* priority queue w/ O(1) insert and O(1) getMin ? (and O(logn) extractMin)
  hard for each individual operation,
  but possible "amortized"

* Binomial { cheap insert usually
  expensive insert some time

* observation :
  { insert to (merge w/) small tree : cheap
  large : expensive

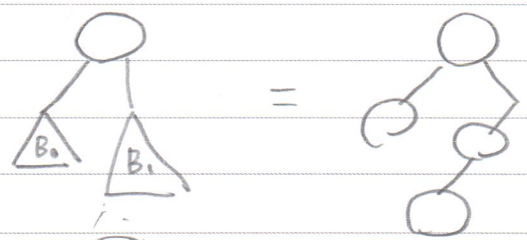
idea : instead of using one tree (heap or leftist)
use many trees, from small to large
try merge w/ small trees first

* binomial tree

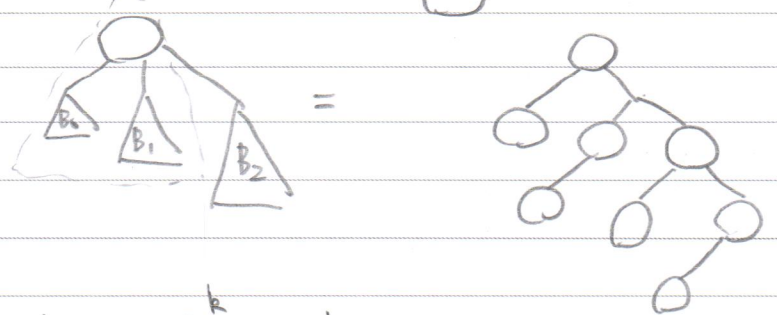
B_0 =

B_1 =

B_2 =



B_3 =



B_k contains 2^k nodes

* binomial forest
  { at most one B_k per each k }
  ⇒ can represent any n elements in node

  n = 10 : $\{B_3, B_1\}$
  n = 11 : $\{B_3, B_1, B_0\}$ binary number representation
  :

* (min-) binomial heap
  binomial forest w/ min-trees

  insert ○ to $\{B_0\}$ ⇒ merge B_0 B_0 ⇒ B_1
  insert ○ to $\{B_1\}$ ⇒ $\{B_0, B_1\}$
  insert ○ to $\{B_0, B_1\}$ ⇒ merge B_0, B_0 ⇒ merge B_1, B_1 ⇒ B_2
  insert ○ to $\{B_2\}$ ⇒ $\{B_0, B_2\}$
  :

  every one insertions : add B_0
  two : merge B_0, B_0
  four : merge B_1, B_1
  eight : merge B_2, B_2

  after n insertions
  $\frac{n}{2^k} + \frac{n}{2^{k-1}} + \cdots + n = O(n)$ operations ⇒ amortized O(1)
  (like incrementing binary numbers)

* getMin : search for $\{B_0, B_1, \cdots, B_k\}$ for min
  at most $O(\log n)$ trees for n nodes
  ⇒ $O(\log n)$

  can be improved by keeping a pmin pointer to min-min-tree

* merge : $O(\log n)$, like adding to binary numbers
* delMin : remove and merge sub-trees w/ existing trees