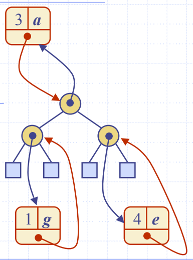
Locators



Outline and Reading

- Locators (§7.4, §9.6)
- Locator-based methods (§7.4.1)
- Implementation
- Positions vs. Locators

Locators

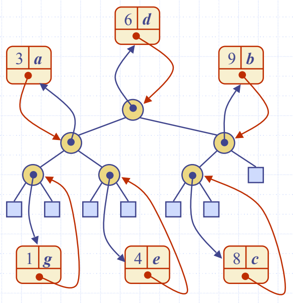
- A locators identifies and tracks a (key, element) item within a data structure
- A locator sticks with a specific item, even if that element changes its position in the data structure
- Intuitive notion:
  - claim check
  - reservation number
- Methods of the locator ADT:
  - key(): returns the key of the item associated with the locator
  - element(): returns the element of the item associated with the locator
- Application example:
  - Orders to purchase and sell a given stock are stored in two priority queues (sell orders and buy orders)
    - the key of an order is the price
    - the element is the number of shares
  - When an order is placed, a locator to it is returned
  - Given a locator, an order can be canceled or modified

Locator-based Methods

- Locator-based priority queue methods:
  - insert(k, o): inserts the item (k, o) and returns a locator for it
  - min(): returns the locator of an item with smallest key
  - remove(l): remove the item with locator l
  - replaceKey(l, k): replaces the key of the item with locator l
  - replaceElement(l, o): replaces with o the element of the item with locator l
  - locators(): returns an iterator over the locators of the items in the priority queue
- Locator-based dictionary methods:
  - insert(k, o): inserts the item (k, o) and returns its locator
  - find(k): if the dictionary contains an item with key k, returns its locator, else return a special null locator
  - remove(l): removes the item with locator l and returns its element
  - locators(), replaceKey(l, k), replaceElement(l, o)

Possible Implementation

- The locator is an object storing
  - key
  - element
  - position (or rank) of the item in the underlying structure
- In turn, the position (or array cell) stores the locator
- Example:
  - binary search tree with locators



Positions vs. Locators

- Position
  - represents a “place” in a data structure
  - related to other positions in the data structure (e.g., previous/next or parent/child)
  - often implemented as a pointer to a node or the index of an array cell
- Position-based ADTs (e.g., sequence and tree) are fundamental data storage schemes
- Locator
  - identifies and tracks a (key, element) item
  - unrelated to other locators in the data structure
  - often implemented as an object storing the item and its position in the underlying structure
- Key-based ADTs (e.g., priority queue and dictionary) can be augmented with locator-based methods