What is Radix Sort?

Radix sort is a non-comparative integer sorting algorithm, which compares each bit value of stored elements.

Efficiency

Unlike the sorting algorithms we’ve seen, where time complexities are purely based on n, the number of elements, radix sort’s time complexity is O(w(n+b)), where w is the number of bits used to represent each item, and b is the base system we are using. Radix sorting scans the elements a few bits at a time, which can be done in linear time. The number of these full scans depends on the length of the longest element.

As well, radix sort itself is not a comparison-based algorithm. This means that it takes much less time to compare each element. Overall, radix sort is very efficient at sorting integers.

Radix Sort Uses

Although theoretically very efficient, often times, radix sort’s linear time is an idealistic case of numbers, while usually, its efficiency is in the O((n+b)\*logb(k)) time, where k is the largest number in the array. This is pretty much the same as other sorts’ time complexities. Hence, it is not always advantageous. Furthermore, other O(nlogn) sorts such as quicksort, are more implementable to different types of data, while radix sort is limited to an element’s binary representation.

As well, it takes and uses lots of memory, as both LSD and MSD are implemented recursively (often), and also because all radix implementations require secondary arrays to store bucket/digit lists.

This also means that radix sort is mostly used for sorting integers. Currently, it is often implemented in parallel processing machines, since they are capable of handling many processes together. This allows nodes on the same processor to work together without necessary synchronization, unlike other recursive sorts.

Radix Sort History

Radix sort is older than computer programming. It was originally developed in the US in 1887, by Herman Hollerith, the same person who created IBM (back then not called IBM, it was Computer-Tabulating-Recording Company, CTR). It was used on tabulating machines, which are machines that store information on punch cards. Very old. When modern computer programming came into existence, people began to adopt radix sort to sort numbers for their programs.

Bibliography

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Definitions related to Radix Sort:

* Bucket: the place where the numbers get stored with other numbers that have the same x digit
* Radix: the base of a system of numeration