Recitation 8

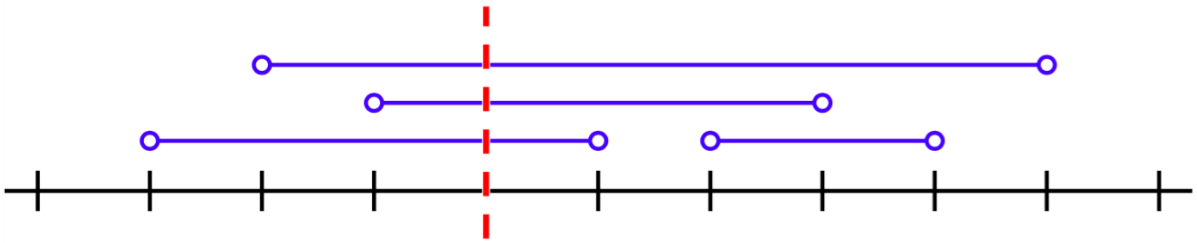
Augmented Tables

8.1 Announcements

- *RangeLab* has been released, and is due *Friday afternoon*.
- *BridgeLab* will be released on Friday. The written portion will be due the following Friday, while the coding portion will be due the Monday after that.

8.2 Interval Checking

Suppose you're given a set of intervals $I \subset \mathbb{Z} \times \mathbb{Z}$ and some $k \in \mathbb{Z}$, and you're interested in determining whether or not there exists $(l, r) \in I$ such that $l < k < r$. For simplicity, let's assume that no two intervals share an endpoint.



Task 8.1. *Implement a function*

val `intervalCheck : (int * int) Seq.t → int → bool`

where `(intervalCheck I k)` *answers the query mentioned above. Your function must be staged such that the line*

val `q = intervalCheck I`

performs $O(|I| \log |I|)$ *work and* $O(\log^2 |I|)$ *span, while each subsequent call* $q(k)$ *only performs* $O(\log |I|)$ *work and span. Try solving this problem with augmented tables.*

8.3 Interval Counting

Now suppose you want to solve a more general problem. Given I and k, you want to return $|\{(l, r) \in I \mid l < k < r\}|$. Once again, for simplicity, we'll assume all endpoints are distinct.

Task 8.2. *Implement a function*

val `intervalCount : (int * int) Seq.t → int → int`

where `(intervalCheck I k)` *answers the interval counting query as mentioned above. Your function must be staged, just like Task 8.1.*