Problem 1 Solution

• (a)
Problem 1 Solution

• (b)

\[ \Pi_{A,B,C} \]
\[ \rightarrow \]
\[ \rightarrow \]
\[ R_4 \]
\[ S_1 (or \ S_2) \]
Problem 1 Solution

• or

\[
\begin{array}{c}
\text{\(\bigcirc\)} \\
\text{\(R_4\)} & \text{\(\Pi_A\)} \\
\text{\(S_1(\text{or } S_2)\)}
\end{array}
\]
Problem 1 Solution

- or

```
    /
   /\   
 R4  S1(or S2)
  /   /
```


Problem 1 Solution

• (c)

\[ \Pi_{A,D} \cup \Pi_{A,D} \]

\[ \sigma_{A<40} \]

\[ R_1 \quad S_1 \quad \sigma_{A<40} \quad S_1 \]

\[ R_4 \]
Problem 1 Solution

• or

\[
\begin{align*}
\Pi_A & \quad \sigma_{A<40} \\
R_1 & \quad R_4
\end{align*}
\]

\[
\begin{align*}
S_1 & \\
\Pi_A & \quad S_1
\end{align*}
\]
Problem 1 Solution

• or
Problem 1 Grading

• Each subproblem worth 3 points
  – An incorrect solution (if it reflects partially understanding of the problem): reduce 2 points
  – A solution with unnecessary step(s): reduce 1 point
  – Conduct union before join: reduce 1 point
Problem 2(a) Solution

<table>
<thead>
<tr>
<th>from node</th>
<th>to node</th>
<th>what is sent</th>
<th>number of tuples sent</th>
<th>cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>N2</td>
<td>N1</td>
<td>$\pi_A S$</td>
<td>5K</td>
<td>20</td>
</tr>
<tr>
<td>N1</td>
<td>N2</td>
<td>$\pi_A (R \bowtie S)$</td>
<td>1K</td>
<td>4</td>
</tr>
<tr>
<td>N2</td>
<td>N1</td>
<td>$S \bowtie R$</td>
<td>10K</td>
<td>1540</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1564</td>
</tr>
</tbody>
</table>

Total cost
Problem 2(a) Grading

- The first two steps worth 2 points
  - A suboptimal solution: reduce 1 point
- The third step worth 2 points
  - A suboptimal solution: reduce 1 point
- The total cost worth 1 points
- Typos or errors in "what is sent" column: marked without any point reduction
- The plan is correct but the number of tuples sent is wrong: reduce 0.5 point
## Problem 2(b) Solution

<table>
<thead>
<tr>
<th>from node</th>
<th>to node</th>
<th>what is sent</th>
<th>number of tuples sent</th>
<th>cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>N2</td>
<td>N1</td>
<td>πₐS</td>
<td>5K</td>
<td>20</td>
</tr>
<tr>
<td>N1</td>
<td>N2</td>
<td>R ⊙ S</td>
<td>1K</td>
<td>204</td>
</tr>
<tr>
<td><strong>Total cost</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>224</strong></td>
</tr>
</tbody>
</table>
Problem 2(b) Grading

• Same as Problem 2(a), except for the first step worth 2 points and the second step worth 2 points
Problem 3(a) Solution

- Place at node 1 fragments: A, C
- Place at node 2 fragments: B, D
- Number of global transaction classes: 3
Problem 3(a) Solution

• or
  – Place at node 1 fragments: A, D
  – Place at node 2 fragments: B, C
  – Number of global transaction classes: 5
Problem 3(a) Grading

• The fragment allocation worth 3 points
  – An incorrect answer (if it is a valid plan): reduce 1 point
  – An invalid plan: reduce 3 points

• The number of global transaction classes worth 2 points
Problem 3(b) Solution

- Place at node 1 fragments: A, B, C, D
- Place at node 2 fragments: -
- Number of global transaction classes: 0
- Load imbalance: 10
Problem 3(b) Grading

• The fragment allocation worth 3 points
  – An incorrect answer (if it is a valid plan): reduce 1 point
  – An invalid plan: reduce 3 points

• The number of global transaction classes and load imbalance worth 2 points
  – The plan is not optimal, but the number of global transaction and load imbalance is correct for that suboptimal plan: reduce 1 point
Problem 4 Solution

- W → W  ping/ok  (or ping/ok & exec)
- I → W  exec/ok*
- W → A/F  nok/-
- C → C  ping/commit
- C → A/F  commit*/-
- A/F → A/F  ping/nok  (or ping/done)
Problem 4 Grading

• Each blank worth 1 point
  – Missing a star or having an unnecessary star: reduce 0.5 point
  – The following answer also gets full mark:
    ping/abort on A/F → A/F, and nok,abort/- on W → A/F
Problem 5 Solution

• (a) $T3 \rightarrow T2 \rightarrow T1$ or $T3 \rightarrow T2 \rightarrow T1$
• (b) Yes
• (c) No
• (d) No
• (e) Yes
• (f) No
Problem 5 Grading

• (a) worth 2 points
• (b) worth 2 points
• (c) worth 2 points
• (d) worth 1 point
• (e) worth 1 point
• (f) worth 2 points
Statistics

• Mean  41.2
• Median  42