Query Optimization

2. Exercise
Due November 6, 2017, 9 AM
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Exercise 1
For relations $R_1, R_2$, predicates $p_1, p_2$, $\mathcal{F}(p_1) \subseteq \mathcal{A}(R_1)$ and assuming set semantics.

- Prove the following equivalence:
  \[ \sigma_{p_1}(R_1 \times_{p_2} R_2) = \sigma_{p_1}(R_1) \times_{p_2} R_2 \]

- Does the equivalence also hold for outer joins? Justify your answer.
  \[ \sigma_{p_1}(R_1 \times_{p_2} R_2) \neq \sigma_{p_1}(R_1) \times_{p_2} R_2 \]

Exercise 2
Given $|R_1|, |R_2|$, the domain of $R_1.x$ and $R_2.y$, and the information if $R_1.x$ and/or $R_2.y$ are keys of $R_1$ and $R_2$.

1. How can we estimate the selectivity of $\sigma_{R_1.x = c}$, where $c$ is a constant?

2. How can we estimate the selectivity of $\times_{R_1.x = R_2.y}$?

Note that we don’t know the output size of $\sigma_{R_1.x = c}$ ($\times_{R_1.x = R_2.y}$, respectively), so we can’t simply use the definition of selectivity.

Exercise 3
Given are two relations $R$ and $S$, with sizes 1,000 and 100,000 pages respectively. Each page has 50 tuples. The relations are stored on a disk, the average access time for the disk is 10 ms and the transfer speed is 10,000 pages/sec. How long does it take to perform the Nested Loops Join of $R$ and $S$? How long does it take to perform the Block Nested Loops Join with a block size of 100 pages? Assume that CPU costs are negligible and ignore I/O costs for the join output.