

5. Loop Invariants and QuickSort

Loop invariants: QuickSort

Consider the following alternative implementation of the QuickSort algorithm and the Partition method:

QUICKSORT2(A, p, r):

```
if p < r then
    q = PARTITION2(A, p, r)
    QUICKSORT2(A, p, q - 1)
    QUICKSORT2(A, q + 1, r)
```

PARTITION2(A, p, r):

```
x = A[r]
i = p - 1
for j = p to r - 1
    if A[j] ≤ x
        i = i + 1
        exchange A[i] with A[j]
exchange A[i + 1] with A[r]
return i + 1
```

1. Show how PARTITION2 works on the following 8-element array

2	8	7	1	3	5	6	4
---	---	---	---	---	---	---	---

2. State the loop invariants for the PARTITION2 procedure.
3. Prove the correctness of the algorithm using the proposed loop invariants.