



— 70 years —
1950-2020

SOLUTION TO OBLIG-II

Question 1a

Any positive trace will "skip" the veto. Due to causality the first event in both operands of the alt is !Model. If the loop iterates zero times we get the empty trace, but the empty trace has no events. Hence, the answer is !Model

Question 1b

We get

- <> from looping zero times
- 10 traces of length 14 from looping one time executing the second alt operand
- 4 traces from executing the first alt operand when looping 1, 2, 3 or 4 times.

This gives 15 traces.

Question 1c

Due to causality we get

- ?Model if the loop executes 0 times,
- ?Nok if the loop executes first alt operand in its last iteration,
- ?Report if the loop executes second alt operand in its last iteration.

The loop may not terminate, but in an infinite trace there is no last event.

Hence, there are only the last events specified above.

Question 1d

#N16 is greater than #P16.

- We get 14 traces if Analyzer receives ?Model before the loop starts executing.
- We get lots of additional traces otherwise.

Question 2a

The first thing that happens is that Model is sent as part of the initialization. Hence the answer is !Model.

Question 2b

There are eight:

- 1 trace of length 1 if no input is received: <!Model>
- 2 traces of length 2: <!Model,?Report>, <!Model,?Ok>
- 2 traces of length 3 terminating in Iterate:
<!Model,?Report,?Report>, <!Model,?Nok,!Model>
- 3 traces of length 3 terminating in Await report:
<!Model,?Report,?Ok>, <!Model,?Ok,?Ok>, <!Model,?Ok,?Nok>

Question 2c

There are infinitely many. The negative traces are those that the machine cannot produce given its specification. For example, in Iterate the machine is not allowed to output anything after receiving report. Hence, the trace $\langle !\text{Model}, ?\text{Report}, !\text{Hello} \rangle$ is negative, and so is any other trace where $!\text{Hello}$ is replaced by an output signal not specified by the machine.

Question 3a

The alternative in the specified scenario abstraction for an if-then-else. We want both options in an implementation. Hence, it should be xalt.

Question 3b

The two diagrams have the same sets of traces, but in GestaltService1 these traces are split between infinitely many partly overlapping interaction obligations. None of these interaction obligations contain all the traces of GestaltService0. Hence, some of the traces the single interaction obligation in the semantics of GestaltService0 will be inconclusive in each of the interaction obligations of GestaltService1. Hence, GestaltService1 is not a general refinement of GestaltService0 (and therefore also not a limited refinement).

Hence, the answer is no.

Question 4a

We get 2 from looping 1 time, 4 from looping 2 times and 8 from looping 3 times.

The choice between looping 1, 2 or 3 times corresponds to an alt. Hence, we must use the semantics of alt (inner union) to compose the interaction obligations from the 3 different options.

This means that we 2 interaction obligations from looping 1 time, $2 \cdot 4$ from looping 1 or 2 times and $8 \cdot 8$ from looping 1, 2 or 3 times.

Hence, the answer is 64.

Question 4b

For any interaction obligation in GestaltService2 there is an interaction obligation in GestaltService1 that supplements it.

On the other hand, there are interaction obligations in GestaltService1 that are not refined by any interaction obligation in GestaltService2.

Hence, it is a general refinement, but not a limited refinement.

Question 5a

Veto describes the empty trace as positive. The loop (due to the assert) describes the empty trace as negative. Since the two fragments are composed by seq (see semantics of seq) we get (positive+negative gives negative) the empty trace as negative. Hence, the answer is 0.

Question 5b

Due to the assert, for each xalt fragment any trace not explicitly specified as positive, is negative. Infinitely many of those are infinite.

Hence, the answer is infinite.

Question 5c

Yes, the number of interaction obligations are the same. The only change from GestaltService2 to GestaltService3 is that the interaction obligations get additional negative traces. Hence, for each pair of obligations we have supplementing.

Hence, we have limited refinement and therefore also general refinement.



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