

Games and Probabilistic Verification



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Outline

What is Verification good for?

Games

Probabilistic Verification

What is Verification good for?

saves money, lives and for critical systems.

Famous failures

- Ariane 5 explosion (integer overflow)
- Intel CPUs (floating point error)
- Software for cars, planes, automatic trains

Games

The first player supplies input

The second tries to meet the specification (usually given in logic)

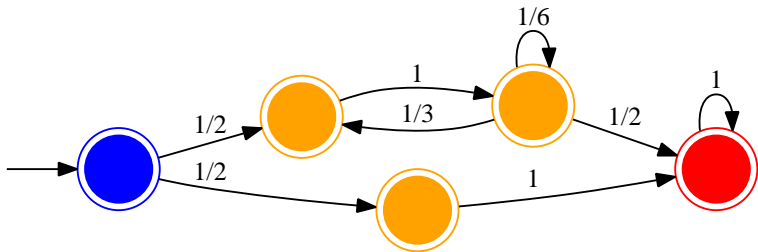
Example:

- First chooses either red, green, brown or orange
- Second chooses 1, 2, 3 or 4

Second wins iff the largest number he chooses infinitely often =
colors First chooses infinitely often

Probabilistic Verification

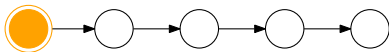
Model checking Markov Chains:



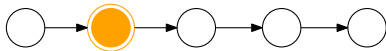
Probabilistic Verification

Specification given in (LTL) Linear Temporal Logic:

orange



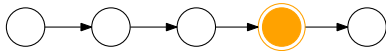
X orange



orange U red



F orange



G orange

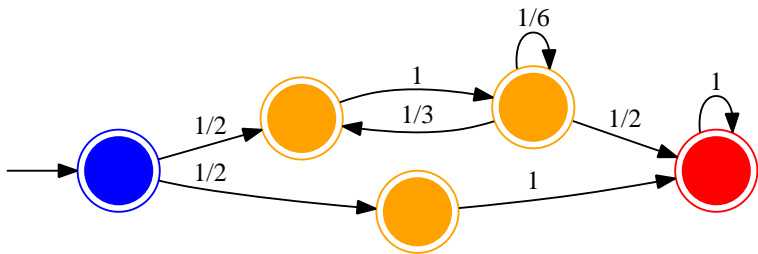


X ((orange \vee green) U red)



Probabilistic Verification

Example specifications: $F \text{ red}$, $X X \text{ red}$, $X (G \text{ orange} \vee \text{ red})$



My current work

Complexity of verification of:

- Parallel Markov Chains
- Specification given in FO2

Example: $\forall x \in A. \exists y. y \geq x \wedge y \in B$

Result

Somewhere between 2EXPTIME and 3EXPTIME

Thank you

Any questions?