

Assignment 5

1. **[20 Points]** Given input {4371, 1323, 6173, 4199, 4344, 9679, 1989} and a hash function $h(x) = x \bmod 10$, show the resulting:
 - a. Separate Chaining hash table
 - b. Hash Table using linear probing
 - c. Hash table using quadratic probing
 - d. Hash table with second hash function $h_2(x) = 7 - (x \bmod 7)$
2. **[10 Points]** A min-max heap is a data Structure that supports both deleteMin and deleteMax in $O(\log N)$ per operation. The structure is identical to a binary heap, but the heap-order property is that for any node, X, at even depth, the element stored at X is smaller than the parent but larger than the grandparent (where this makes sense), and for any node X at odd depth, the element stored at X is larger than the parent but smaller than grandparent. See Fig.
 - a. How do we find the minimum and maximum element?
 - b. Give an algorithm to insert a new node into the min-max heap.

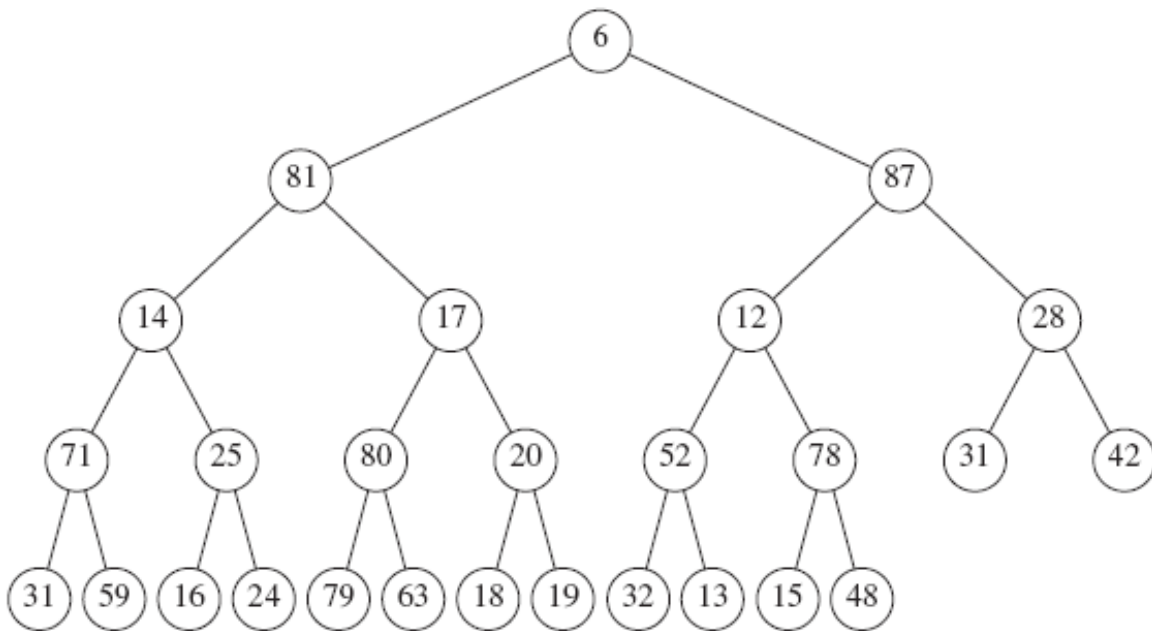


Figure 6.57 Min-max heap

3. **[10 Points]** Merge the two binomial queues

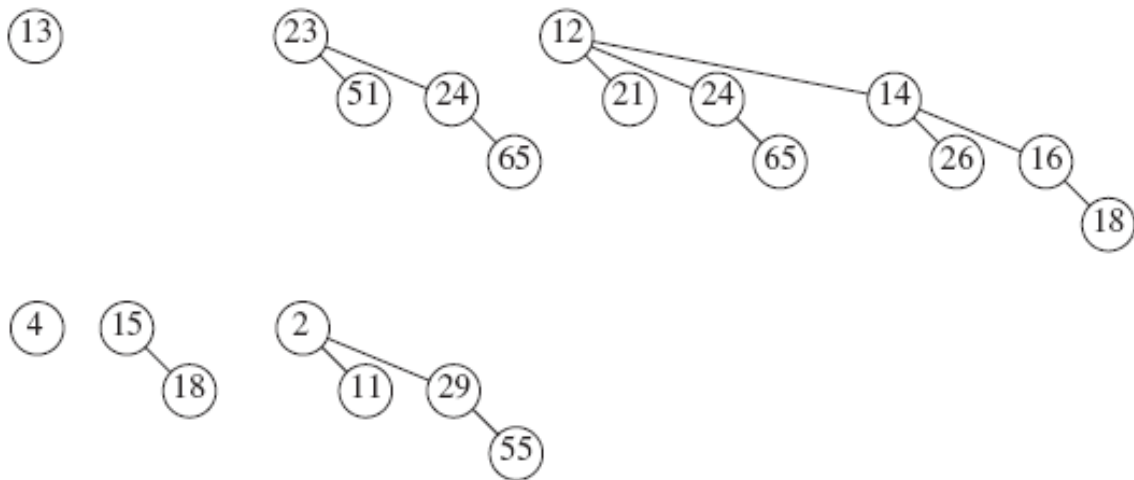


Figure 6.59 Input for Exercise 6.32

4. **[10 Points]** Give an algorithm to find all nodes less than some value X , in a binary heap. Your algorithm should run in $O(K)$, where K is number of nodes output.