Introduction to Radix Sort
Recitation #2

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Introduction of radix sort

Radix sorting algorithms came into common use as early as 1923.

Radix sort is a non-comparative sorting algorithm.

- Look at the least-significant digits
- Group numbers with the same digits
- Place groups back in array together
- Repeat for increasingly significant digits
Example

Let’s sort the following array

[52, 10, 32, 15, 11]
Example

Look at the least-significant digit
[52, 10, 32, 15, 11]
Example

Place these digits into corresponding buckets

\[ \{52, 10, 32, 15, 11\} \]
Example

Place these digits into corresponding buckets

\[
[0, 10, 32, 15, 11]
\]
Example

Place these digits into corresponding buckets

\[
[\quad , \quad , 32, 15, 11]
\]
Example

Place these digits, maintaining relative orders

\[
[\phantom{0}, \phantom{0}, \phantom{0}, 15, 11]
\]
Example

Place these digits, maintaining relative orders

\[ [\ , \ , \ , \ , 11] \]
Example

Place these digits, maintaining relative orders

\[
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
\]
Example

Place these groups back in the array

\[
[\ , \ , \ , \ , \ , \ ]
\]
**Example**

Place these groups back in the array

\[
[10, \_ , \_ , \_ , \_ , ]
\]
Example

Place these groups back in the array

\[ [10, 11, \ , \ , \ ] \]
Example

Place these groups back in the array

\[ [10, 11, 52, \quad , \quad ] \]
Example

Place these groups back in the array

[10, 11, 52, 32, ...]
Example

Place these groups back in the array

[10, 11, 52, 32, 15]
Example

Repeat for increasingly significant digits

\[10, 11, 52, 32, 15\]
Example

Place these digits, maintaining relative orders
\[10, 11, 52, 32, 15\]
Example

Place these groups back in array

\[
[ \quad , \quad , \quad , \quad , \quad ]
\]
Example

Done!

[10, 11, 15, 32, 52]
Questions

- How to represent these categories or “buckets”?
  - Use queue

- How to access each digit of the numbers?
  - Use mod and divide

- How to handle negative numbers?
  - Add one more bucket to contain negative numbers

- What is the runtime and memory?
  - Time: O(nd); Space: O(n+d)
  - n is # of numbers to sort; d is the digit base