Question 1 (Exercise 16.1.3a)

- Give the parse tree for the following query about relations \( R(a,b) \) and \( S(b,c) \): (10 pts)

```
SELECT a, c FROM R, S WHERE R.b = S.b;
```

Answer:
Given the grammar:

```
Expr  ::= Term       | Expr + Term | Expr - Term
Term  ::= Factor    | Term * Factor | Term / Factor
Factor ::= number    | identifier
```

Show the parse tree for the following expression: (15 pts)

```
a - 3 * b + 7
```

Answer:
Question 2 (Exercise 16.3.2a) (25 pts)

- Give the initial query plan (= relational algebra tree) for the following query about relations \( R(a,b) \) and \( S(b,c) \):

\[
\text{SELECT a, c FROM R, S WHERE R.b = S.b;}
\]

Answer:
• Question 3 (Exercise 16.3.2b)
  ○ Give the initial query plan (= relational algebra tree) for the following query about relations \( R(a, b) \) and \( S(b, c) \) using a two-argument selection operation: \((10 \text{ pts})\)

```sql
SELECT a FROM R WHERE b IN
  (SELECT a FROM R, S WHERE R.b = S.b)
```

Answer:
Give the initial query plan (= relational algebra tree) for the previous query about relations $R(a, b)$ and $S(b, c)$ without using a two-argument selection operation: (15 pts)

Answer:
• Question 4 (Exercise 16.4.1)  (5 pts each)

○ Given the statistics of 4 relations:

<table>
<thead>
<tr>
<th></th>
<th>W(a, b)</th>
<th>X(b, c)</th>
<th>Y(c, d)</th>
<th>Z(d, e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(W)</td>
<td>= 100</td>
<td>T(X) = 200</td>
<td>T(Y) = 300</td>
<td>T(Z) = 400</td>
</tr>
<tr>
<td>V(W, a)</td>
<td>= 20</td>
<td>V(X, b) = 50</td>
<td>V(Y, c) = 50</td>
<td>V(Z, d) = 40</td>
</tr>
<tr>
<td>V(W, b)</td>
<td>= 60</td>
<td>V(X, c) = 100</td>
<td>V(Y, d) = 50</td>
<td>V(Z, e) = 100</td>
</tr>
</tbody>
</table>

Give an estimate for the size of the following results:

1. \( W \bowtie X \bowtie Y \bowtie Z \)
2. \( \sigma_{c=20}(Y) \bowtie Z \)
3. \( \sigma_{a=1 \text{ AND } b=2}(W) \)
4. \( W \times Y \)
5. \( X \bowtie_{X.c < Y.c} Y \)

Solutions:

http://192.168.1.9/~cheung/T/hw/hw5.html