CSE245- ALGORITHM
RADIX SORT

Presented BY

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RADIX SORT

- We have seen many sorting algorithms but this one is different, it is not based on the general algorithm strategy above, but on a totally different method. It is interesting because it requires the absolute minimum amount of space and the minimum amount of data movement, and, most amazing of all, it does *no* comparisons.

- In Computer Science Radix Sort is a non – comparative integer sorting algorithm that sort data with integer keys by grouping keys by the individual digits which share same significant position and value.

WHY IT IS CALLED ‘ RADIX ’ ???

Does it named before any Person?

e.g. The **Floyd-Warshall** Algorithm

Does it named before any Person?

e.g. The **Floyd-Warshall** Algorithm

NO

Radix Means :   the base of a system of numeration

Examples:

- The decimal number system that we use every day has 10 digits {0,1,2,3,4,5,6,7,8,9} and so the radix is 10.

CLASSIFIACATION

1. Least Significant Digit (LSD) radix sorts
2. Most Significant Digit (MSD) radix sorts

LEAST SIGNIFICANT DIGIT (LSD) RADIX SORTS

- How many times we will sort the number ?

  or

  How many passes will required ?

LEAST SIGNIFICANT DIGIT (LSD) RADIX SORTS

Examples :

4310 , 357 , 251 , 78

LEAST SIGNIFICANT DIGIT (LSD) RADIX SORTS

Examples :

4310 , 357 , 251 , 78

4310

So 4 passes will require .

EXAMPLE (LSD)

Input list :

126	**328**	**636**	**341**	**416**	**131**	**328**

EXAMPLE (LSD)

BinSort on lower digit / Pass 1 :

12**6**	32**8**	63**6**	34**1**	41**6**	13**1**	32**8**

EXAMPLE (LSD)

BinSort on lower digit / Pass 1 :

12**6**	32**8**	63**6**	34**1**	41**6**	13**1**	32**8**

0	1	2	3	4	5	6	7	8	9

EXAMPLE (LSD)

BinSort on lower digit:

12**6**	32**8**	63**6**	34**1**	41**6**	13**1**	32**8**

0	1	2	3	4	5	6	7	8	9
						12**6**			

EXAMPLE (LSD)

BinSort on lower digit:

12**6**	32**8**	63**6**	34**1**	41**6**	13**1**	32**8**

0	1	2	3	4	5	6	7	8	9
						12**6**		32**8**	

EXAMPLE (LSD)

BinSort on lower digit:

12**6**	32**8**	63**6**	34**1**	41**6**	13**1**	32**8**

0	1	2	3	4	5	6	7	8	9
						12**6** 63**6**		32**8**	

EXAMPLE (LSD)

BinSort on lower digit:

12**6**	32**8**	63**6**	34**1**	41**6**	13**1**	32**8**

0	1	2	3	4	5	6	7	8	9
	34**1**					12**6** 63**6**		32**8**	

EXAMPLE (LSD)

BinSort on lower digit:

12**6**	32**8**	63**6**	34**1**	41**6**	13**1**	32**8**

0	1	2	3	4	5	6	7	8	9
	34**1**					12**6** 63**6** 41**6**		32**8**	

EXAMPLE (LSD)

BinSort on lower digit:

12**6**	32**8**	63**6**	34**1**	41**6**	13**1**	32**8**

0	1	2	3	4	5	6	7	8	9
	34**1** 13**1**					12**6** 63**6** 41**6**		32**8**	

EXAMPLE (LSD)

BinSort on lower digit:

12**6**	32**8**	63**6**	34**1**	41**6**	13**1**	32**8**

0	1	2	3	4	5	6	7	8	9
	34**1** 13**1**					12**6** 63**6** 41**6**		32**8** 32**8**	

EXAMPLE (LSD)

0	1	2	3	4	5	6	7	8	9
	34**1** 13**1**					12**6** 63**6** 41**6**		32**8** 32**8**	

After Sorting:

34**1**	13**1**	12**6**	63**6**	41**6**	32**8**	32**8**

EXAMPLE (LSD)

BinSort on next higher digit / Pass 2 :

3**4**1	1**3**1	1**2**6	6**3**6	4**1**6	3**2**8	3**2**8

EXAMPLE (LSD)

BinSort on next higher digit:

3**4**1	1**3**1	1**2**6	6**3**6	4**1**6	3**2**8	3**2**8

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

EXAMPLE (LSD)

BinSort on next higher digit:

3**4**1	1**3**1	1**2**6	6**3**6	4**1**6	3**2**8	3**2**8

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

EXAMPLE (LSD)

BinSort on next higher digit:

3**4**1	1**3**1	1**2**6	6**3**6	4**1**6	3**2**8	3**2**8

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

EXAMPLE (LSD)

BinSort on next higher digit:

3**4**1	1**3**1	1**2**6	6**3**6	4**1**6	3**2**8	3**2**8

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

EXAMPLE (LSD)

BinSort on next higher digit:

3**4**1	1**3**1	1**2**6	6**3**6	4**1**6	3**2**8	3**2**8

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

EXAMPLE (LSD)

BinSort on next higher digit:

3**4**1	1**3**1	1**2**6	6**3**6	4**1**6	3**2**8	3**2**8

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

EXAMPLE (LSD)

BinSort on next higher digit:

3**4**1	1**3**1	1**2**6	6**3**6	4**1**6	3**2**8	3**2**8

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

EXAMPLE (LSD)

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

After Sorting:

4**1**6	1**2**6	3**2**8	3**2**8	6**3**6	1**3**1	3**4**1

EXAMPLE (LSD)

BinSort on next higher or highest digit / Pass 3 :

416	**1**26	**3**28	**3**28	**1**31	**6**36	**3**41

EXAMPLE (LSD)

BinSort on next higher/highest digit:

416	**1**26	**3**28	**3**28	**1**31	**6**36	**3**41

0	1	2	3	4	5	6	7	8	9
				416					

EXAMPLE (LSD)

BinSort on next higher/highest digit:

416	**1**26	**3**28	**3**28	**1**31	**6**36	**3**41

0	1	2	3	4	5	6	7	8	9
	126			**4**16					

EXAMPLE (LSD)

BinSort on next higher/highest digit:

416	**1**26	**3**28	**3**28	**1**31	**6**36	**3**41

0	1	2	3	4	5	6	7	8	9
	126		**3**28	**4**16					

EXAMPLE (LSD)

BinSort on next higher/highest digit:

416	**1**26	**3**28	**3**28	**1**31	**6**36	**3**41

0	1	2	3	4	5	6	7	8	9
	126		**3**28 **3**28	**4**16					

EXAMPLE (LSD)

BinSort on next higher/highest digit:

416	**1**26	**3**28	**3**28	**1**31	**6**36	**3**41

0	1	2	3	4	5	6	7	8	9
	126 **1**31		**3**28 **3**28	**4**16					

EXAMPLE (LSD)

BinSort on next higher/highest digit:

416	**1**26	**3**28	**3**28	**1**31	**6**36	**3**41

0	1	2	3	4	5	6	7	8	9
	126 **1**31		**3**28 **3**28	**4**16		**6**36			

EXAMPLE (LSD)

BinSort on next higher/highest digit:

416	**1**26	**3**28	**3**28	**1**31	**6**36	**3**41

0	1	2	3	4	5	6	7	8	9
	126 **1**31		**3**28 **3**28 **3**41	**4**16		**6**36			

EXAMPLE (LSD)

0	1	2	3	4	5	6	7	8	9
	126 **1**31		**3**28 **3**28 **3**41	**4**16		**6**36			

After Sorting:

126	**1**31	**3**28	**3**28	**3**41	**4**16	**6**36

EXAMPLE (LSD)

Completed

126	**131**	**328**	**328**	**341**	**416**	**636**

EXAMPLE (LSD)

The Numbers are now sorted

126	**131**	**328**	**328**	**341**	**416**	**636**

RADIX SORT

- Radix sort is generalization of bucket sort.
- It uses several passes of bucket sort.
- Radix sort is stable and fast.

ALGORITHM

1. Create an array a[0…..n-1] elements.
2. Call bucket sort repeatedly on least to most significant digit of each element as the key.
3. Return the sorted array.

ANALYSIS

- Each pass over n d-digit numbers and k base keys then takes time O(n+k). (Assuming counting sort is used for each pass.)
- There are d passes, so the total time for radix sort is O(d (n+k)).
- When d is a constant and total run time = O(n)

APPLICATIONS

- Mostly used in parallel computing

SOURCES

- Google
- Wikipedia

Questions ?

Thank You