

# Master internship proposal

## The value 1 problem

### for probabilistic automata

This internship will take place in [LaBRI](#), Bordeaux, under the direction of [Hugo Gimbert](#). An office and a computer will be provided to the intern, as well as the minimal legal internship grant.

### Game theory and controller synthesis

Controller synthesis aims at automatically generating hardware devices or programs given a logical specification. A correct controller has to drive the system by means of actions and ensure that the behaviour of the system is correct whatever be the interaction of the system with its environment. For example, the program controlling an ATM should guarantee that no cash is delivered until the correct pin code has been produced by the current user of the ATM.

Controller synthesis can rely on models and algorithms developed by game theoretists. Various models of interaction have been developed by mathematicians, economists, biologists, computer scientists together with algorithms to analyze and predict the behaviour of rational agents playing these games. Synthesizing a good controller amounts to computing an optimal strategy in a game.

Of course in most real-case applications, there is only partial monitoring of the system, and the proper class of games to use are games with imperfect information. For a start, the special case of game with one player and no feedback is interesting. Such games can be seen as probabilistic automata and a basic problem is to decide whether the game has value one or in other words if there exists words accepted with arbitrarily high probability by the automaton.

There has been two recent papers on the subject, see [The Decidability Frontier for Probabilistic Automata on Infinite Words](#) by Chatterjee and Tracol and [Deciding the Value 1 Problem of Probabilistic Leaktight Automata](#) by Fijalkow, Gimbert and Oualhadj. Each one of these two papers presents a class of automata with a decidable value 1 problem, with very different proofs techniques. The goals of the internship are:

- to understand these two results and their proofs
- to compare these two classes (is one of them included in the other, is one of the decidable problem reducible to the other?)
- and to look for a larger class of automata with a decidable value 1 problem.

This work can be continued in PhD afterwards.

