

UNIT – I

BINOMIAL QUEUES:

We know that previous concepts support merging, insertion, and delete min all effectively in $O(\log n)$ time per operation but insertion take constant average time.

Binomial Queues support all three operations in $O(\log n)$ worst case time per operation, but insertions take constant time on average.

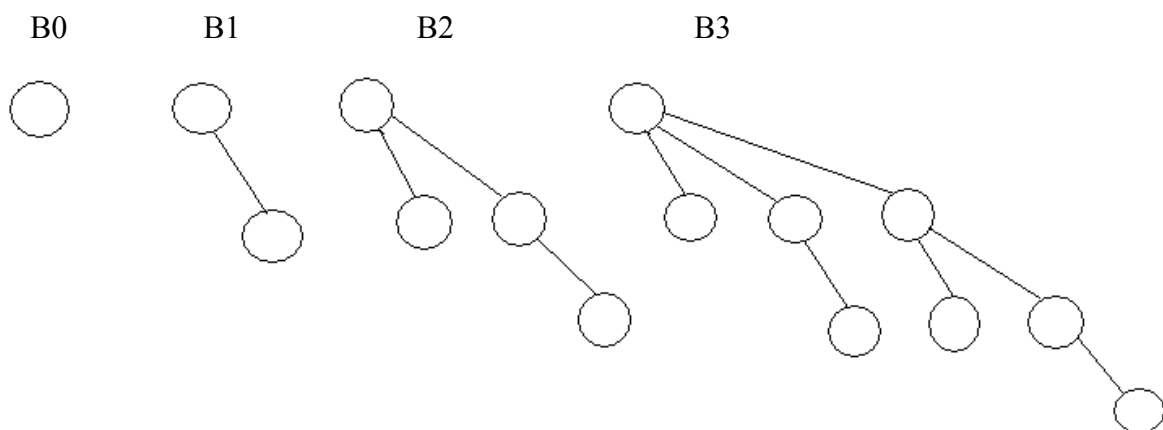
Binomial Queue Structure:

It differs from all the priority queue implementations that a binomial queue is not a heap – ordered tree but rather a collection of heap – ordered trees known as a forest.

Each of the heap – ordered trees is of a constrained form known as a binomial tree. There is at most one binomial tree of every height.

A binomial tree of height 0 is a one – node tree

A binomial tree B_k of height k is formed by attaching a binomial tree B_{k-1} to the root of another binomial tree B_{k-1}



The above diagram shows binomial trees B_0, B_1, B_2 and B_3 from the diagram we see that a binomial tree B_k consists of a root with children $B_0, B_1, B_2, \dots, B_{k-1}$

NOTE: Binomial tree of height k have exactly 2^k nodes and the no. of nodes at depth d is the binomial coefficient $\binom{k}{d}$

NOTE: If we impose heap order on the binomial tree and allow at most one binomial tree of any height we can uniquely represent a priority queue of any size by a collection of binomial trees (forest).

For instance, a priority queue of size 13 could be represented by the forest $B_3 B_2 B_0$. We might write this representation as 1 1 0 1. Which not only represent 13 in binary but also represent the fact that $B_3 B_2$ and B_0 are present in the representation and B_1 is not.

As an example, a priority queue of six elements could be represented as in below figure

H1:

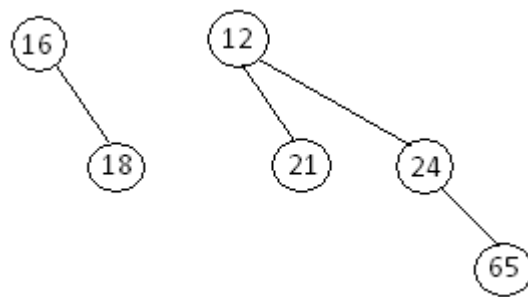


Figure: Binomial queue H1 with six elements

Reference Links

1. <https://zhu45.org/posts/2017/Apr/08/binomial-queue/>
2. <https://courses.cs.washington.edu/courses/cse373/02au/lectures/lecture12l.pdf>
3. <https://www.geeksforgeeks.org/binomial-heap-2/>

Video Links

1. <https://www.youtube.com/watch?v=9G-5jUqQAVc>
2. https://www.youtube.com/watch?v=e_gh1aD4v-A

Questions

1. What is Binomial Queue and Construct Binomial Queue with the elements :12,7,25,15,28,33,41,39,57,73,81.
2. Discuss about Binomial Queues.
3. Briefly discuss about Binomial Queue with Example.