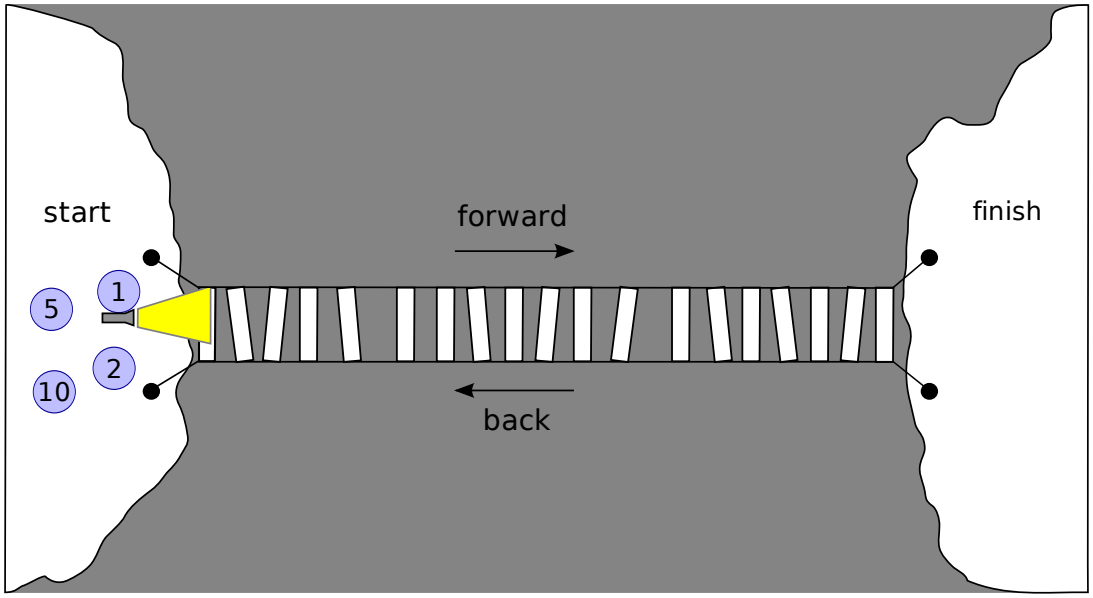
The Adventurers' Problem

In the middle of the night four adventurers encounter a shabby rope-bridge spanning a deep ravine. For safety reasons, they decide that no more than 2 people should cross the bridge at the same time and that a flashlight needs to be carried by one of them in every crossing. They have only one flashlight. The 4 adventurers are not equally skilled: crossing the bridge takes them 1, 2, 5, and 10 minutes, respectively. A pair of adventurers crosses the bridge in an amount of time equal to that of the slowest of the two adventurers.



One of the adventurers claims that they cannot be all on the other side in less than 19 minutes. One companion disagrees and claims that it can be done in 17 minutes. Your task it to verify these claims in UPPAAL[1]. Specifically, your task is to,

1. model the system above using what you learned about timed automata;
2. express in CTL that it is possible for all adventurers to be on the other side in 17 minutes;
3. express in CTL that it is impossible for all adventurers to be on the other side in less than 17 minutes;
4. test these formulae in UPPAAL.

Some hints to help you get started: the fact that only one person can carry the flashlight is a mutual exclusion problem. Do not try to model the whole system with just one timed automaton. Instead use what you learned about parallel composition. We suggest one timed automaton for the flashlight and one timed automaton for each person.

[1] An animated description of the problem is available here.