
Algorithm 1 Cup-Lid-Match

Input: a : cup array with the number of n ; b : lip array with the number of n ; l : the left location of the array; r : the right location of the array;

Output: a' : the sorted cup array with the number of n ; b' : the sorted lip array with the number of n ;

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1: initial  $t = a[l]$ ,  $mark = -1$ ,  $count = 0$ ;
2: for  $i$  do  $l$  to  $r$ 
3:   if  $t$  matches  $b[i]$  then
4:      $mark = i$ ;
5:   else if  $t$  is bigger than  $b[i]$  then
6:      $count = count + 1$ ;
7:   end if
8: end for
9:  $swap(a[l+count], a[l])$ ;
10:  $swap(b[l+count], b[mark])$ ;
11:  $mark = l + count$ ;
12: initial  $i = l$ ,  $j = r$ ;
13: while  $i < mark$  and  $j > mark$  do
14:   while  $i < j$  and  $a[i] < b[mark]$  do
15:      $i = i + 1$ ;
16:   end while
17:   while  $i < j$  and  $a[j] > b[mark]$  do
18:      $j = j - 1$ ;
19:   end while
20:   if  $i < j$  then
21:      $swap(a[i++], a[j--])$ ;
22:   end if
23: end while
24: initial  $i = l$ ,  $j = r$ ;
25: while  $i < mark$  and  $j > mark$  do
26:   while  $i < j$  and  $b[i] < a[mark]$  do
27:      $i = i + 1$ ;
28:   end while
29:   while  $i < j$  and  $b[j] > a[mark]$  do
30:      $j = j - 1$ ;
31:   end while
32:   if  $i < j$  then
33:      $swap(b[i++], b[j--])$ ;
34:   end if
35: end while
36: if  $l < mark$  then
37:   Cup-Lid-Match( $a, b, l, mark - 1$ );
38: end if
39: if  $r > mark$  then
40:   Cup-Lid-Match( $a, b, mark + 1, r$ );
41: end if
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