

Problem 3

Give a version of the ENQUEUE and DEQUEUE procedures that check for the overflow and underflow errors. An *overflow* error is adding an element to the full queue, and an *underflow* is trying to get an element from an empty queue.

```
ENQUEUE( $Q, n, x$ )
if  $head[Q] = tail[Q] + 1$  or  $(head[Q] = 1$  and  $tail[Q] = n)$ 
    then error "overflow"
 $Q[tail[Q]] \leftarrow x$ 
if  $tail[Q] = n$ 
    then  $tail[Q] \leftarrow 1$ 
    else  $tail[Q] \leftarrow tail[Q] + 1$ 

DEQUEUE( $Q, n$ )
if  $head[Q] = tail[Q]$ 
    then error "underflow"
 $x \leftarrow Q[head[Q]]$ 
if  $head[Q] = n$ 
    then  $head[Q] \leftarrow 1$ 
    else  $head[Q] \leftarrow head[Q] + 1$ 
return  $x$ 
```

Problem 4

Write a modified version of QUICK-SORT for finding the k th smallest element of an array.

```
QUICK-FIND( $A, p, r, k$ )
if  $p = r$ 
    then return  $A[p]$ 
 $q \leftarrow \text{PARTITION}(A, p, r)$ 
if  $k \leq q$ 
    then return QUICK-FIND( $A, p, q, k$ )
    else return QUICK-FIND( $A, q + 1, r, k$ )
```