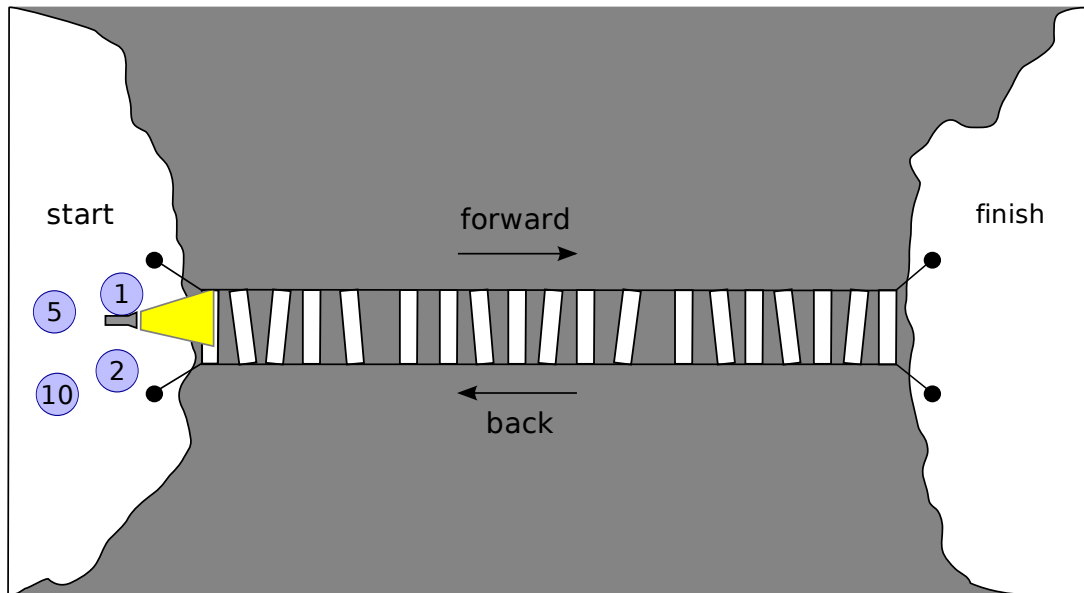


Assignment 2: Modelling and analysis of real-time systems now with monads !

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Arquitectura e Cálculo – 2019/2020

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.

First task (80% of the grade)

Your first task is to verify these claims using HASKELL¹. Specifically, your first task is to,

1. model the system above using what you learned about monads, in particular the duration and list monads;
2. show that it is indeed possible for all adventurers to be on the other side in 17 minutes;
3. show that it is impossible for all adventurers to be on the other side in less than 17 minutes.

¹An animated description of the problem is available here.

We require that you fulfill this task by completing the code in attachment (`Adventurers.hs`), i.e. by adding a definition to the functions that lack a definition, following the comments present in the code. Write a report that explains your code and the conclusions obtained (around 1-2 pages excluding images).

Some hints to help you get started: Recall the duration monad from the slides and the code that was previously provided. Analyse in detail the code concerning the Knight's quest, and in particular the monad `LogList`.

N.B. Do not change the names of the functions in the code, as we will use these names for automatic testing.

Second task (20% of the grade)

Your second task is to compare your approaches via UPPAAL and via HASKELL to the problem of the adventurers. Specifically, you should provide strong and weak points of the two approaches: what are the (dis)advantages of UPPAAL for this problem? What about HASKELL? The comparison should be around 300 words.

Optional task (extra points to the grade)

Add new functionalities to the code: for example, present the sequence of states respective to the movements of the adventurers from the initial state to the final goal.

What to submit: A single report in PDF for tasks 1 and 2 **and** the completed source file (`Adventurers.hs`). Send by email (nevrenato@gmail.com) a unique zip file "`ac1920-N1_N2.zip`", where `N1` and `N2` are your student numbers. The subject of the email should be "`ac1920 N1 N2`"

Deadline: 16h June 2020 @ 23h59