Homework # 1

Sean Hinchee and Ryan Radomski

September 28, 2017
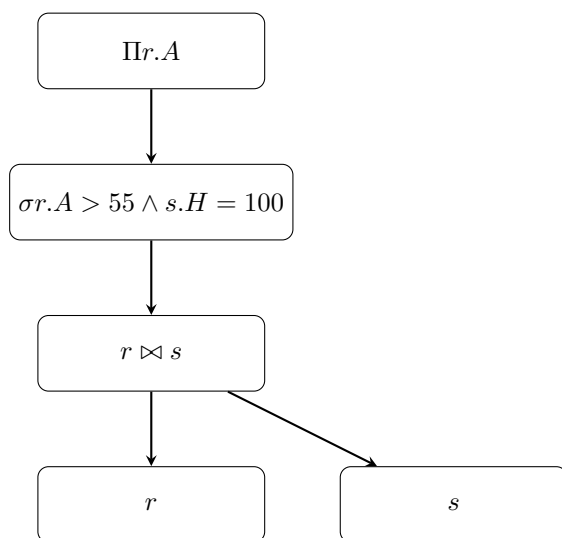
1.

$\Pi r.A(\sigma r.B = s.B \wedge r.A > 55 \wedge s.H = 100(r \times s))$

2.

$\Pi r.A(r.A > 55 \wedge s.H = 100(r \bowtie s))$

3.

```
┌─────────────┐
│   Πr.A      │
└─────────────┘
       │
       ▼
┌──────────────────────┐
│ σr.A > 55 ∧ s.H = 100 │
└──────────────────────┘
       │
       ▼
┌─────────────┐
│   r ⋈ s     │
└─────────────┘
     │      \
     ▼       ▼
┌────────┐  ┌────────┐
│   r    │  │   s    │
└────────┘  └────────┘
```

4.

$r \bowtie s = 800$ pages

$r = 800 * 0.2 = 160$ pages

$s = 1500 * 0.02 = 30$ pages

$160 + (30 * \frac{160}{8}) + 800 =$ page accesses $= 1,560$ page accesses

Two buffers used, one in, one out.

5.
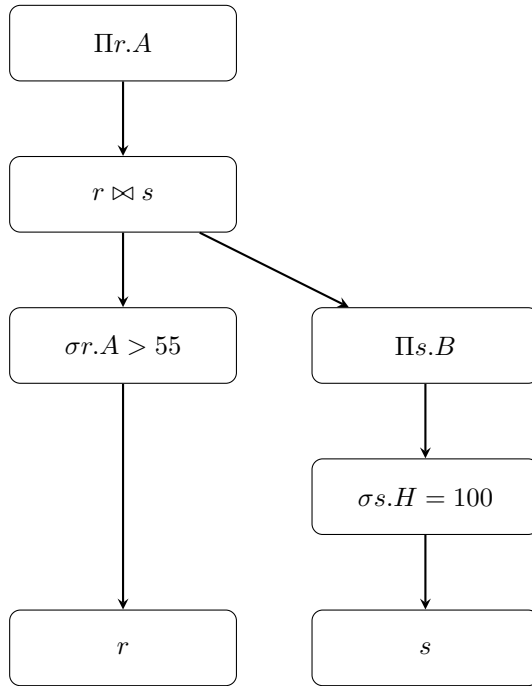
6.

Preprocess s: $1500 * 0.02 = 30$ pages

2 buffers

Cost of input: 2 buffers * $800 = 1600$ pages of r

Cost for output: $1600 * 0.02 * \frac{10}{10*8} = 4$ page accesses

Cost of join: $30 + 800 * \frac{4}{8} = 430$ page accesses

10 buffers

Total cost: $(1600 + 4) + 430 = 2034$ page accesses

Buffers: 2 and 10

7.

Preprocess r $= 800 * 0.2 = 160$ page accesses

2 buffers

Preprocess s $= 1500 * 0.04 = 60$ page accesses

2 buffers

Cost of input: 4 buffers * $800 * 1500 = 4,800,000$ pages of r and s

Cost for output: $4,800,000 * 0.04 * 0.2 * \frac{10}{10*8} = 4800$ page accesses

Cost of join: $160 + 60 + 800 * \frac{4800}{8} = 480,220$ page accesses

10 buffers

Total cost: $(4,800,000 + 4800) + 480,220 = 5,285,020$ page accesses

Buffers: 4 and 10

8.

$m = 3$

Input r: 800 pages accesses

Input s: $30000 * 3$ page accesses

Output: $1500 * 0.02$ page accesses

Total: $800 + 30000 * 3 * 0.02 + 1500 * 0.02 = 2,630$

9.

Preprocess r:

Cost $= 800 + (800 * 0.2) = 960$ page accesses

reduced size $= 160$ pages

2 buffers

Preprocess s:

Cost $= 1500 + 10 = 1510$ page accesses

2 buffers

Sort reduced r:

$2 * 160 * log_{10}(160) = 2 * 160 * 2 = 640$ page accesses

10 buffers

Sort reduced s:

$2 * 1510 * log_{10}(1510) = 2 * 1510 * 3 = 9000$ page accesses

10 buffers

Join by merging:

$160 + 10 + 3 = 173$ pages accesses

Total cost: $960 + 1510 + 640 + 9000 + 173 + 3 = 12286$

3 buffers

Buffers: 2, 10, and 3