (snum, _, 'Houston', _) ∈ Supplier}

RA: Part |x| π_{pnum} (Supply |x| $\sigma_{scity='Houston'}$(Supplier))

RA interpreter:

PART JOIN (PROJECT [PNUM] (SELECT [SCITY = 'Houston'] (SUPPLIER JOIN SUPPLY)));

SQL:

```
SELECT DISTINCT p.*
FROM Part AS p INNER JOIN Supply AS u ON (p.pnum = u.pnum)
        INNER JOIN Supplier AS s ON (u.snum = s.snum)
WHERE s.scity = 'Houston';
```

24. Show all information of suppliers supplying a red part.

TORC:

DORC:

RA:

RA interpreter:

SQL:

25. Show all information of suppliers with a status of greater than five and supplies a part of weight greater than five.

TORC: {s | p ∈ part, u ∈ Supply, s ∈ Supplier, u.pnum=p.pnum, s.snum=u.snum, s.status > 5, p.weight >5}

DORC: {(snum, sname, scity, status) | (snum, sname, scity, status) ∈ Supplier , (snum, pnum, _) ∈ Supply, (pnum, _, _, weight) ∈ Part. Status > 5, weight > 5}

RA: $\sigma_{status>5}$(Supplier |x| π_{snum} (Supply |x| $\sigma_{weight>5}$(Part)))

RA interpreter:

```
(SELECT [STATUS > 5] (SUPPLIER))
JOIN
(PROJECT [SNUM] (SELECT [WEIGHT > 5] (SUPPLY JOIN PART)));
```

SQL:

```
SELECT DISTINCT s.*
FROM Part AS p INNER JOIN Supply AS u ON (p.pnum = u.pnum)
        INNER JOIN Supplier AS s ON (u.snum = s.snum)
WHERE s.status > 5
AND p.weight > 5;
```

26. Show all cities that contain inactive suppliers.

TORC:

DORC:

RA:

RA interpreter:

SQL:

27. Show the supplier numbers of all suppliers that supply part P1 but not part P2.

TORC: {(u1.snum) | u1 ∈ Supply, u1.pnum = 'P1', (u2 ∉ Supply V u2.snum <> u1.snum V u2.pnum <> 'P2')}

DORC: {(snum) | (snum, 'P1', _) ∈ Supply, (snum, 'P2', _) u ∉ Supply}

RA: $\pi_{snum}(\sigma_{PNum='P1'}(Supply)) - \pi_{snum}(\sigma_{PNum='P2'}(Supply))$

RA interpreter:

```
(PROJECT [SNUM] (SELECT [PNUM = 'P1'] (SUPPLY)))
MINUS
(PROJECT [SNUM] (SELECT [PNUM = 'P2'] (SUPPLY)));
```

SQL:

```
SELECT DISTINCT snum
FROM Supply
WHERE pnum = 'P1'
AND snum NOT IN (SELECT DISTINCT snum FROM Supply WHERE pnum = 'P2');
```

28. Show the supplier numbers of all suppliers that supply red parts but not green parts.

TORC:

DORC:

RA:

RA interpreter:

SQL:

29. Show all information of parts that are supplied by at least one supplier in Houston.

This is really the same as question #23, asking in a different format.

TORC: {p | p ∈ part, u ∈ Supply, s ∈ Supplier, u.pnum=p.pnum, s.snum=u.snum, s.scity='Houston'}

DORC: {(pnum, pname, color, weight) | (pnum, pname, color, weight) ∈ Part, (snum, pnum, _) ∈ Supply, (snum, _, 'Houston', _) ∈ Supplier}

RA: Part |x| π_{pnum} (Supply |x| $\sigma_{scity='Houston'}$(Supplier))

RA interpreter:

(SELECT [STATUS > 5] (SUPPLIER))
JOIN
(PROJECT [SNUM] (SELECT [WEIGHT > 5] (SUPPLY JOIN PART)));

SQL:

```
SELECT DISTINCT p.*
FROM Part AS p INNER JOIN Supply AS u ON (p.pnum = u.pnum)
        INNER JOIN Supplier AS s ON (u.snum = s.snum)
WHERE s.scity = 'Houston';
```

30. Show the supplier numbers of all suppliers that supplies all parts supplied by supplier S1.

TORC:

DORC:

RA:

RA interpreter:

SQL:

31. Show the part names of all parts that are supplied by at least one supplier in Houston with a status of 5 or above.

TORC: {p | p ∈ part, u ∈ Supply, s ∈ Supplier, u.pnum=p.pnum, s.snum=u.snum, s.scity='Houston', s.status>= 5}

DORC: {(pnum, pname, color, weight) | (pnum, pname, color, weight) ∈ Part, (snum, pnum, _) ∈ Supply, (snum, _, 'Houston', status) ∈ Supplier, status>5}

RA: Part |x| π_{pnum} (Supply |x| $\sigma_{scity='Houston', status>5}$(Supplier))

RA interpreter:

PART JOIN (PROJECT [PNUM] (SELECT [SCITY = 'Houston' AND STATUS>5] (SUPPLIER JOIN SUPPLY)));

SQL:

```
SELECT DISTINCT p.*
FROM Part AS p INNER JOIN Supply AS u ON (p.pnum = u.pnum)
        INNER JOIN Supplier AS s ON (u.snum = s.snum)
WHERE s.scity = 'Houston'
AND s.status>5;
```

32. Show the part names of all parts that are supplied by every supplier in Houston with a status of 5 or above.

TORC:

DORC:

RA:

RA interpreter:

SQL: