

Mandatory Exercise: External memory II

Inge Li Gørtz

1 Databases You are working as a consultant for the company "*Boxes, Boxes and Boxes*", that sells boxes. They want a database containing information about all their boxes. Each box has an unique id, a size, a type, and a price. They want to be able to update the database with insertions and deletions of boxes. The database should—in addition to the updates—support the following updates and queries efficiently:

- $\text{insert}(i, t, s, p)$: insert a box with id i , type t , size s and price p .
- $\text{delete}(i)$: delete the box with id i .
- $\text{report-size-price}(a, b)$: Return the price of all boxes with a size between a and b .
- $\text{report-size-type}(a, b)$: Return the type of all boxes with a size between a and b .
- $\text{report-price-size}(a, b)$: Return the size of all boxes with a price between a and b .

Give a data structure supporting the required updates and queries. Analyse the space and the I/O complexity of your data structure.