7.1-2.

What value of q does PARTITION return when all elements in the array $A[p..r]$ have the same value? Modify PARTITION so that $q = \lfloor (p+q)/2 \rfloor$ when all elements in that array $A[p..r]$ have the same value.

Answer.

PARTITION returns r when all elements in the array $A[p..r]$ have the same value.

We can augment PARTITION to count the number of elements equal to $A[r]$ to see if all elements in that array $A[p..r]$ have the same value, and return $q = \lfloor (p+q)/2 \rfloor$ if it is the case.

```
PARTITION(A, p, r)
 1  x = A[r]
 2  i = p − 1
 3  count = 1
 4  for j = p to r − 1
 5       if A[j] ≤ x
 6            if A[j] == x
 7                 count = count + 1
 8            i = i + 1
 9            exchange A[i] with A[j]
10  if count == (r − p) + 1
11       return ⌊(p + q)/2⌋
12  else exchange A[i + 1] with A[r]
13       return i + 1
```


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