2001

p2q1c
LCP

Software Engineering II (4-mark question)

Describe the software engineering principles of loop design. Illusrate your answer using the example of a loop that reverses the order of the first N elements of the array A.

(The value in $A[k]$ after execution will be the value held in $A[N+1-k]$ before execution, for $k = 1, \ldots, N$. — do I have to say this?)

Solution Notes

Bookwork from Lecture 2 of Software Engineering II. Answers should describe the simple **while** loop with its invariant that holds initially and is restored by the end of execution of the loop body, which must also make progress. The example loop has the form

```
i := 1;  j := N;

while i < j do

  begin swap(A[i], A[j]);  i := i+1;  j := j-1  end
```

The invariant expresses that the current value in $A[k]$ equals the value held in $A[N+1-k]$ before execution, for $1 \leq k < i$ and also for $j < k \leq N$. After termination we have $j \leq i$, so the desired property holds in the entire range $1 \leq k \leq N$.