9. (2019)

A possible solution is Radix sort, which works with positive integers

To explain the algorithm consider the array

53, 89, 150, 36, 633, 233

Starting by sorting the number by the last digit

150, 233, 633, 53, 36, 89

Then sort by second to last digit

633, 233, 36, 150, 53, 89

Then sort by first digit (0 for 2 digit number)

36, 53, 89, 150, 233, 633

The array is then sorted.

Complexity

Number of data : n
Number of max digit : d
Base of numbers : b

Each sort step takes $O(n+b)$ (counting sort) — keys $(0, 1, \dots, 9)$

Thus for the whole algo. $O(d(n+b))$

→ Less than Quick sort !
but $b < n$ and $b \propto \frac{1}{d}$

Limitations

1. Only for positive integer
2. Bad for small bases
3. Uses A LOT of memory (depends on d)