Recitation 8

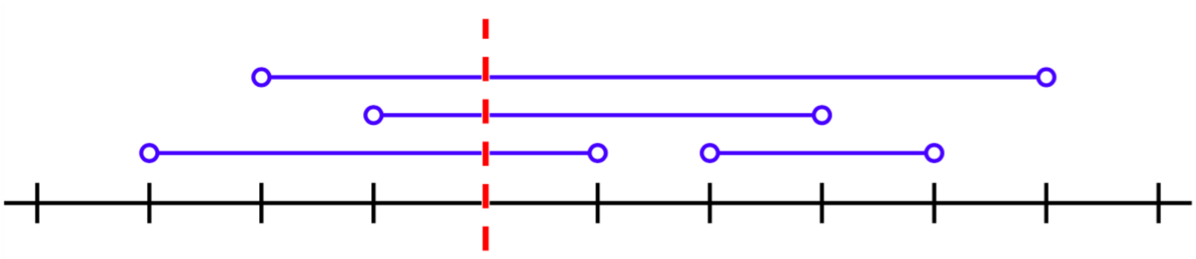
Augmented Tables

8.1 Announcements

- *RangeLab* has been released, and is due *Friday afternoon*.
- *BridgeLab* will be released on Friday. It's not due for two weeks, so enjoy your spring break!

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 $\mathtt{intervalCheck} : (\mathtt{int} * \mathtt{int})\ \mathtt{Seq.t} \to \mathtt{int} \to \mathtt{bool}$

where $(\mathtt{intervalCheck}\ I\ \ k)$ *answers the query mentioned above. Your function must be staged such that the line*

val $q = \mathtt{intervalCheck}\ I$

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 $\mathtt{intervalCount} : (\mathtt{int} * \mathtt{int})\ \mathtt{Seq.t} \to \mathtt{int} \to \mathtt{int}$

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