Why Selection sort can be stable or unstable

Asked 9 years, 4 months ago Modified 26 days ago Viewed 42k times



I know that selection sort can be implemented as stable or unstable. But I wonder how it can be. I think sort algorithm can be only stable or only unstable. Can someone explain?

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algorithm sorting arrays



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asked Dec 24, 2013 at 12:58

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fortegente **1,351** 2 11 22

6 Answers

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Basically in selection sort, swap that occurs at the end of each "round" can change the relative order of items having the same value.

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for example, suppose you sorted 4 2 3 4 1 with selection sort.





the first "round" will go through each element looking for the minimum element. it will find that 1 is the minimum element. then it will swap the 1 into the first spot. this will cause the 4 in the first spot to go into the last spot: 1 2 3 4 4

now the relative order of the 4's has changed. the "first" 4 in the original list has been moved to a spot after the other 4.

remember the definition of stable is that

the relative order of elements with the same value is maintained.

Well, selection sort works by finding the 'least' value in a set of values, then swap it with the first value:

Code:

2, 3, 1, 1 # scan 0 to n and find 'least' value

1, 3, 2, 1 # swap 'least' with element 0.

1, 3, 2, 1 # scan 1 to n and find 'least' value

1, 1, 2, 3 # swap 'least' with element 1.

...and so on until it is sorted.

To make this stable, instead of swaping values, insert the 'least' value instead:

Code:

2, 3, 1, 1 # scan 0 to n and find 'least' value

1, 2, 3, 1 # insert 'least' at pos 0, pushing other elements back.

1, 3, 2, 1 # scan 1 to n and find 'least' value

1, 1, 2, 3 # insert 'least' at pos 1, pushing other elements back.

...and so on until it is sorted.

It shouldn't be too hard to modify an unstable selection sort algorithm to become stable.

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edited Jun 20, 2020 at 9:12

Community Bot

answered Dec 24, 2013 at 13:07

Prashant Shilimkar

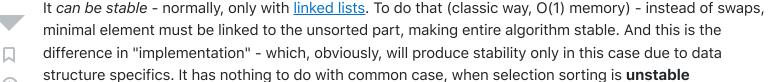
8,312 13 54 89

- Nice answer. Thanks. But if I understand correctly, a selection sorting implemented with "insert" rather than "swap", deviates from its <u>canonical algorithm definition</u>, so that it is not the same animal anymore. The price of being stable is the overhead of "insert" is much larger than "swap". @Alma-Do has a better explanation about this topic. RayLuo Oct 29, 2014 at 7:06
- 2 good explanation. Would have been better if the second example (2,3,1,1) was unstable in the normal algorithm and was stable after the modified algo. Its stable in either way. The first example is a better one. crackerplace Apr 29, 2017 at 19:26



In common case - you're not correct. Selection sorting is <u>unstable</u>. That comes from it's definition. So, you're obviously confused with one custom case.







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answered Dec 24, 2013 at 13:10

Alma Do

36.9k 9 74 104

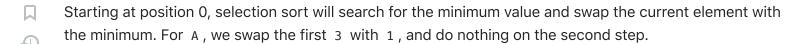


Let's say I have this array:



 $A = \{3, 3, 1\}$





This is not stable as the first 3 should have come before the second. If you use a linked list instead of an array, and insert an element in the correct position instead of swapping, selection sort is stable.

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answered Dec 24, 2013 at 13:05 sebii





The fact that a sorting routing is a selection sort does not define everything about it. There are still decisions to be made that may be made differently in different implementations, and different choices may produce either a stable or an unstable sort. (Most sorts that can be stable don't have to be; usually, the interesting theoretical question is whether the sort *can* be implemented stably.)



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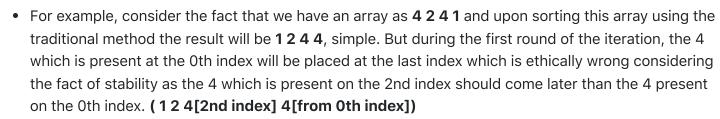
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answered Dec 24, 2013 at 13:05 user2357112 256k 28 419 494



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• First, you have to understand that there is nothing unstable kind of thing with the Selection sort as it vividly depends upon the data structure you are using for the specific.



- If asked! You can make a slight modification in the implementation and instead of swapping the numbers, choose the minimum element during the first round and then place that element at its correct position and shift the whole array. I know the shifting operation might cost more than the swapping but this is the best I can think of.
- If you are concerned about the shifting operation, you may use the Linked list rather than the array and insert the appropriate element at its appropriate position in **O(1)** time.

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answered May 20, 2021 at 7:22





First of all I want to mention that I'm a student, not an expert so I may be wrong.

O

why is selection sort unstable?

- let *a* be an array of integers such that *a* = [0, 0, 2, 3, 4].
- if a is to be sorted using an unstable implementation of selection sort; first two indexes of a (a[0] = 0 and a[1] = 0) will get swapped. (because the inner loop makes sure that if a[i] <= a[i] then j =

smallest_index and therefore should get swapped with the current i. (where innerloop iterates a[j ... len] for each index of outerloop: a[i ... len - 1])).

• if a is to be sorted by any stable sorting algorithm, the order of equal members (in this case, 0 and 0) will be preserved. (a[0] and a[1] won't be swapped.)

is this stable selection sort ?! (NO GUARANTEE :)!)

In your code you must have an if statement like:

```
if a[j] <= a[smallest_index]
    smallest_index = j</pre>
```

which is the unstable version.

I simply made it stable by making sure that smallest_index is set to j if and only if a[j] < a[smallest_index], therefore equal values do not get swapped at all.

simply by making sure that the:

```
if a[j] < a[smallest_index]
    smallest_index = j</pre>
```

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answered Apr 23 at 16:48



NO GUARANTEE indeed, especially not showing how to handle the selected index. - greybeard Apr 24 at 4:18

(You focused on the selected value getting swapped in the current iteration. How about the other participant in the swap? Consider case insensitive comparison and [Y, y, x, X] – greybeard Apr 24 at 4:35

@greybeard thank you for comment. about the selected index, the index for smallest element gets set to smallest_index. after that; on each iteration of outer loop right after the inner loop finishes, the a[smallest_index] gets swapped with a[i]. and about the non numerical array. YES YOU ARE RIGHT:), X gets selected in first iteration of outer loop and get's swapped with a[0] causing it to appear before x in final sorted a. do you think my solution works fine for any array of integers? – no_hope Apr 24 at 10:18

(I think I know it to not work for any kind of item where stability / order of same key items matters. Otherwise (including integers), it avoid dispensable swaps in case of = ...) – greybeard Apr 24 at 10:24

@greybeard ok, i get it. hey should i delete this answer? - no_hope Apr 24 at 11:30 /