

# Assignment 9

12 minutes

## Quicksort Pseudocode.

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QUICKSORT( $A[\ell \dots r]$ ):
1  if  $l < r$  :
2     $i = \ell$       (i increases from the left and searches elements  $\geq$  than pivot)
3     $j = r + 1$     (j decreases from the right and searches elements  $\leq$  than pivot.)
4     $v = A[\ell]$   (v is the pivot.)
5    while  $i < j$  :
6       $i = i + 1$ 
7      while  $i < r$  and  $A[i] < v$  :
8         $i = i + 1$ 
9       $j = j - 1$ 
10     while  $j > \ell$  and  $A[j] > v$  :
11        $j = j - 1$ 
12      $A[i] \leftrightarrow A[j]$  (Undo the extra swap at the end)
13      $A[i] \leftrightarrow A[j]$  (Undo the extra swap at the end)
14      $A[j] \leftrightarrow A[\ell]$  (Move pivot to its proper place)
15     QUICKSORT( $A[\ell \dots j - 1]$ )
16     QUICKSORT( $A[j + 1 \dots r]$ )
```

**Question 1.** You are given an array:

$a + 10$	$c$	$a + 20$	$a$	$c + 5$	$b$	$b + 20$	$a + 15$	$b + 1$	$b + 15$	$2 \cdot c$	$b + 2$
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Here  $a, b, c$  are the last three digits of your Student ID.

The pseudocode (same as in the sample) is used to sort it. Pivot is the leftmost element.

**(A)** Run the initial call of  $\text{QUICKSORT}(A[0..11])$ . Draw the state of the array every time you swap two elements.

**(B)** Draw the content of the array immediately **before** the second recursive call of  $\text{QUICKSORT}()$ . (The original call  $\text{QUICKSORT}(A[0..11])$  is assumed to be the 0<sup>th</sup> call of this function).