

Testing Techniques 2019 – 2020

Tentamen

January 15, 2020 – 8:30–11:30/12:00 h. – HG00.071 / HG00.622

1 Testing with ioco

Consider the labelled transition systems q_1 , q_2 , q_3 , and q_4 in Fig. 1. These systems model *queues* with input $?in$ and output $!out$.

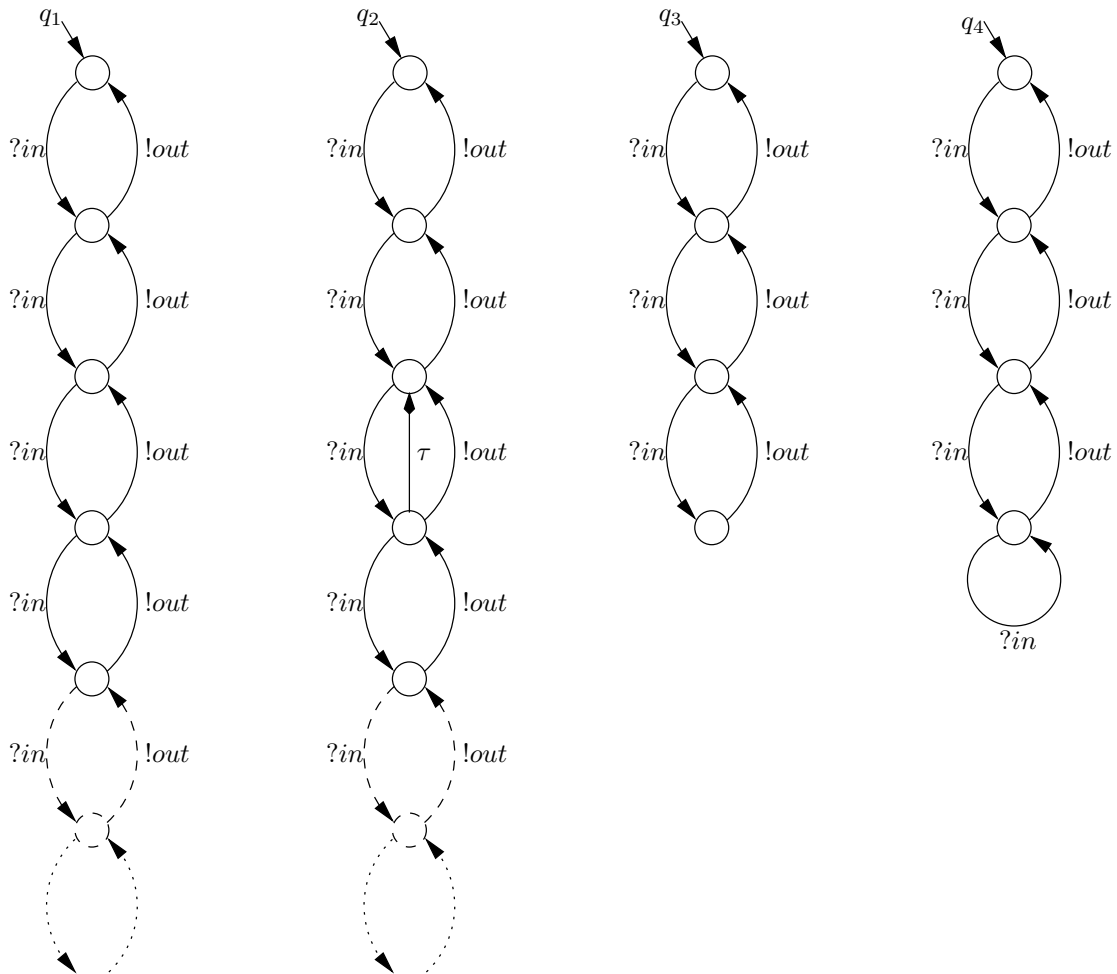


Figure 1: Four models of queues.

System q_1 represents an unbounded queue; the dotted lines at the bottom of q_1 are meant to indicate that there are infinitely many states, and that there is no bound on the number of $?in$ actions that can be performed after each other. System q_2 is also an unbounded queue, but it is

a lossy queue: the third input can get lost. Queues q_3 and q_4 are bounded queues with capacity three, the difference being that q_4 explicitly neglects additional inputs.

- a. Which states of q_2 are *quiescent*? Why?
- b. Which of the systems q_1, q_2, q_3, q_4 are *input-enabled*? Why?
- c. Consider q_3 as specification, q_4 as implementation, and **ioco** as implementation relation. Is q_4 an **ioco**-correct implementation of q_3 , i.e., does q_4 **ioco** q_3 hold? Explain.
- d. Can an unbounded queue correctly implement a bounded queue specification, i.e., does q_1 **ioco** q_3 hold? And the lossy queue q_2 : does q_2 **ioco** q_3 hold?
- e. What can you say about the inverse: can a bounded queue correctly implement an unbounded (lossy) queue specification, i.e., q_4 **ioco** q_1 or q_4 **ioco** q_2 ? Explain.
- f. We have that $q_3 \not\stackrel{\sigma}{\Rightarrow}$ with $\sigma = ?in \cdot ?in \cdot ?in \cdot ?in$. Moreover, $out(q_3 \text{ after } \sigma) = \emptyset$ for this σ . Argue that this holds in general for any system $p \in \mathcal{LTS}(L)$ and any $\sigma \in (L \cup \{\delta\})^*$, i.e.,

$$p \not\stackrel{\sigma}{\Rightarrow} \text{ iff } out(p \text{ after } \sigma) = \emptyset$$

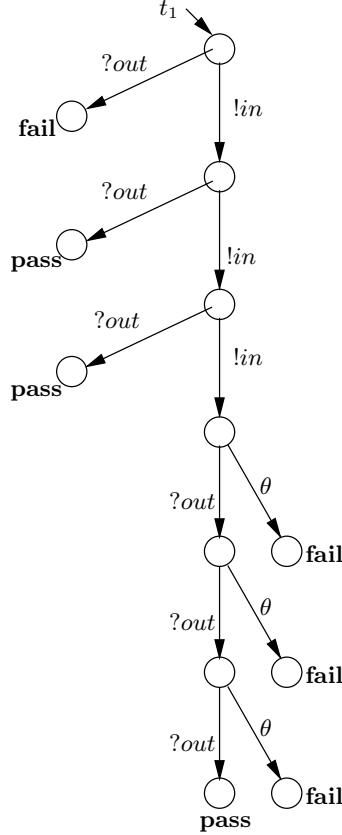


Figure 2: Test case t_1 for queue systems.

- g. Fig. 2 gives a test case t_1 . Give the test runs and determine the verdicts of executing the test case t_1 on q_2 .
- h. For which of the specifications q_1, q_2, q_3 , or q_4 , is test case t_1 *sound* with respect to implementation relation **ioco**? Explain.