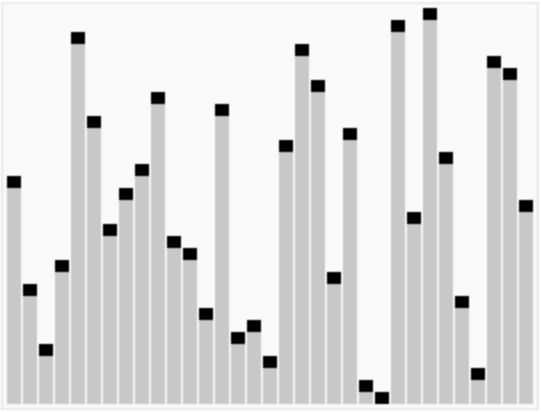
Study Write-Up: Quicksort

Quicksort is often considered the most efficient sorting algorithm. It can run several times faster than even the merge sort and heapsort algorithms, when implemented well. It is also considered to be a divide-and-conquer algorithm. Here is a sample visualization of the quicksort process:



Here is how the algorithm works: Quicksort first divides the array (i.e., data set) in question into two smaller sub-arrays: the low elements and the high elements. Quicksort can then recursively sort the sub-arrays.

The steps are:

1. Pick an element, called a pivot, from the array.
2. Reorder the array so that all elements with values less than the pivot come before the pivot, while all elements with values greater than the pivot come after it (equal values can go either way). After this partitioning, the pivot is in its final position. This is called the partition operation.
3. Recursively apply the above steps to the sub-array of elements with smaller values and separately to the sub-array of elements with greater values.

Here is a simple implementation of Quicksort in Ruby:

```ruby
def quicksort(array)
  if array.length <= 1
    return array
  else
    pivot = array.sample
```

```
    array.delete_at(array.index(pivot))
    less = []
    greater = []

    array.each do |x|
      if x <= pivot
        less << x
      else
        greater << x
      end
    end

    sorted_array = []
    sorted_array << quicksort(less)
    sorted_array << pivot
    sorted_array << quicksort(greater)
  end
  sorted_array.flatten!
end
quicksort([2, 4, 3, 0, 1, 5, 2]) # returns [0, 1, 2, 2, 3, 4, 5]
```

Quicksort's efficiency is definitely the reason for its popularity. Since its creation, it gained widespread popularity appearing in Unix as the default library sort function, which in turn lent its name to the C standard library `qsort` function. It is even used as the default sort method for Ruby, in Array#sort. All in all, Quicksort was a great invention for computer science and is still quite often used for sorting data to this day.