Competitive Programming

Bucketing

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HARDWORK DISCIPLINE REC

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Bucketing

- A more efficient approach is to use the concept of bucketing.

Find the Duplicate Element in an Array

- Size: n + 1
- Numbers: 1 to n

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

Brute Force Approach

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

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5	4	3	7	2	1	8	8	6	9

Brute Force Approach

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Brute Force Approach

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Brute Force Approach

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Brute Force Approach

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0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

Brute Force

- Time Complexity: O(n^2)
- Space Complexity: O(1)

Bucketing

- For each element in the array A, we increment it’s frequency (or number of occurrences) in B.
- The element which has more than one occurrence is our duplicate element.
- The time complexity of this approach is O(n).
- However, the space complexity of this approach is also O(n), since we will always be required to have a secondary array B which stores our buckets.

Bucketing Approach

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
0	0	0	0	0	0	0	0	0

Bucketing Approach

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
0	0	0	0	1	0	0	0	0

Bucketing Algorithm

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
0	0	0	1	1	0	0	0	0

Bucketing Algorithm

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
0	0	1	1	1	0	0	0	0

Bucketing Algorithm

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
0	0	1	1	1	0	1	0	0

Bucketing Algorithm

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
0	1	1	1	1	0	1	0	0

Bucketing Algorithm

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
1	1	1	1	1	0	1	0	0

Bucketing Algorithm

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
1	1	1	1	1	0	1	1	0

Bucketing Algorithm

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
1	1	1	1	1	0	1	2	0

Bucketing Algorithm

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
1	1	1	1	1	1	1	2	0

Bucketing Algorithm

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
1	1	1	1	1	1	1	2	1

Bucketing Algorithm

0	1	2	3	4	5	6	7	8	9
5	4	3	7	2	1	8	8	6	9

0	1	2	3	4	5	6	7	8
1	1	1	1	1	1	1	2	1

Bucketing Algorithm

- Time Complexity: O(n)
- Space Complexity: O(n)

Queries?

Thank You…!