



IN5130 Oblig-II 2022

Solution proposal



Solution Question 1

- 1a) 18. There are 9 messages if we skip for loop and veto.
- 1b) 20. There are 10 messages if we skip for loop but execute the veto operand.
- 1c) 4. The only source of nondeterminism is ?Update(CM) that may occur anywhere in between <!Update(CM), !Activate(CM), ?Activate(CM), !Train, ?Train>
- 1d) 24. There are two sources of nondeterminism
 - ?Update(CM) that may occur anywhere in between <!Update(CM), !Activate(CM), ?Activate(CM), !Finished, ?Finished>
 - !UserData that may occur anywhere in between <!Changes(M), ?Changes(M), !Changes(M), ?Changes(M), !Changes(M), ?Changes(M), ?UserData>



Solution Question 2

- 2a) Use alt with two operands as the main construct of sd Main3.
 - Put everything above the veto in sd Main into the first operand.
 - Use refuse as the main construct in the second operand. It should contain everything above the veto in sd Main and the veto operand (but not the veto operator)
- 2b) Transform Train into Train4 by replacing the loop construct in Main with an alt construct with five operands.
 - Use the opt construct as the main construct in the first operand. Use the operand of the loop in sd Main as the operand of the opt.
 - In the other four operands of the alt construct repeat the operand of the loop two, three, four and five times respectively.
- 2c) Train1 and Train2 both have traces that are inconclusive in the other. Hence, they do not refine each other. However, any positive/negative trace in Train1/Train2 is positive/negative in Train. Hence, Train supplements both Train1 and Train2.



Solution Question 3

- 3a) $\leftrightarrow$ if no input is ever received.
- 3b) Any trace of length 2 whose first event is ?Update(CM) and whose second event is an output event is negative.
- 3c) Yes.
 - The state machine may produce infinitely many traces and disallows infinitely many traces.
 - Any positive trace of the lifeline may be produced. Any negative trace of the lifeline is disallowed.



Solution Question 4

- 4a) No. The trace $\langle ?\text{Update}(\text{CM}), ?\text{UserData} \rangle$ is for example positive in Local Model1 but negative in Local Model. Note: If a message is received in a control state that has no transition for this input message, there is an implicit transition from the relevant control state to itself in which the input message is read.
- 4b) No. A state machine has no inconclusive traces.