An Introduction to Bucket Sort

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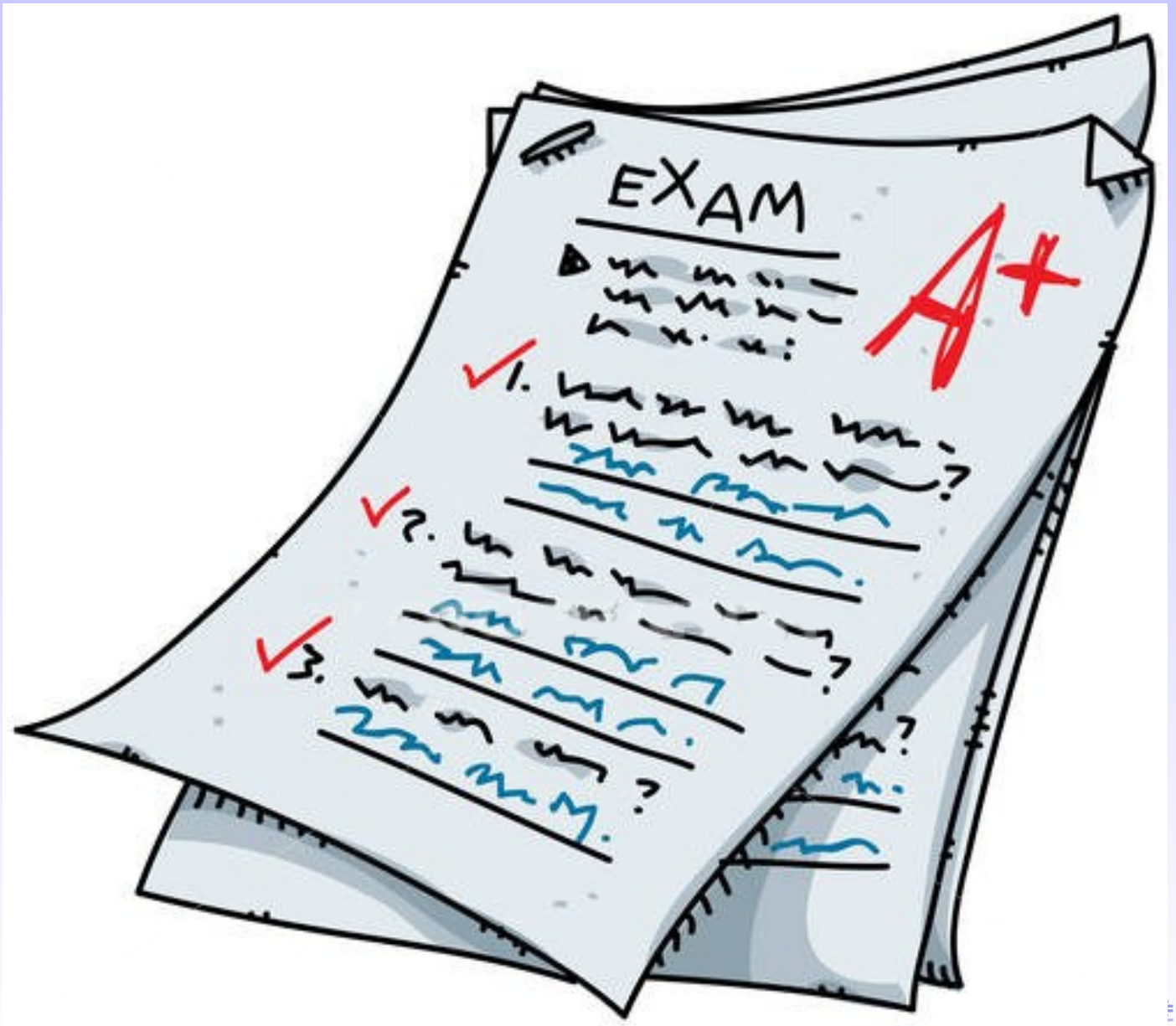
Let's discuss a problem



Let's discuss a problem

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8 students get following marks in an exam.

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29	25	3	49	9	37	21	43

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A teacher needs to sort the marks.

Possible Solution

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We can use some commonly used algorithms here. Like:

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- Bubble Sort

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- Quick Sort

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We can use some commonly used algorithms here. Like:

- Bubble Sort
- Merge Sort
- Quick Sort
- etc.

But wait!!!

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Is there a faster way to sort?

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Yes, there is.

BUCKET SORT!!!

Bucket sorting is a linear time algoritm of sorting

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Assumptions:

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- inputs are distributed uniformly over a range.

Back to our problem.

Index	0	1	2	3	4	5	6	7
Value	29	25	3	49	9	37	21	43

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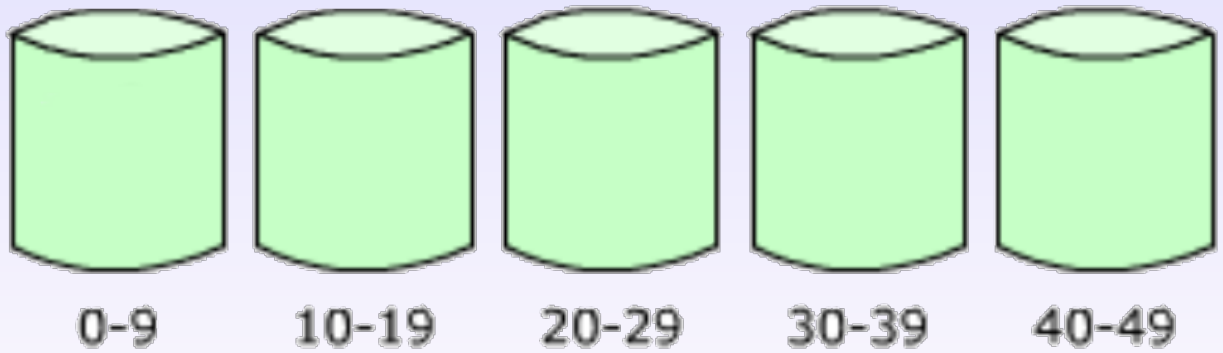
Value	29	25	3	49	9	37	21	43

Here, we assume

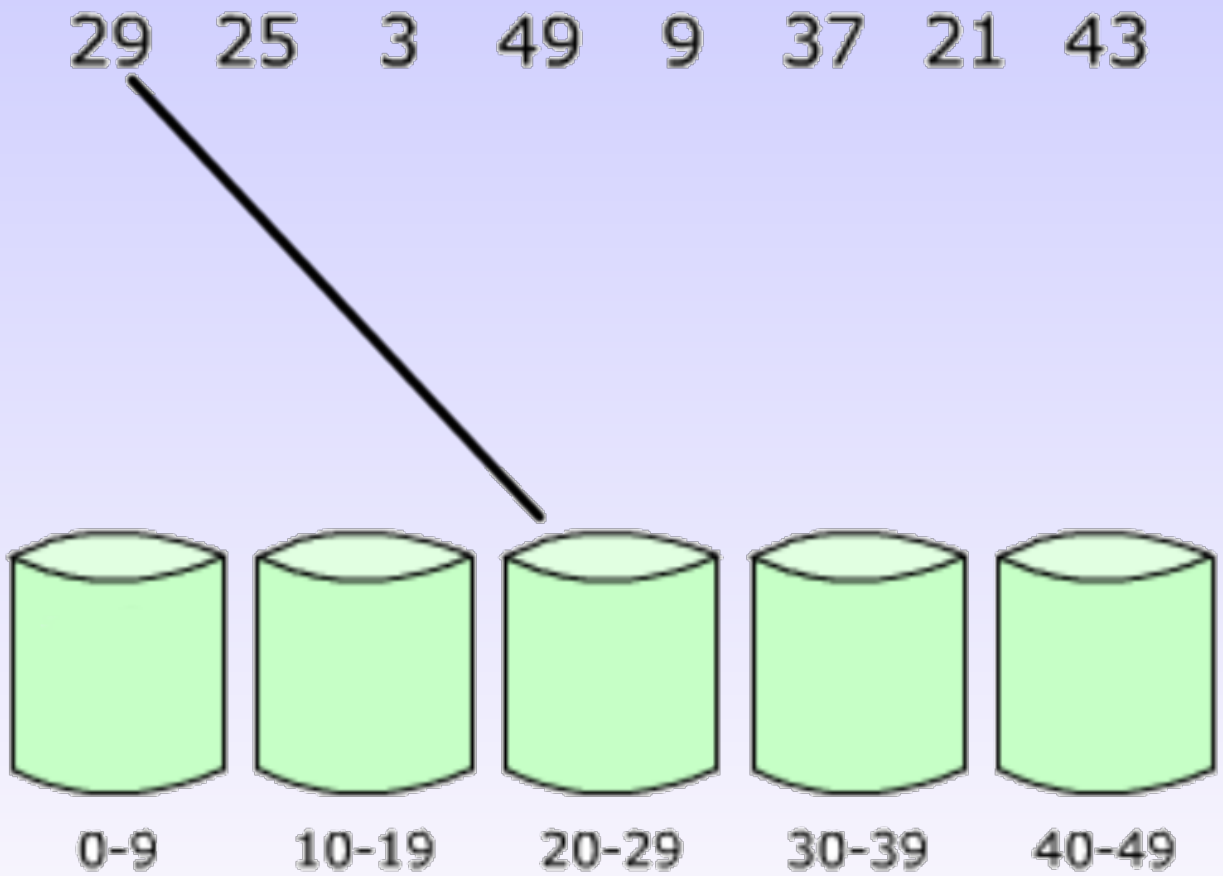
- Array size: 8
- Input range: 0-49
- Let's insert these numbers into 5 buckets.

Sorting...

29 25 3 49 9 37 21 43



Sorting...



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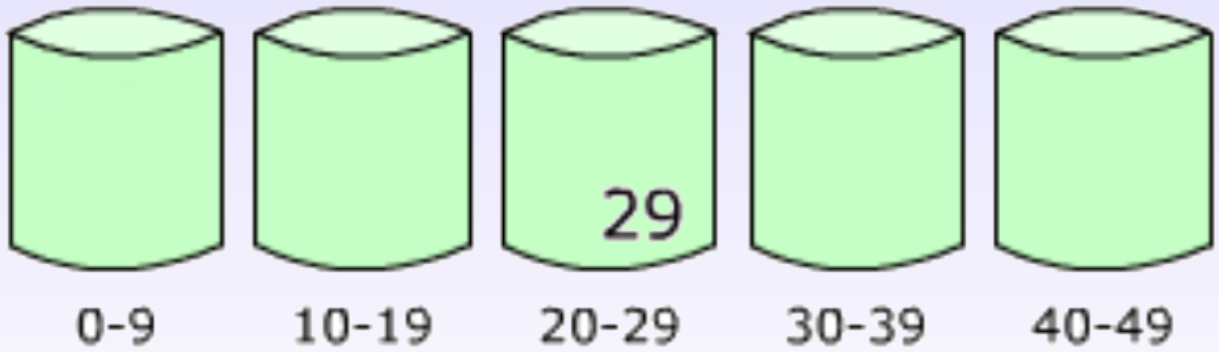
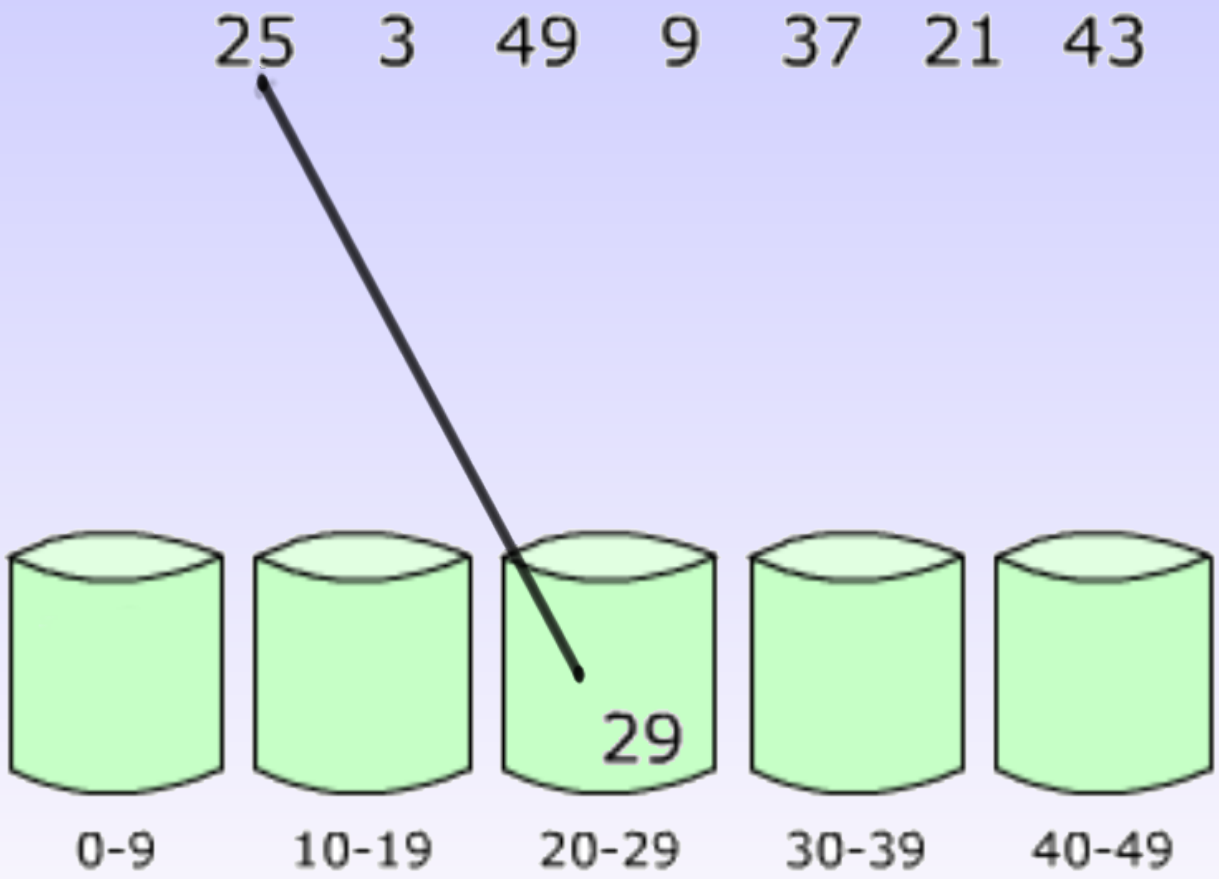
25 3 49 9 37 21 43



Sorting...



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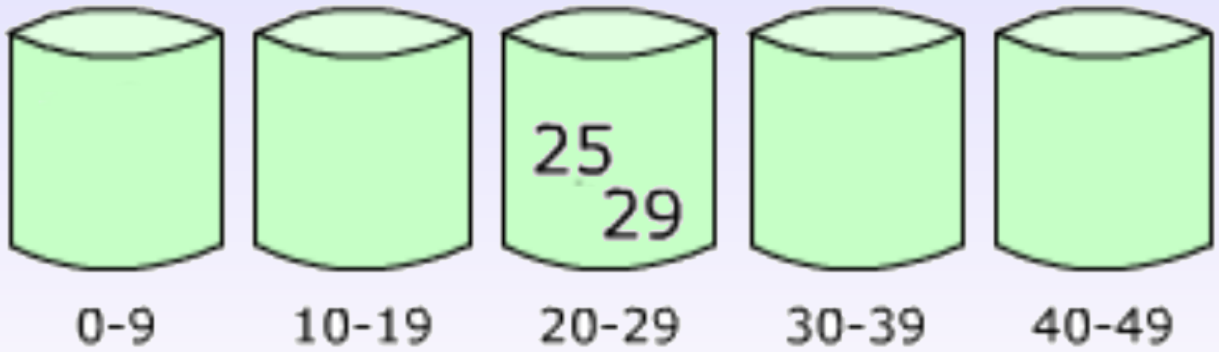
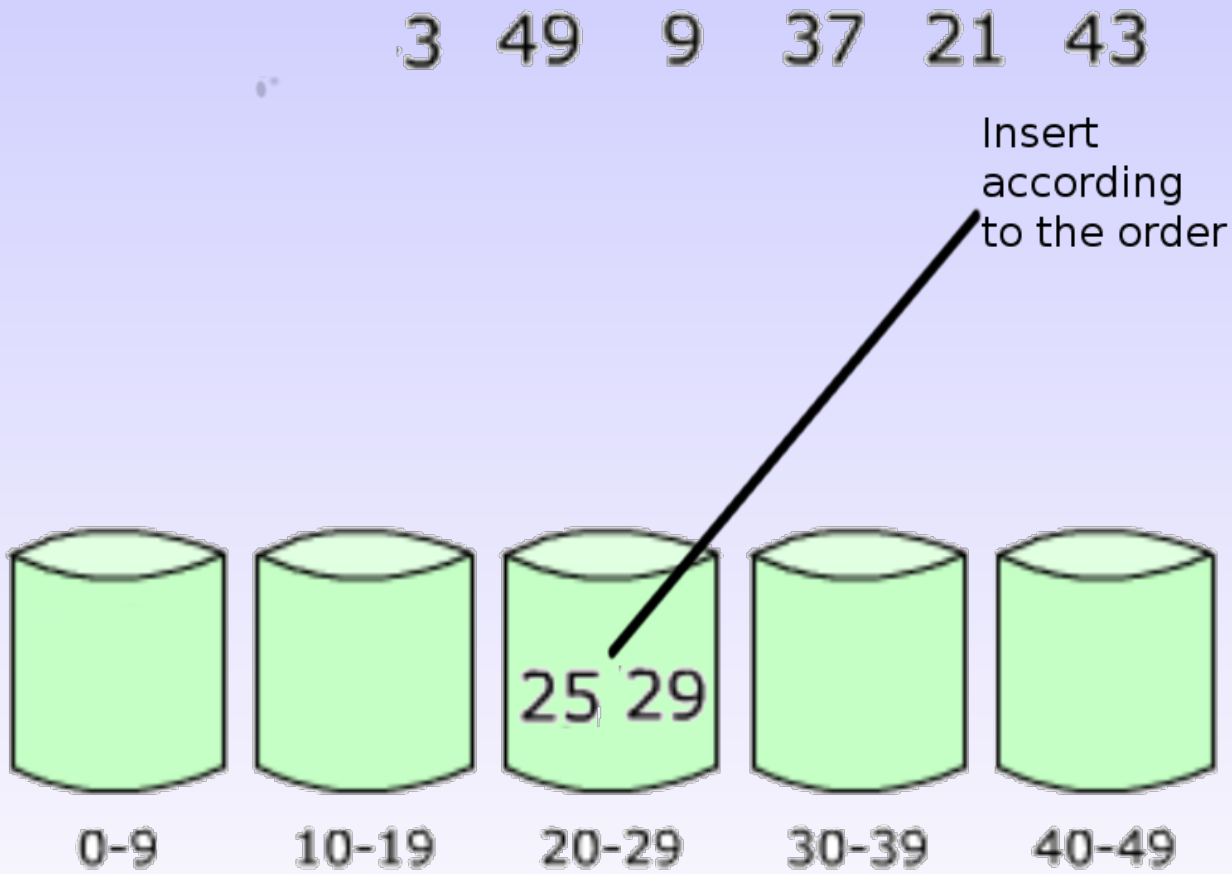
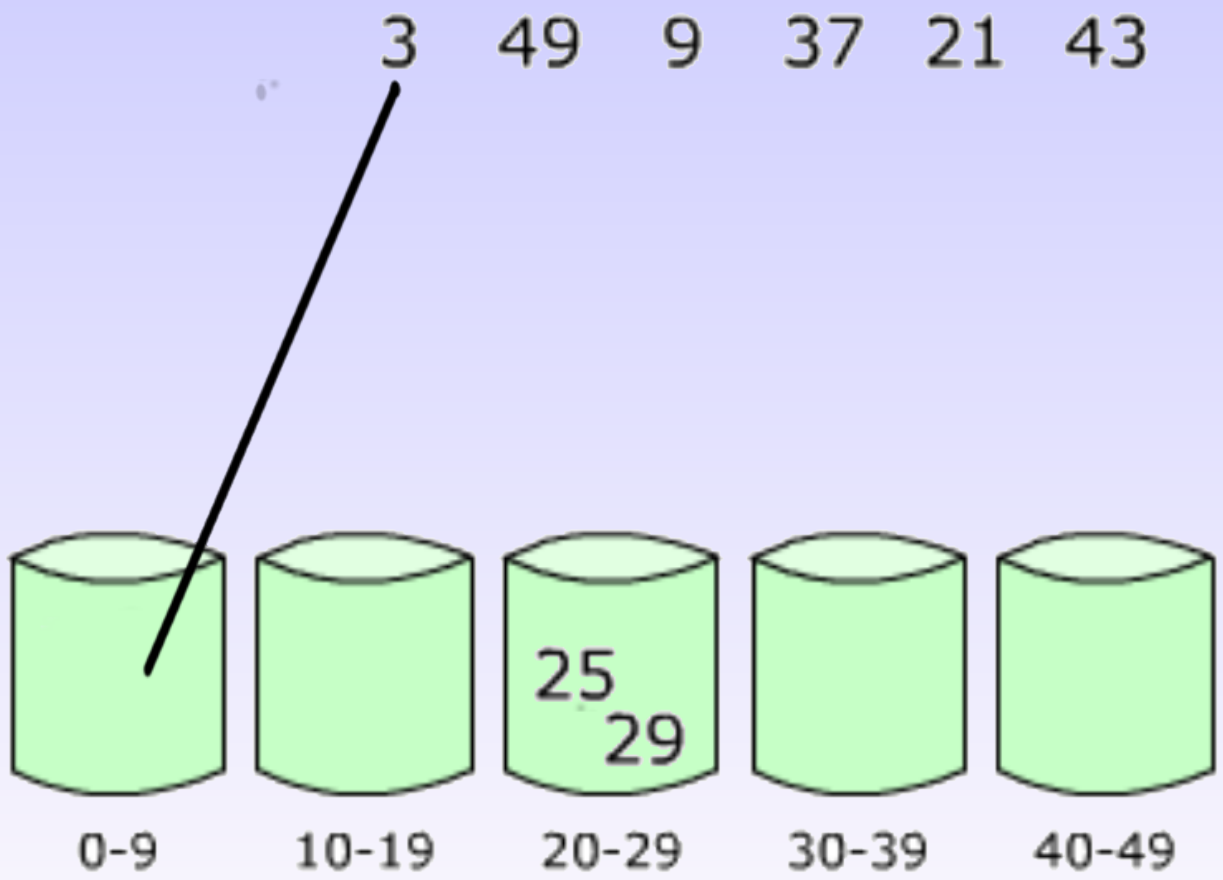
3 49 9 37 21 43



Sorting...

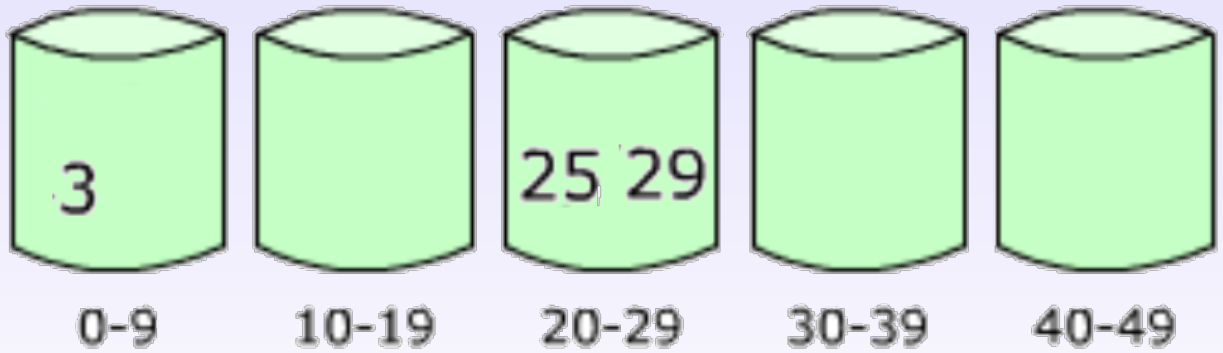

3 49 9 37 21 43
Insert according to the order
25 29
0-9
10-19
20-29
30-39
40-49

Sorting...



Sorting...

49 9 37 21 43



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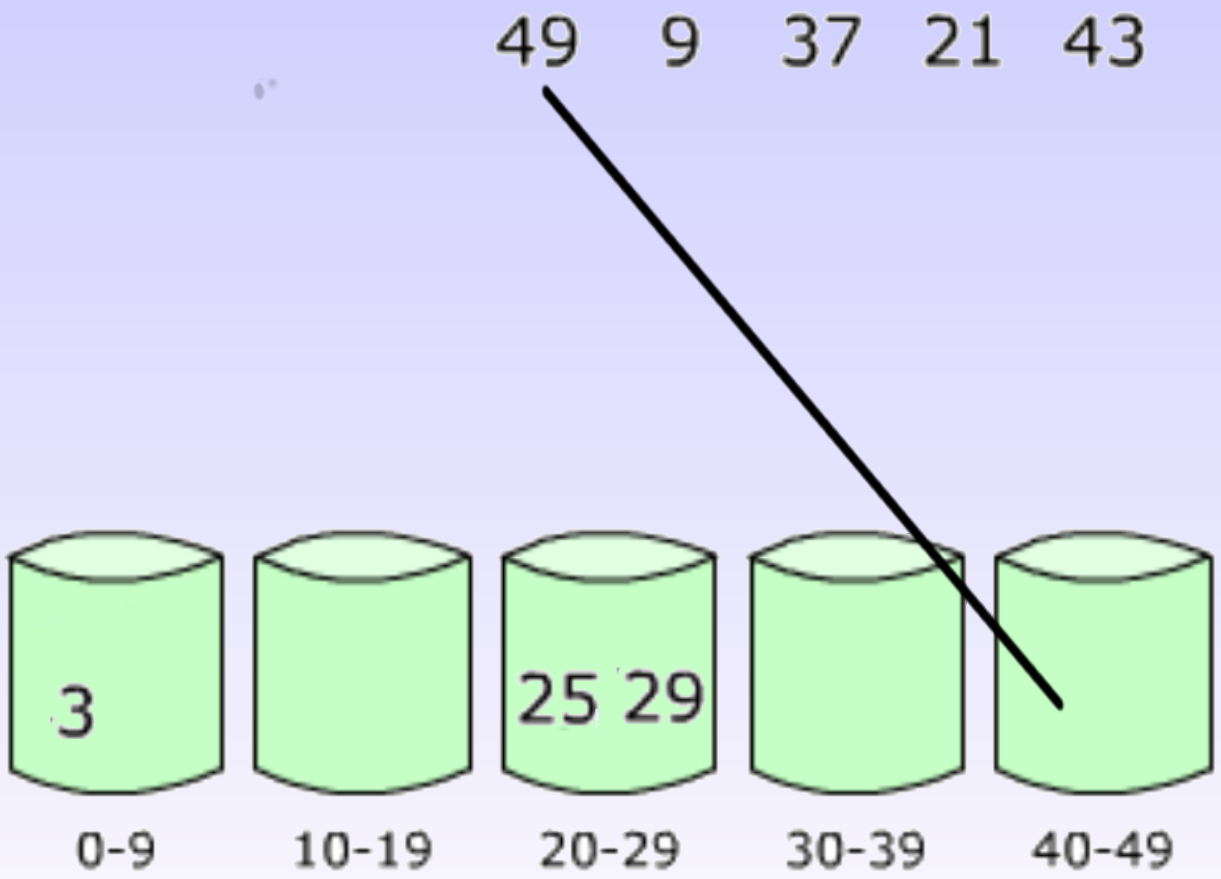

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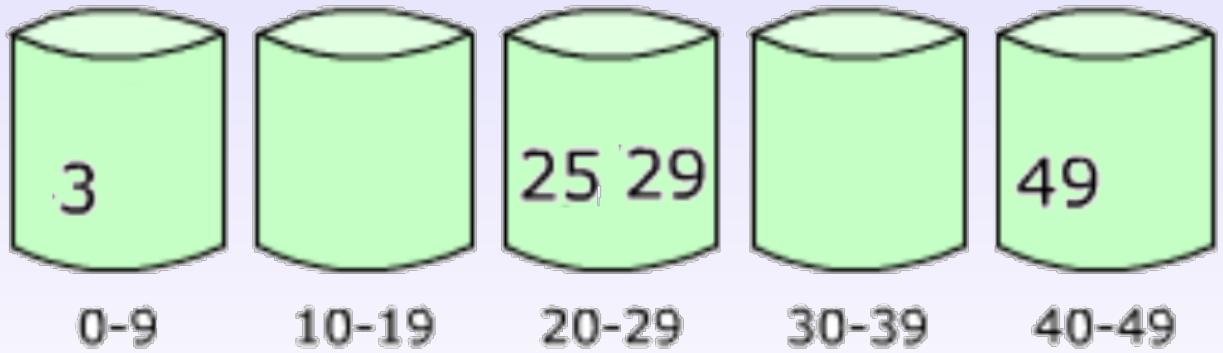
9 37 21 43



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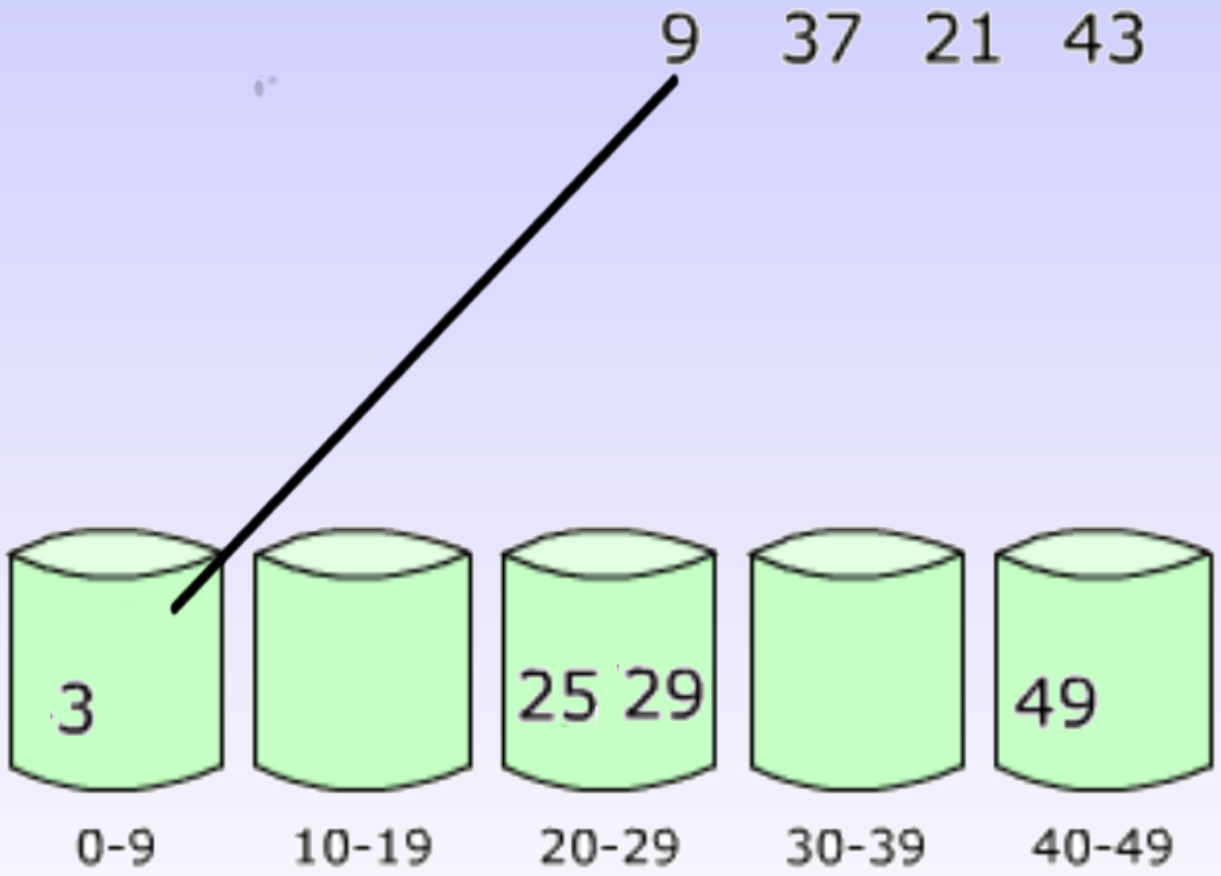
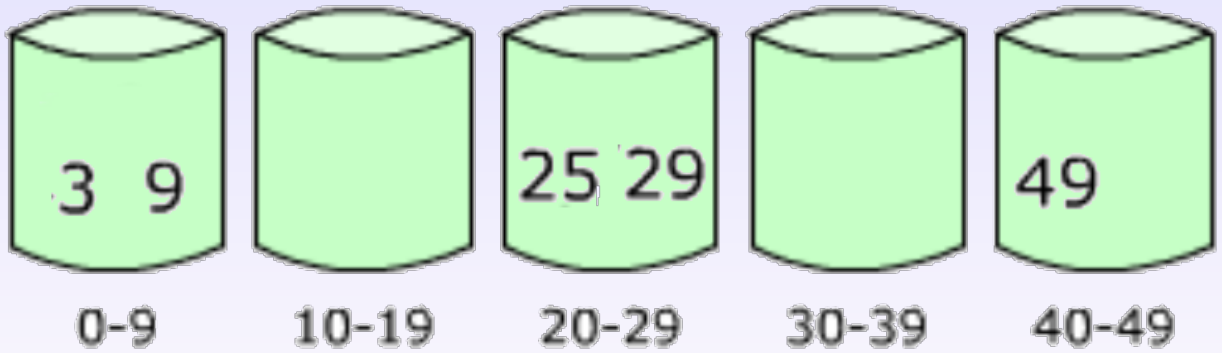


Sorting...

37 21 43



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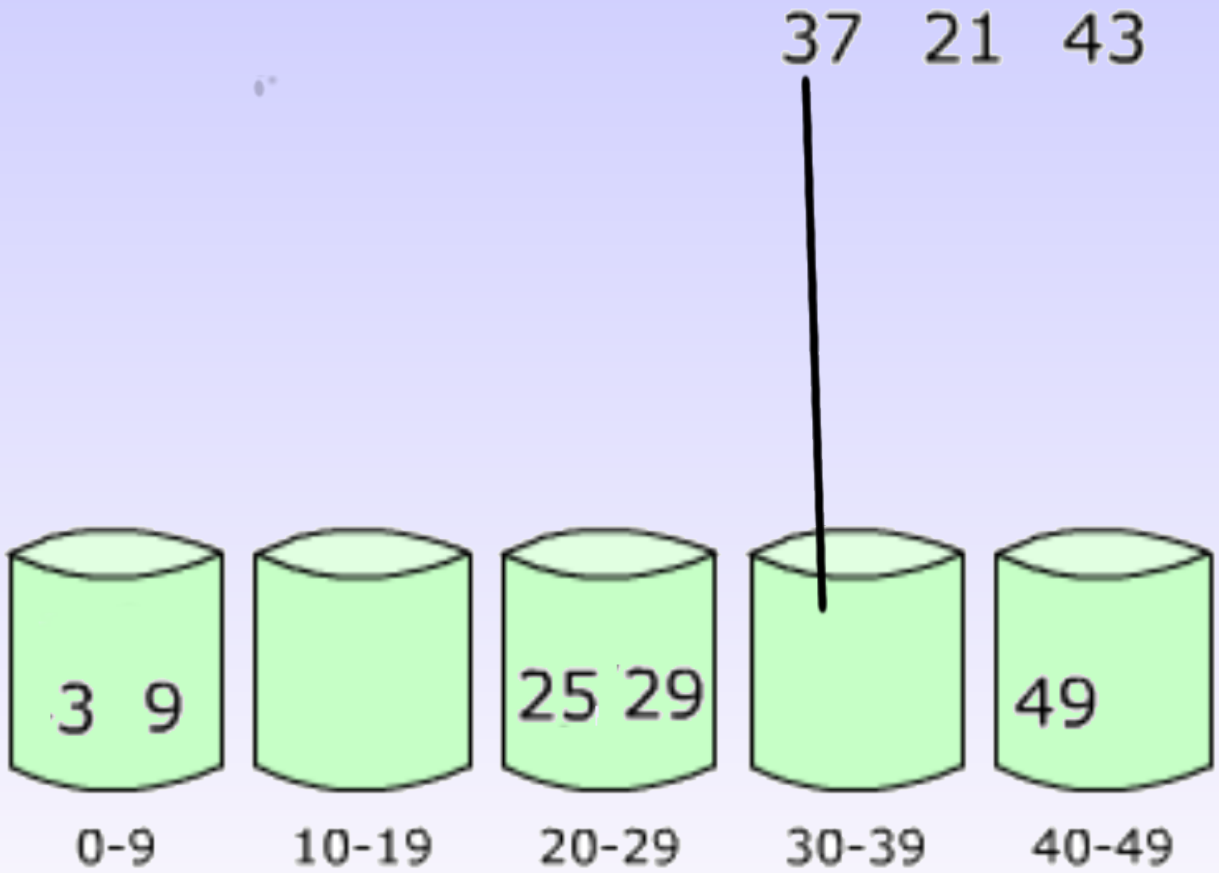

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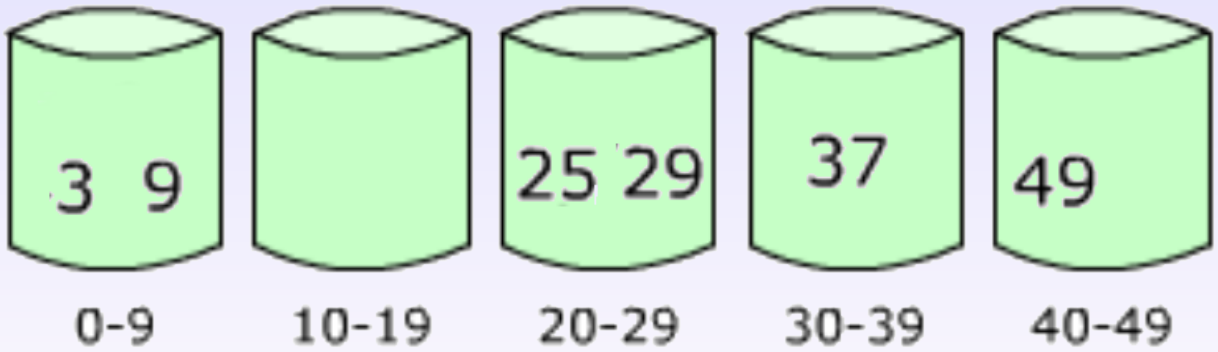
21 43



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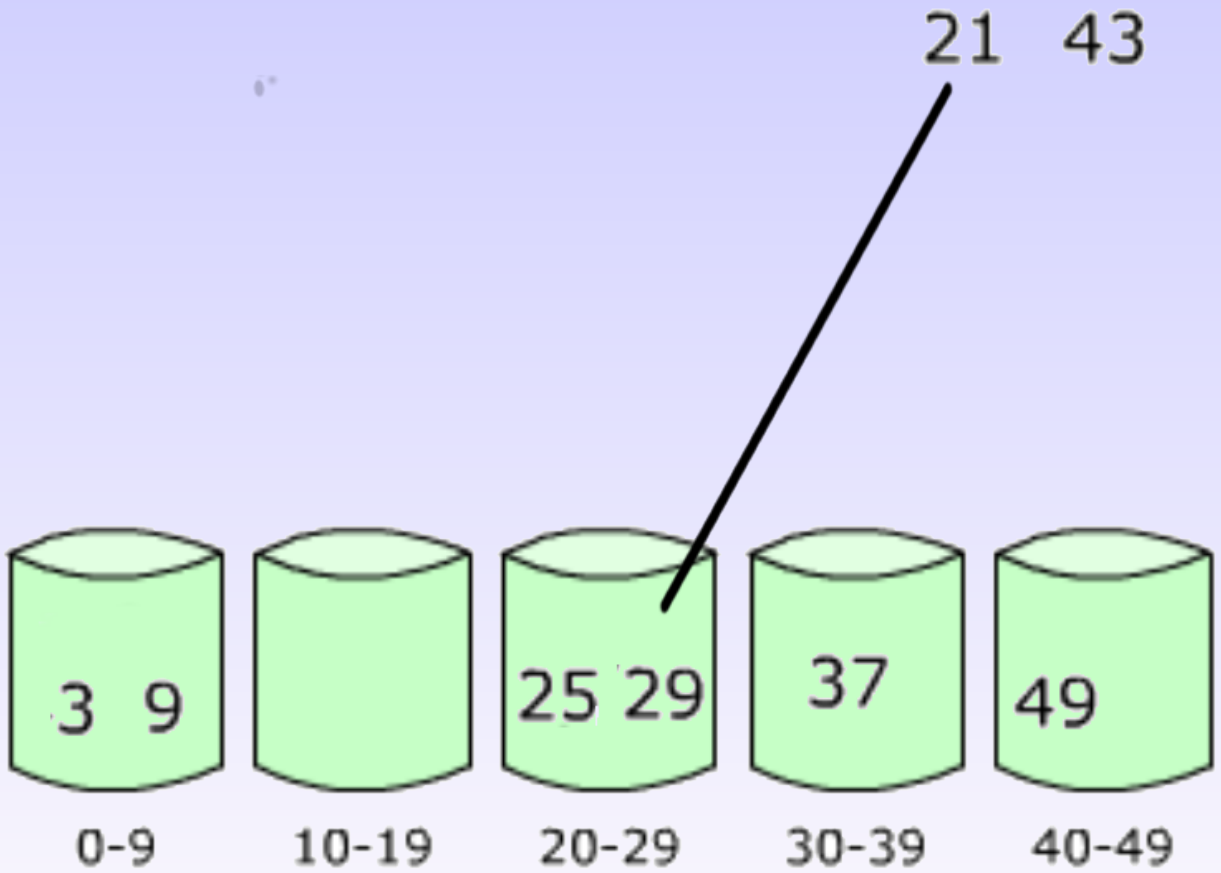
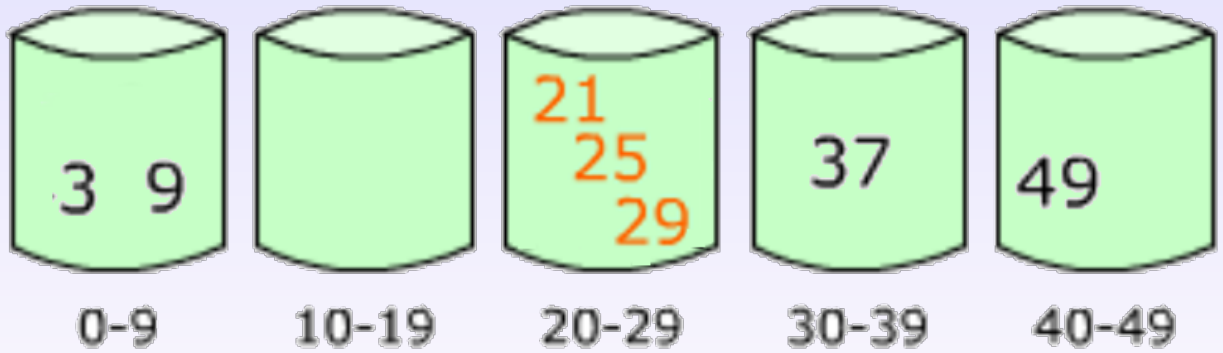


Sorting...

43



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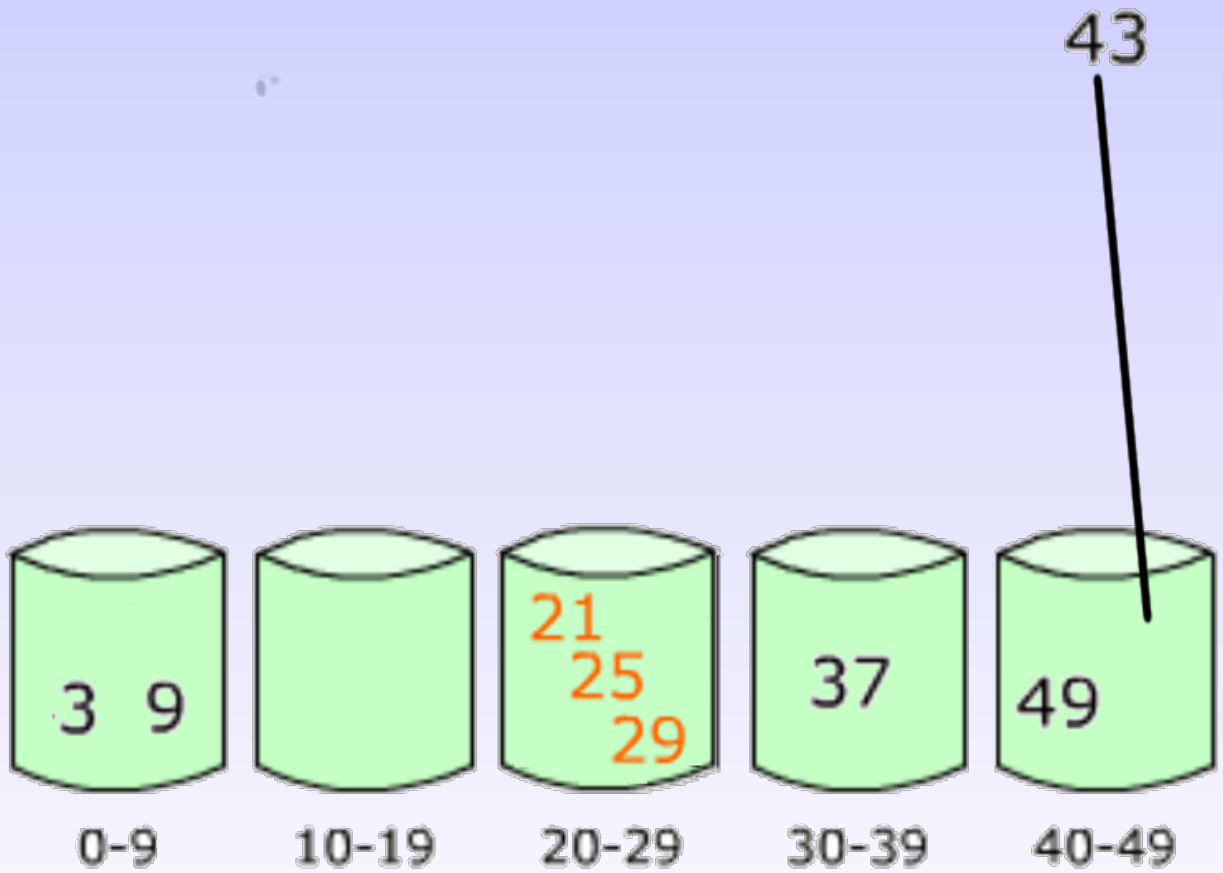

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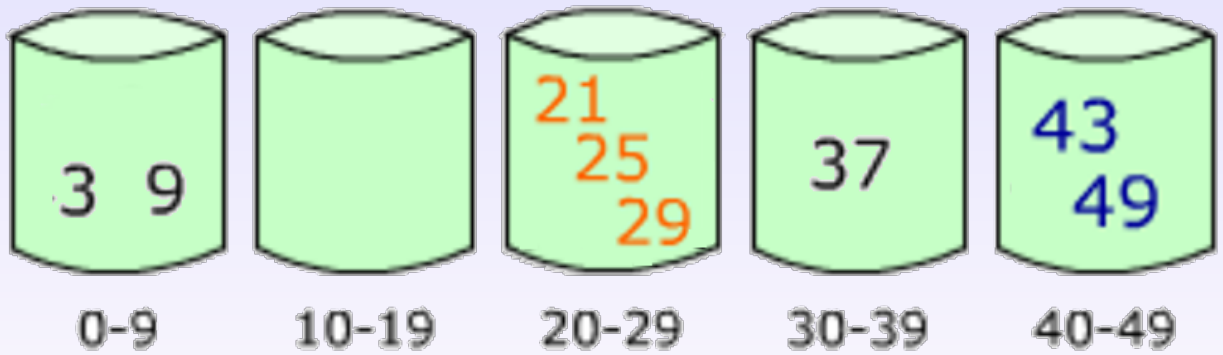

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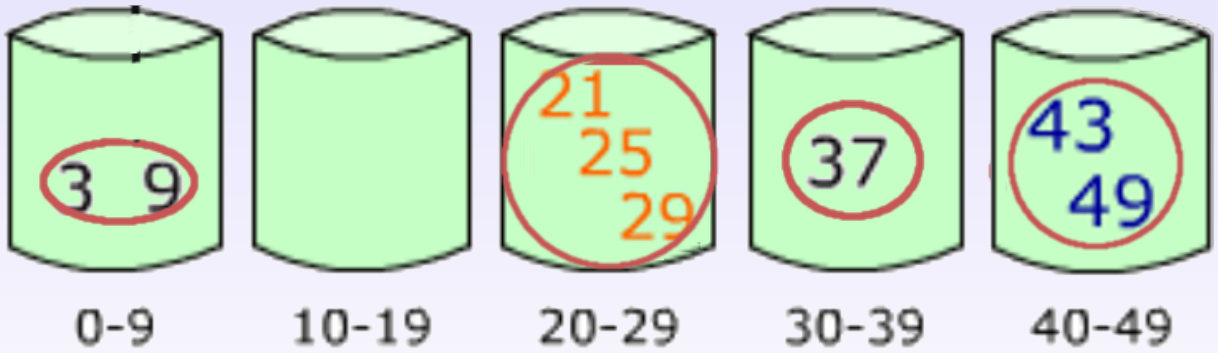
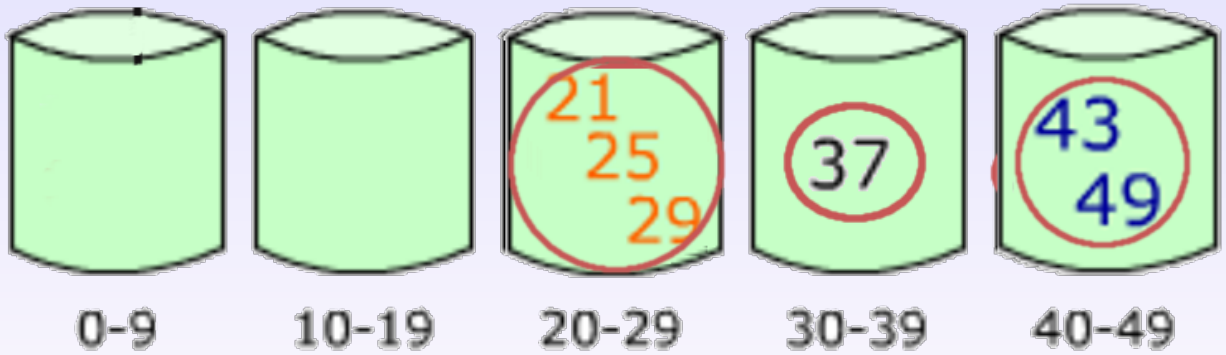


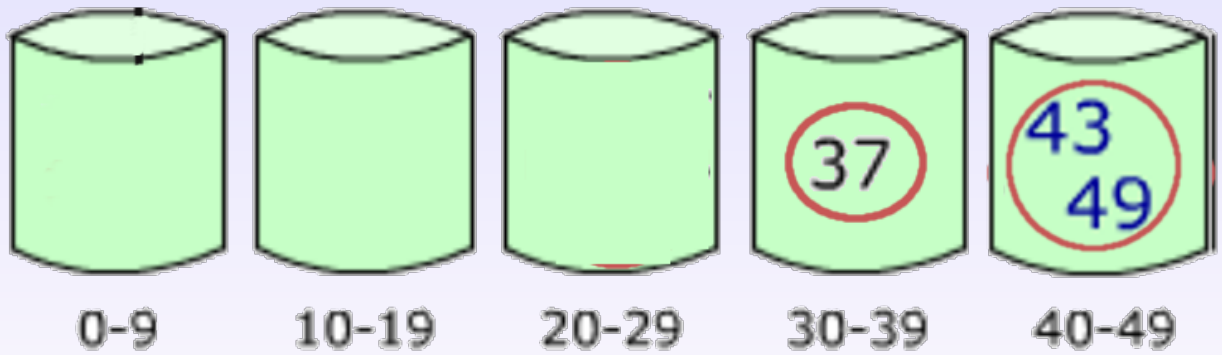
Sorting...

3 9



Sorting...

3 9 21 25 29



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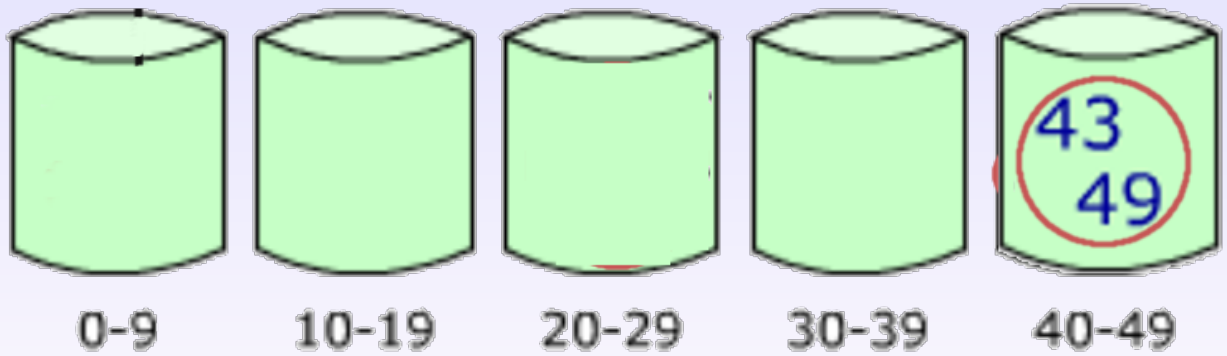
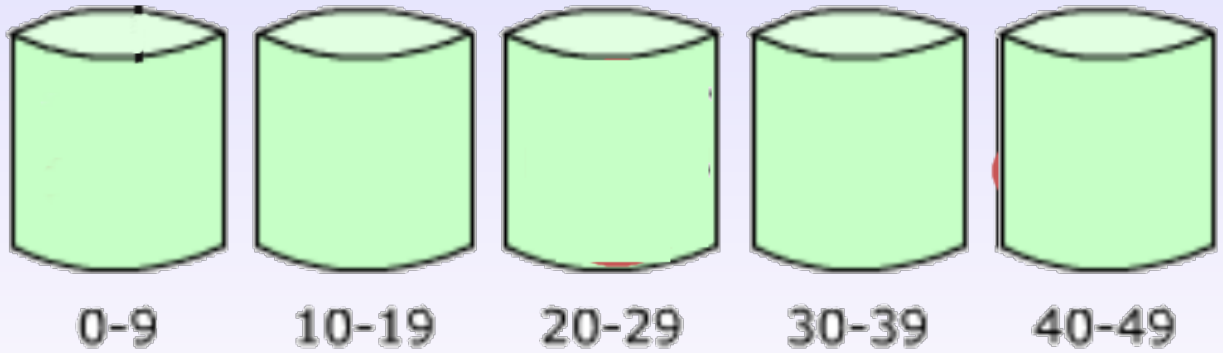
3 9 21 25 29 37



Sorting...

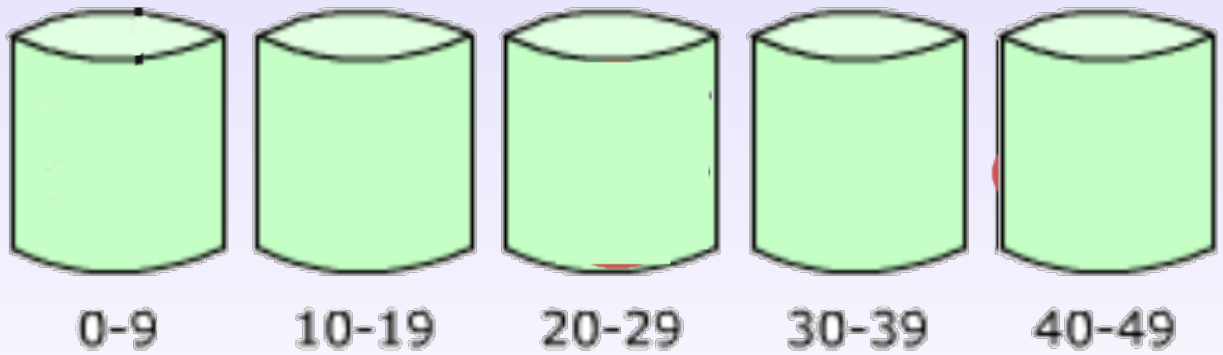
3 9 21 25 29 37 43 49



Sorting...

Sorted Array:

3 9 21 25 29 37 43 49



Brief Overview of Implementation.

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- Take an array of linked list.

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- Take an array of linked list.
- Each element of the array will work as a bucket.
- Put each number into the appropriate bucket.
- Insert each number according to its order.
- Merge the buckets.

Issues with bucket sort.

Advantages:

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- Runtime is proportional to input size.

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- Runtime is proportional to input size.
- More uniform data takes less time to sort.
- Technically its expected runtime is $O(n)$.

Issues with bucket sort.

Limitations:

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- Non uniformly distributed data takes more time.

Issues with bucket sort.

Limitations:

- Non uniformly distributed data takes more time.
- Not suitable for non-versatile data.

Reference

- *Introduction to Algorithms*, Thomas H. Cormen, Charles E.Leiserson, Ronald L. Rivest, Clifford Stein