CSCI 5020 External Memory Data Structures: Exercise List 2

In the following problems, $B$ is the block size, and $M$ is the memory capacity.

**Problem 1 (Batched Range Searching).** Let $R$ be a set of rectangles and $P$ a set of points, all in $\mathbb{R}^2$. Give an algorithm to report all such pairs $(r, p) \in R \times P$ that rectangle $r$ covers point $p$. Your solution should perform $O\left(\frac{|R|}{B} \log_{M/B} \frac{|R|}{B} + \frac{|P|}{B} \log_{M/B} \frac{|P|}{B} + K/B\right)$ I/Os, where $K$ is the number of pairs reported.

**Problem 2 (Batched Range Counting).** Let $R$ be a set of rectangles and $P$ a set of points, all in $\mathbb{R}^2$. Give an algorithm to report, for each rectangle $r \in R$, a pair $(r, c)$ where $c$ is the number of points in $P$ that are covered by $r$. Your solution should perform $O\left(\frac{|R|}{B} \log_{M/B} \frac{|R|}{B} + \frac{|P|}{B} \log_{M/B} \frac{|P|}{B}\right)$ I/Os.