

radix sort

We will describe by example

radix sort

Sort on least significant digit

sorting

0
1
2
3
4
5
6
7
8
9

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----

radix sort

Sort on least significant digit

sorting

0
1
2
3
4
5
6
7
8
9

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on least significant digit

sorting

0
1
2
3
4
5
6
7
8
9

89

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on least significant digit

sorting

0
1
2
3
4
5
6
7
8
9

89

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on least significant digit

sorting

0
1
2
3
4
5
6
7
8
9

28

89

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on least significant digit

sorting

0
1
2
3
4
5
6
7
8
9

28

89

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on least significant digit

sorting

0	
1	81
2	
3	
4	
5	
6	
7	
8	28
9	89

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----

↑



radix sort

Sort on least significant digit

sorting

0	
1	81
2	
3	
4	
5	
6	
7	
8	28
9	89

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----

↑

radix sort

Sort on least significant digit

sorting

0	
1	81
2	
3	
4	
5	
6	
7	
8	28
9	89, 69

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----

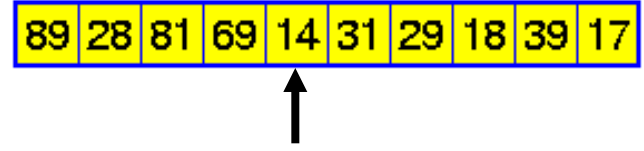
↑

radix sort

Sort on least significant digit

sorting

0	
1	81
2	
3	
4	
5	
6	
7	
8	28
9	89, 69



radix sort

Sort on least significant digit

sorting

0	
1	81
2	
3	
4	14
5	
6	
7	
8	28
9	89, 69

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----

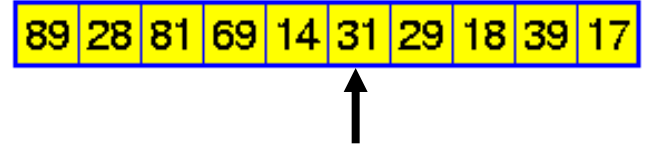
↑

radix sort

Sort on least significant digit

sorting

0	
1	81
2	
3	
4	14
5	
6	
7	
8	28
9	89, 69

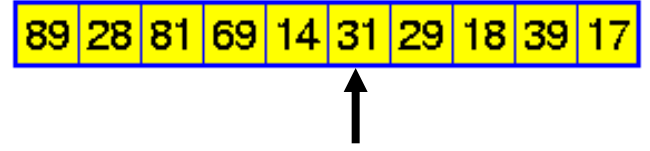


radix sort

Sort on least significant digit

sorting

0	
1	81, 31
2	
3	
4	14
5	
6	
7	
8	28
9	89, 69



radix sort

Sort on least significant digit

sorting

0	
1	81, 31
2	
3	
4	14
5	
6	
7	
8	28
9	89, 69

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----

↑

radix sort

Sort on least significant digit

sorting

0	
1	81, 31
2	
3	
4	14
5	
6	
7	
8	28
9	89, 69, 29

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----

↑

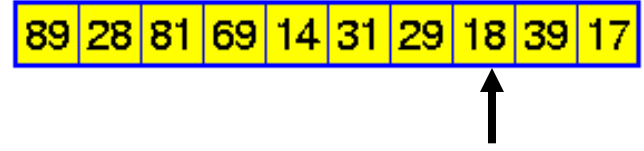


radix sort

Sort on least significant digit

sorting

0	
1	81, 31
2	
3	
4	14
5	
6	
7	
8	28
9	89, 69, 29



radix sort

Sort on least significant digit

sorting

0	
1	81, 31
2	
3	
4	14
5	
6	
7	
8	28, 18
9	89, 69, 29

89	28	81	69	14	31	29	18	39	17
----	----	----	----	----	----	----	----	----	----

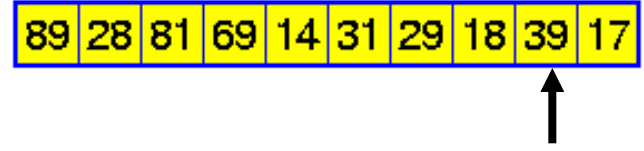
↑

radix sort

Sort on least significant digit

sorting

0	
1	81, 31
2	
3	
4	14
5	
6	
7	
8	28, 18
9	89, 69, 29

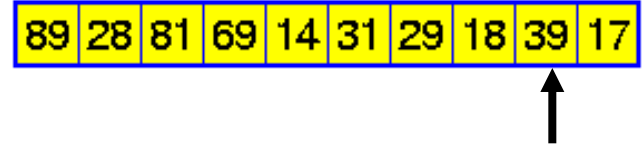


radix sort

Sort on least significant digit

sorting

0	
1	81, 31
2	
3	
4	14
5	
6	
7	
8	28, 18
9	89, 69, 29, 39



radix sort

Sort on least significant digit

sorting

0	
1	81, 31
2	
3	
4	14
5	
6	
7	
8	28, 18
9	89, 69, 29, 39

89 28 81 69 14 31 29 18 39 17

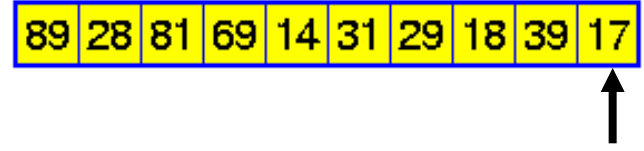


radix sort

Sort on least significant digit

sorting

0	
1	81, 31
2	
3	
4	14
5	
6	
7	17
8	28, 18
9	89, 69, 29, 39



radix sort

Sorted on least significant digit!

sorting

0
1
2
3
4
5
6
7
8
9

81, 31

14

17

28, 18

89, 69, 29, 39

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----

radix sort

Sort on next (second) significant digit

sorting

0
1
2
3
4
5
6
7
8
9

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on next (second) significant digit

sorting

0
1
2
3
4
5
6
7
8
9

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on next (second) significant digit

sorting

0
1
2
3
4
5
6
7
8
9

81

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on next (second) significant digit

sorting

0
1
2
3
4
5
6
7
8
9

81

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on next (second) significant digit

sorting

0
1
2
3
4
5
6
7
8
9

31

81

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on next (second) significant digit

sorting

0
1
2
3
4
5
6
7
8
9

31

81

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on next (second) significant digit

sorting

0	
1	14
2	
3	31
4	
5	
6	
7	
8	81
9	

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----

↑

radix sort

Sort on next (second) significant digit

sorting

0	
1	14
2	
3	31
4	
5	
6	
7	
8	81
9	

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on next (second) significant digit

sorting

0	
1	14, 17
2	
3	31
4	
5	
6	
7	
8	81
9	

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----

↑

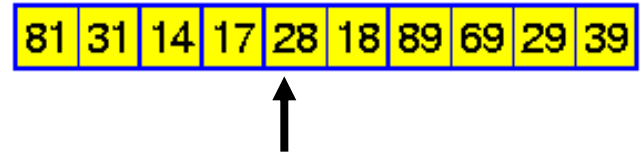


radix sort

Sort on next (second) significant digit

sorting

0	
1	14, 17
2	28
3	31
4	
5	
6	
7	
8	81
9	

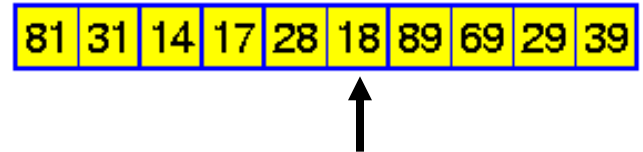


radix sort

Sort on next (second) significant digit

sorting

0	
1	14, 17
2	28
3	31
4	
5	
6	
7	
8	81
9	



radix sort

Sort on next (second) significant digit

sorting

0
1
2
3
4
5
6
7
8
9

14, 17, 18

28

31

81

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on next (second) significant digit

sorting

0
1
2
3
4
5
6
7
8
9

14, 17, 18

28

31

81

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----

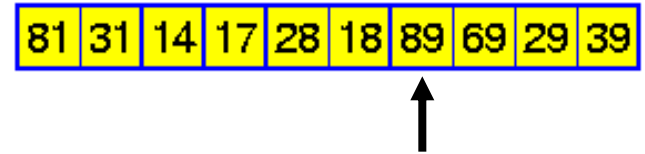


radix sort

Sort on next (second) significant digit

sorting

0	
1	14, 17, 18
2	28
3	31
4	
5	
6	
7	
8	81, 89
9	



radix sort

Sort on next (second) significant digit

sorting

0	
1	14, 17, 18
2	28
3	31
4	
5	
6	
7	
8	81, 89
9	

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----

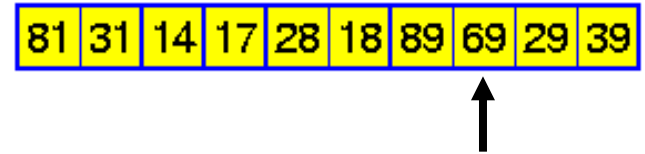


radix sort

Sort on next (second) significant digit

sorting

0	
1	14, 17, 18
2	28
3	31
4	
5	
6	69
7	
8	81, 89
9	



radix sort

Sort on next (second) significant digit

sorting

0	
1	14, 17, 18
2	28
3	31
4	
5	
6	69
7	
8	81, 89
9	

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----





radix sort

Sort on next (second) significant digit

sorting

0	
1	14, 17, 18
2	28, 29
3	31
4	
5	
6	69
7	
8	81, 89
9	

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on next (second) significant digit

sorting

0	
1	14, 17, 18
2	28, 29
3	31
4	
5	
6	69
7	
8	81, 89
9	

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----



radix sort

Sort on next (second) significant digit

sorting

0	
1	14, 17, 18
2	28, 29
3	31, 39
4	
5	
6	69
7	
8	81, 89
9	

81	31	14	17	28	18	89	69	29	39
----	----	----	----	----	----	----	----	----	----



radix sort

Sorted on next (second) significant digit!

sorting

0	
1	14, 17, 18
2	28, 29
3	31, 39
4	
5	
6	69
7	
8	81, 89
9	

14	17	18	28	29	31	39	69	81	89
----	----	----	----	----	----	----	----	----	----

- We can extend this to numbers of any length
- We can do this on strings

Considering numbers to base  $b$

- require  $b$  buckets
- require  $d = \log_b(m)$  scans ( $d$  is number of digits)
  - $\log$  is to base  $b$
  - $m$  is largest number to be sorted
- each scan is of order  $n$
- therefore  $O(d.n)$

SORTED