

Advanced Formal Tools

PRISM: Probabilistic Model Checking

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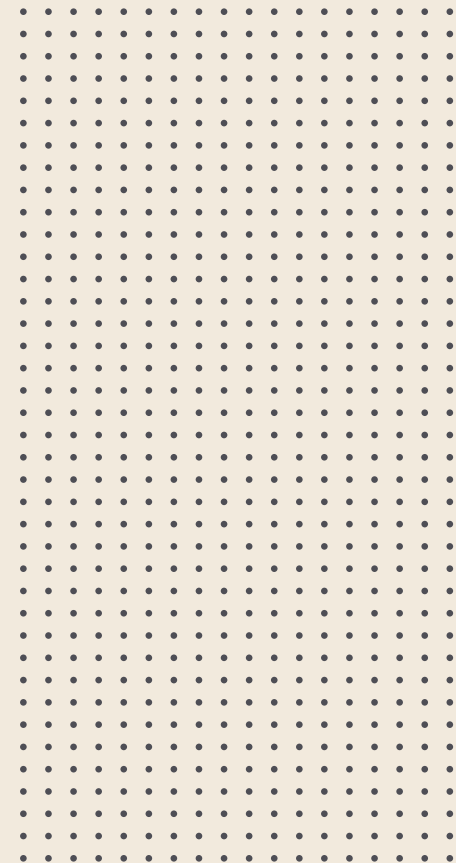
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Overview



1

Current Status

- Understand basic usage (modeling+analysis)
- Found limitations
- Implementing our own case study
- Can export results from properties to get plots (methodology)

2

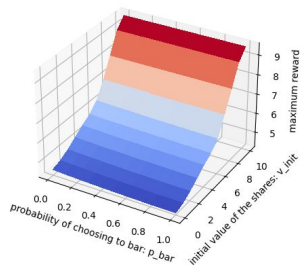
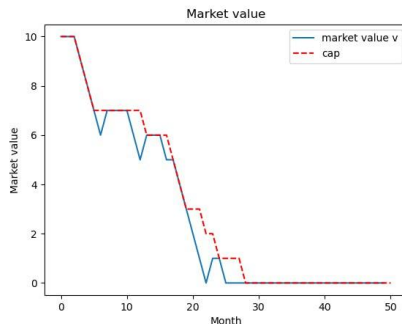
Goals

- Finish implementation
- Analyze case study and properties
- Write a report

Reminder



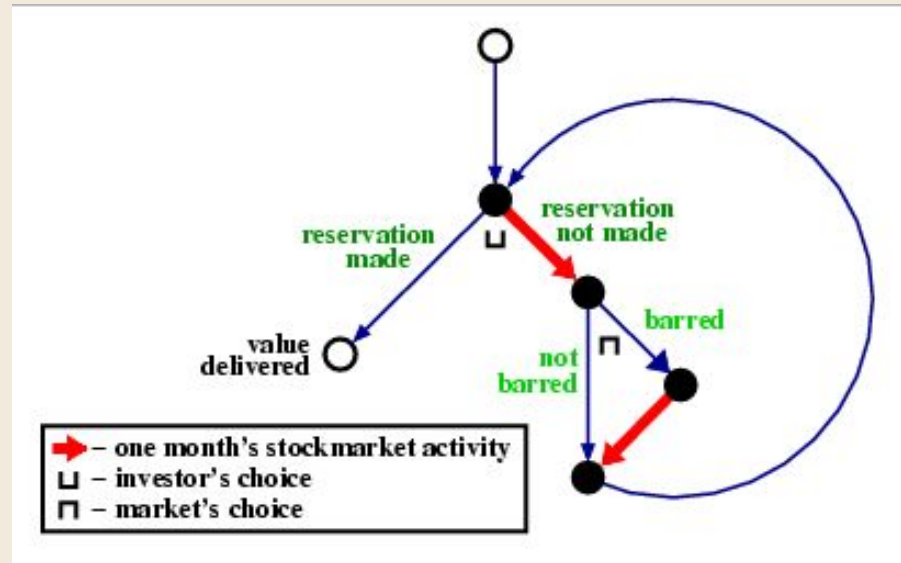
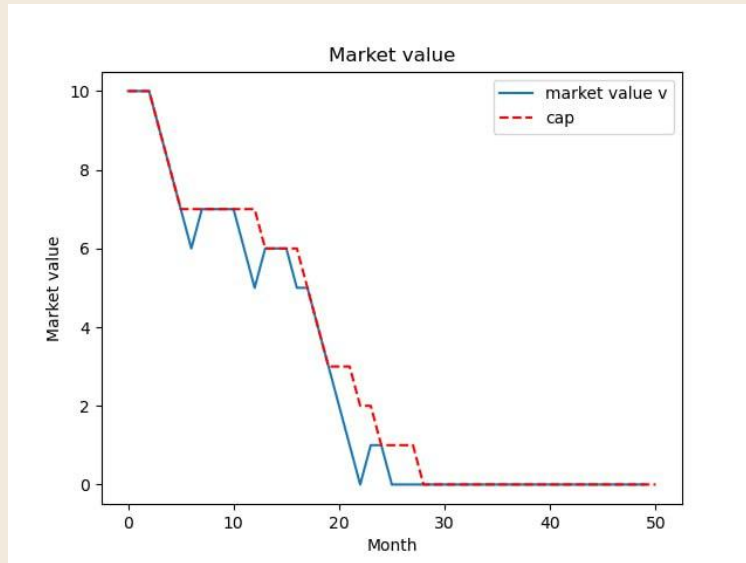
Dice tutorial
Markov chain



Replicating Market Investor case study results
MDP

Extend model ?
More properties ?

Case study: Futures Investor





Our changes



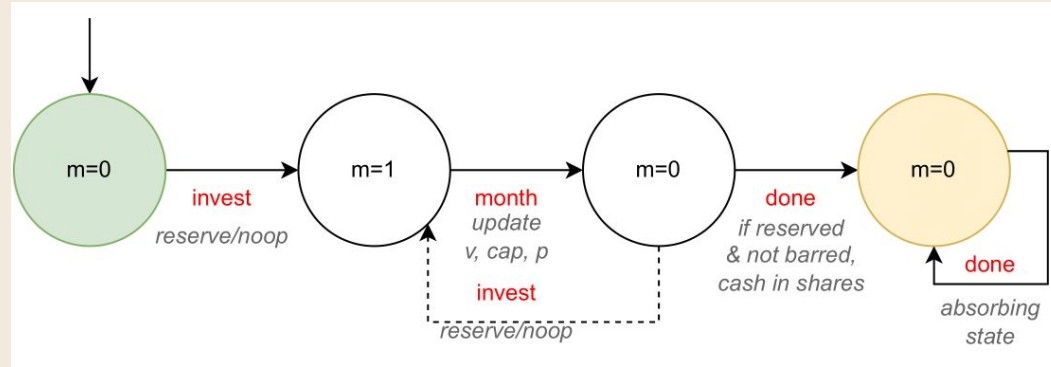
- Change end state to a time limit, allow several investments
 - Changed end state condition
 - Added reward based on “delivery” state
- Add time reward (money now is worth more than money later)
 - Let money received accrue interest
 - Gives incentive to invest earlier than later

Remaining ideas:

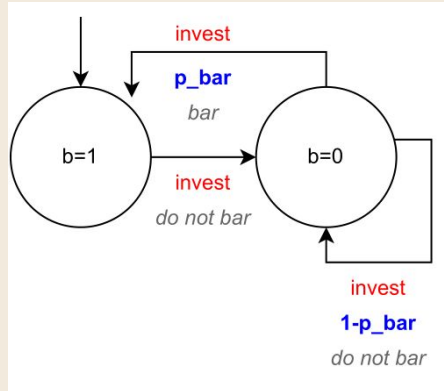
- Have a limit on the number of investments
- Have a cost related to investing

State transition Representation

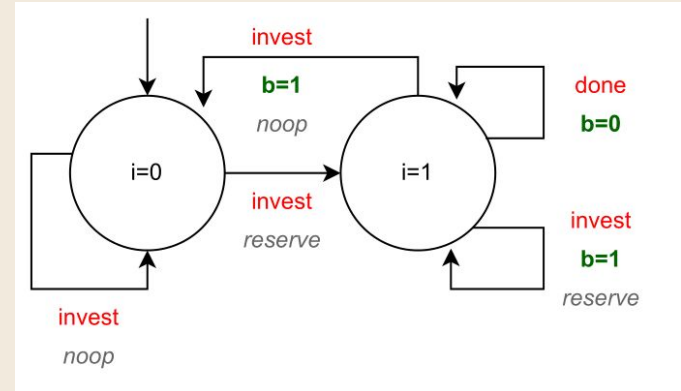
Month Module:



Market Module:

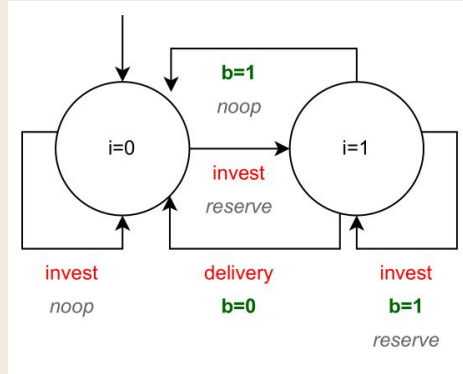


Investor Module:

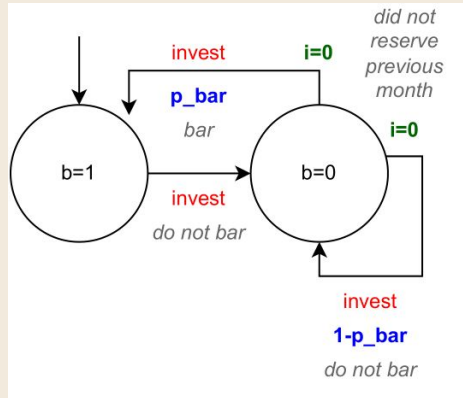


Representation with Changes

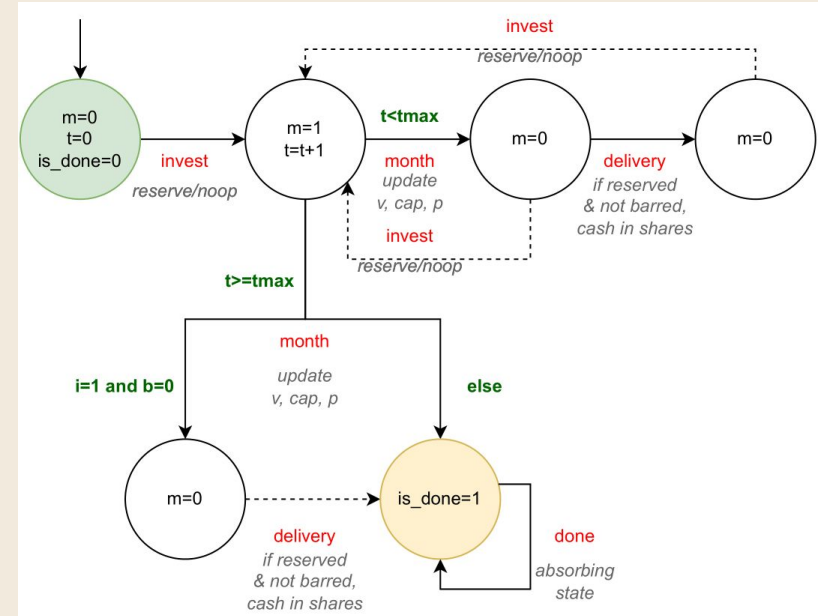
Investor Module:



Market Module:

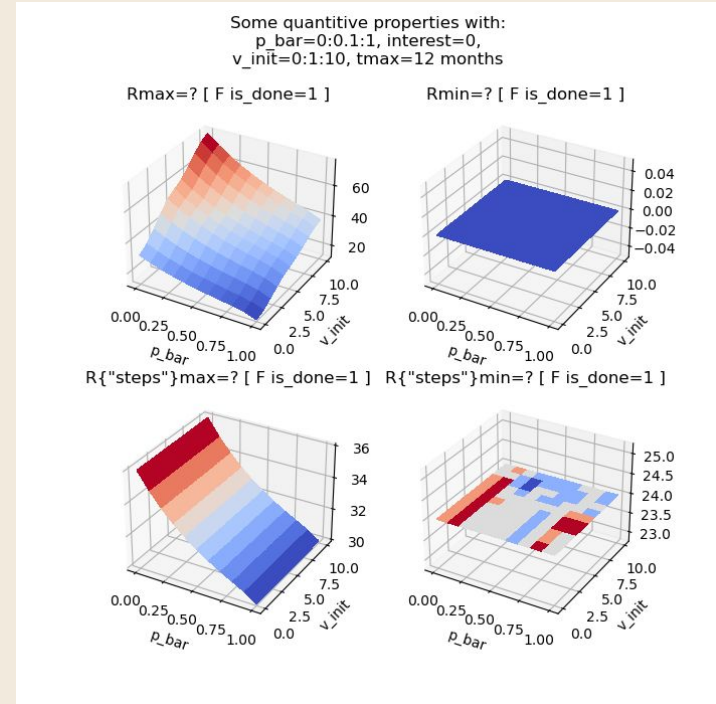
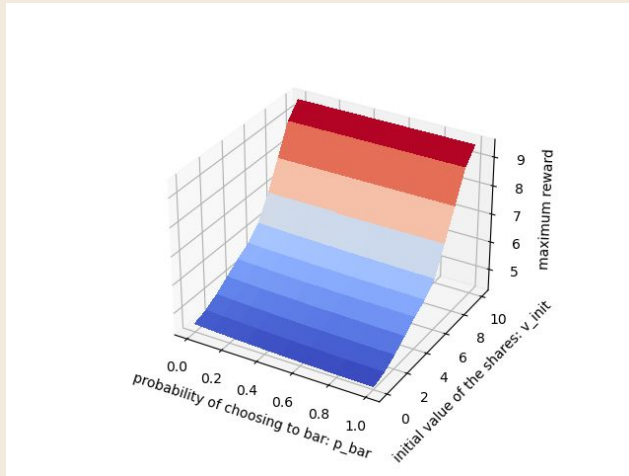


Month Module:



Methodology

- Properties and results for our case study:
- Original case study's results:





PRISM-Games for 2 Investors



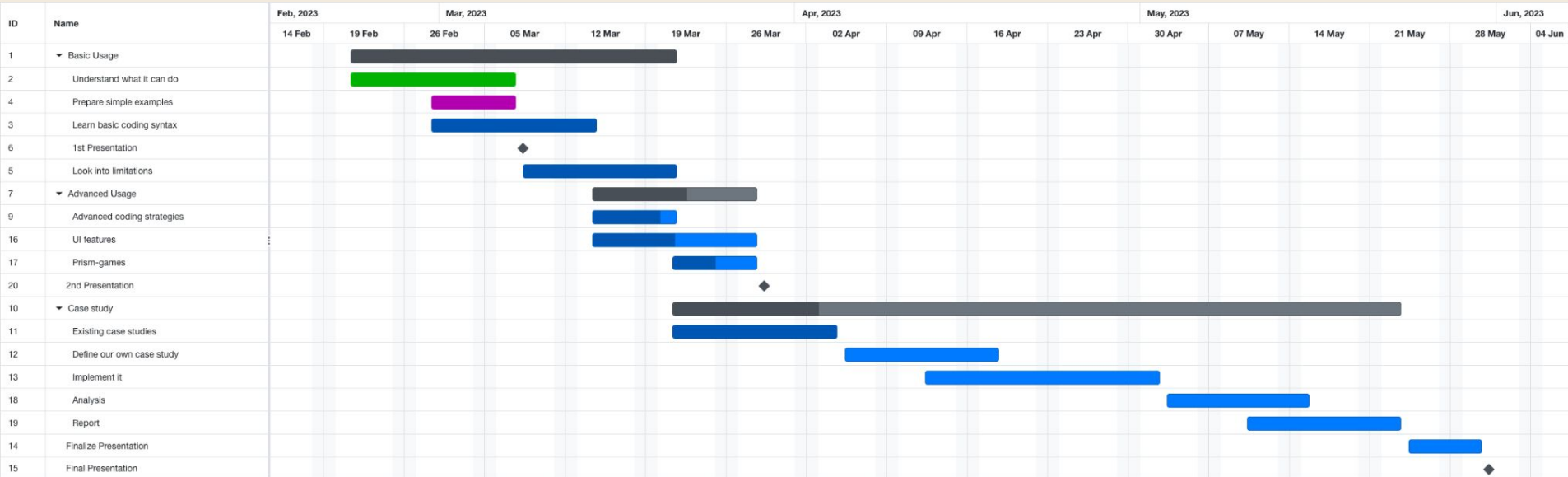
- **Recall TSG: Turned-based Stochastic Game:**
MDP + players can only play in some states + one player per state.
- Extension of PRISM, PRISM-Games can analyze **stochastic multiplayer games**, including TSG.

PRISM-Games based changes:

- Introduce another investor, they take turn buying/selling to each other
- Implement an actual future (both actors settle on a price now, for later)

Note: Need to define the specifics and dynamics of two investors acting in a market, possibly too complex or lacking in time.

Project Progression





Conclusion