

## Derivation of Algorithms 2018

### Partition Problem: Invariant Diagrams

CA worth 10%

#### Question

Formally specify and hence solve the following problem:

Given an array  $f[0..N]$ ,  $\{N > 0\}$  containing only the characters 'A', 'B' and 'C'. Sort the array so that all C's precede all B's and all B's precede all A's. **NOTE:** only swap operations are allowed.

Your answer should include the following parts:

1. Formal specification [6 marks]
2. Diagram representing post condition [4 marks]
3. Invariant diagram showing snapshot during processing [4 marks]
4. Values for variables at **BEGINNING** of processing [2 marks]
5. Values of variables at the **END** of processing [2 marks]
6. Assignments for variables during the **MIDDLE** of processing [6 marks]
7. Termination proof for the above [6 marks]
8. Complete solution [5 marks]
9. A working Java translation of the derived program [5 marks]

**[Total 40 marks]**

#### Deliverables Uploaded to MOODLE

1. PDF document containing your program derivation.
2. A single Java source file with your translated program code.

**NOTE:** you must include and sign the assessment declaration page at the beginning of your PDF document. A typed signature is taken to be a digital signature.

#### Deadline

The deadline for this CA work is **18:00hrs** on the **26<sup>th</sup> of October 2018**.