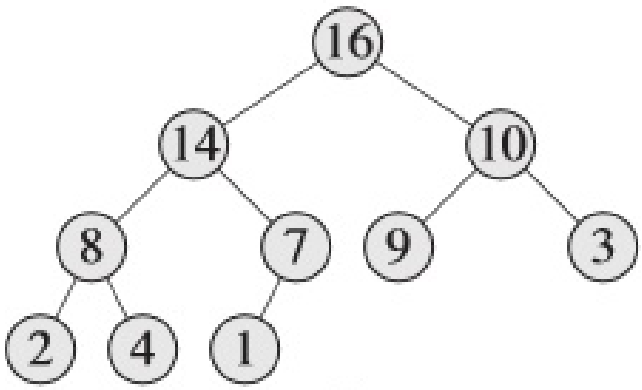
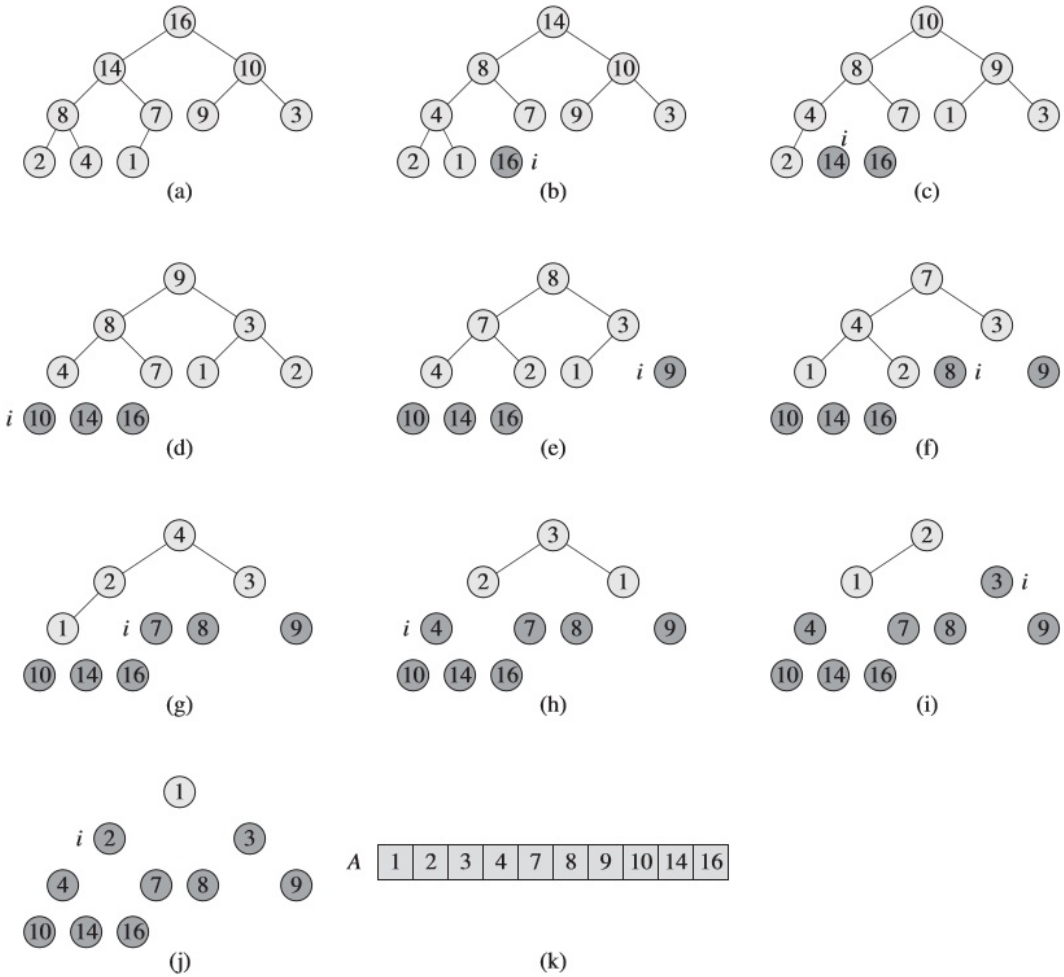
Heap

- Complete binary tree with heap property. What is heap property?
- How to insert an element into heap? Cost?
- How to find the largest element in a max-heap?
- How to find the largest element in a max-heap and remove it?
- How will a max-heap help to sort all numbers? Cost?

Heap Sort



Heap Sort



Mode

Problem: What is **mode** of n numbers? How to compute it? Complexity?

Problems...

We are given an Array A of n non-negative integers in the range of 0 to k. We wish to create another Array C of size $k+1$ such that $C[x]$ is equal to the number of times x appears in the original Array A. **Example:** A $= 2, 5, 3, 0, 2, 3, 0, 3$ then C $= 2, 0, 2, 3, 0, 1$

What is n and k in this example?

How to compute C from A? Complexity?

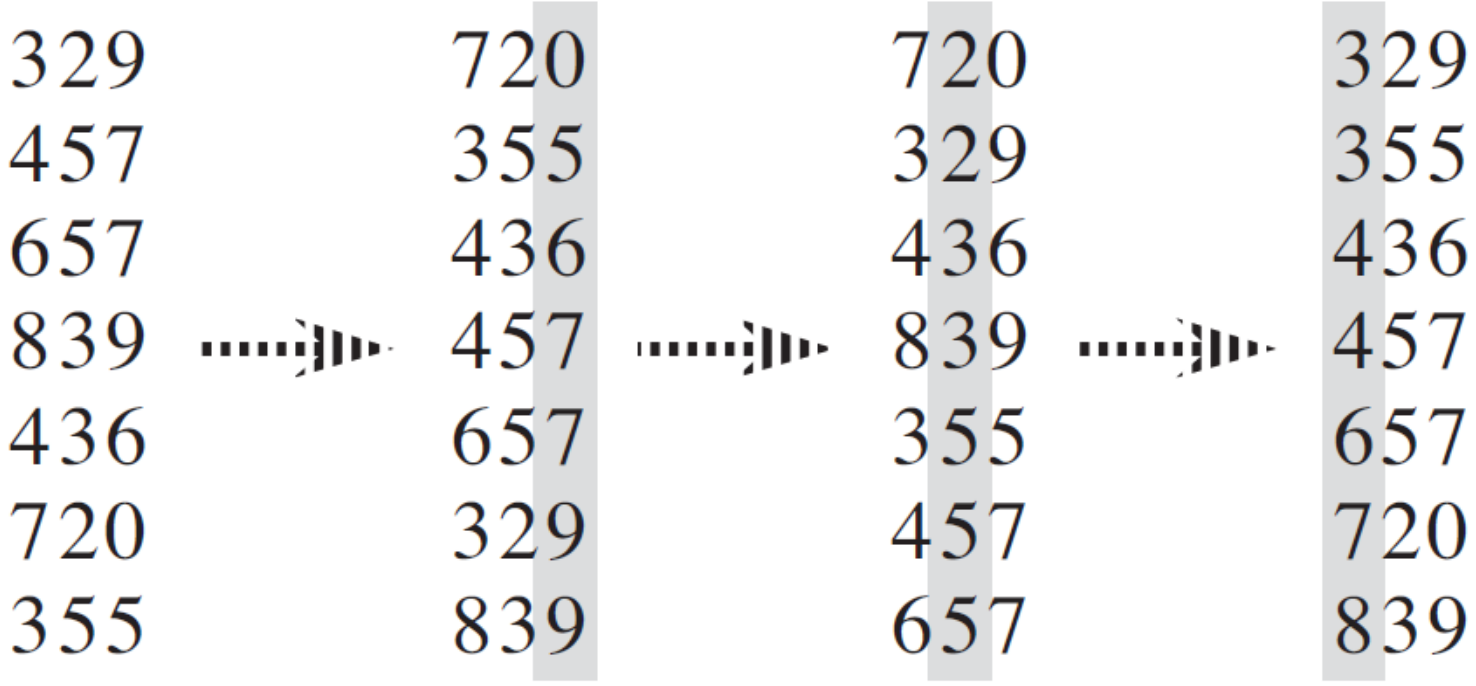
Problems...

How can you use the C array to find how many integers lie in a given range $[a..b]$? Complexity?

Can we do sorting using C? How? Complexity?

Radix Sort

```
RADIX-SORT(A, d)
1  for i = 1 to d
2      use a stable sort to sort array A on digit i
```


329
457
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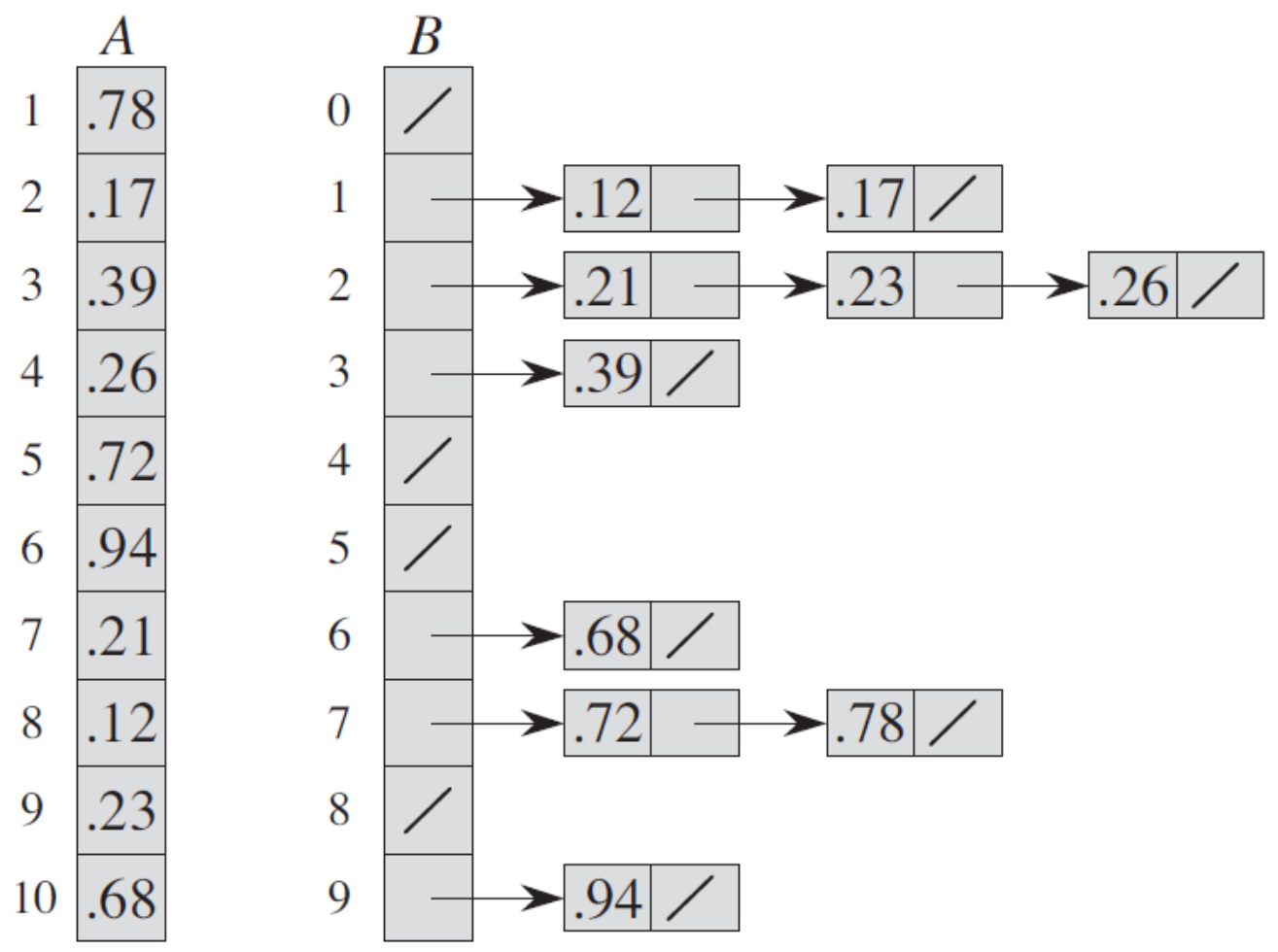
839

Way Forward...

1. Sorting technique vs algorithm - Please go through idea of Bucket Sort (ref. chapter 8, page 200 of your textbook)
2. Assume data is too huge to fit in memory all at once... ideal sorting approach would be?
3. Additional overheads to be counted towards overall computational cost?
4. We call it **External Sort or Disk Sort** (ref. Self-Reading Link)
5. We are done with sorting :)


A
1 .78
2 .17
3 .39
4 .26
5 .72
6 .94
7 .21
8 .12
9 .23
10 .68
B
0
1 .12 .17
2 .21 .23 .26
3 .39
4
5
6 .68
7 .72 .78
8
9 .94