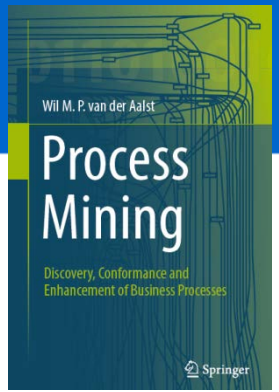
Process Mining: Data Science in Action

Petri Nets (1/2)



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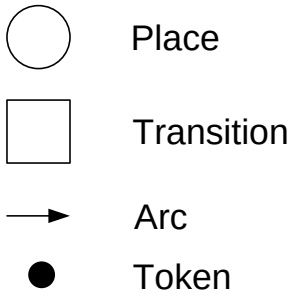
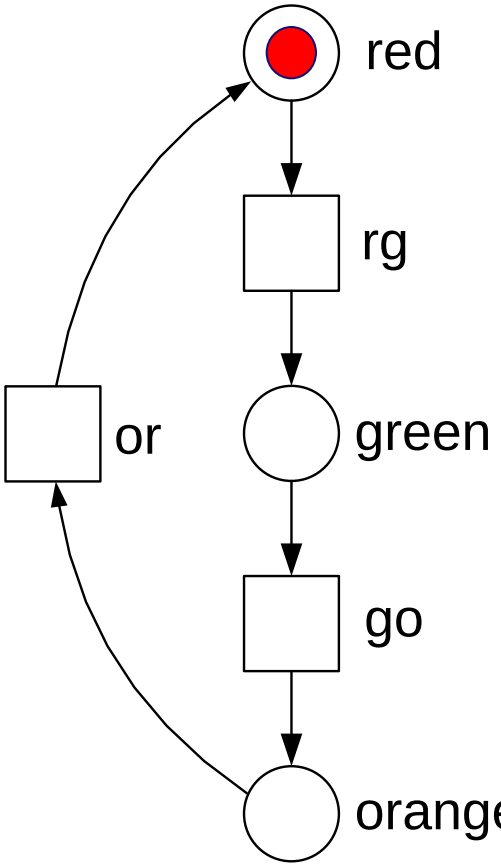
Where innovation starts

A very simple process …

Traffic light Petri net

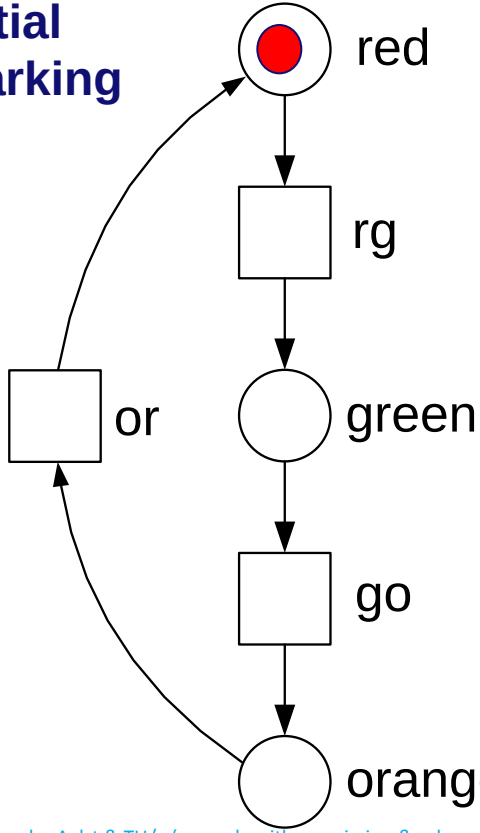
- **Network is static and composed of places and transitions.**
- **Places hold tokens.**
- **Transitions produce and/or consume tokens.**



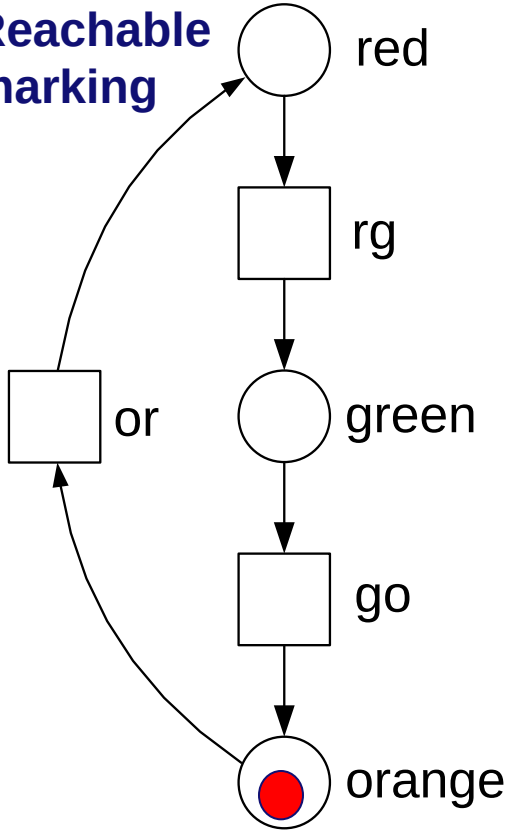


Markings

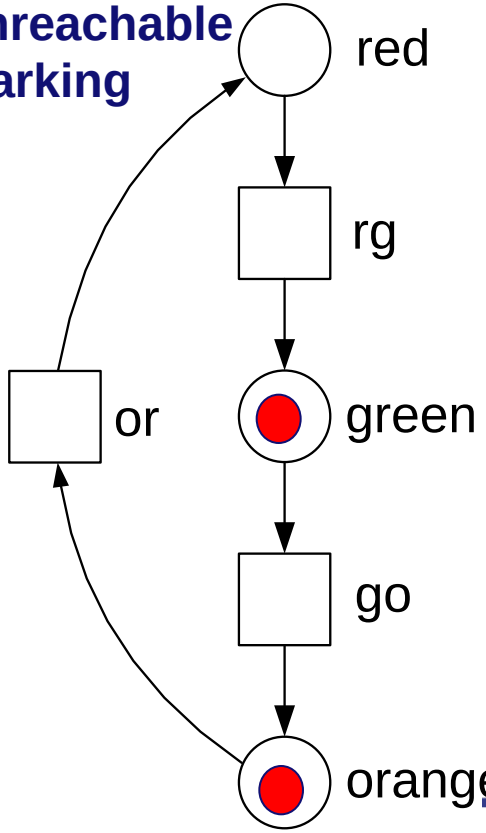
Initial marking



Reachable marking



Unreachable marking



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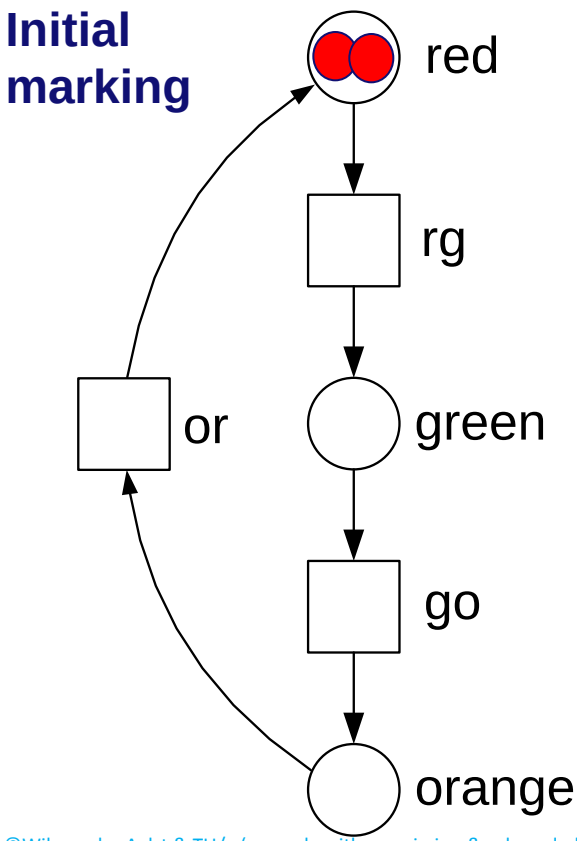
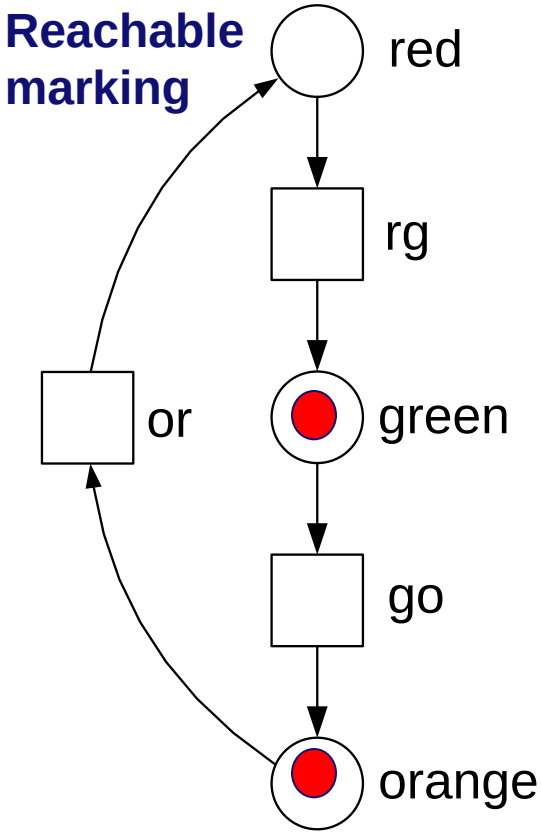
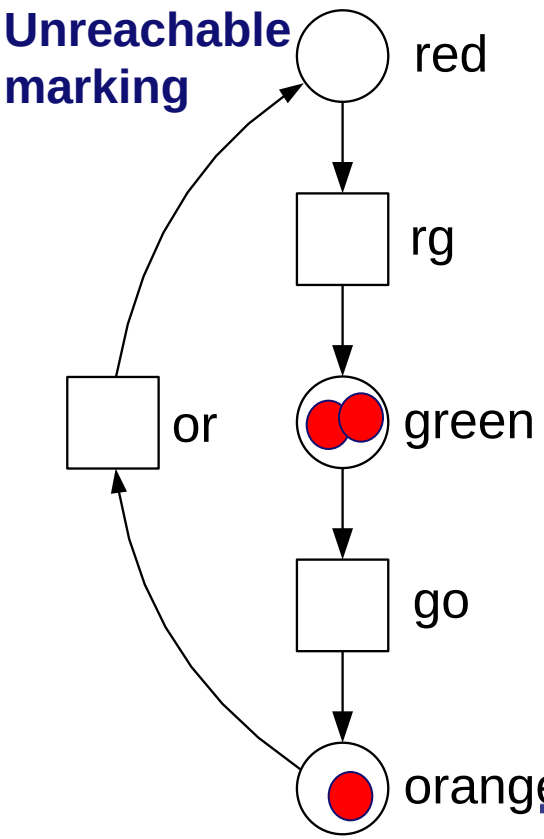
Markings







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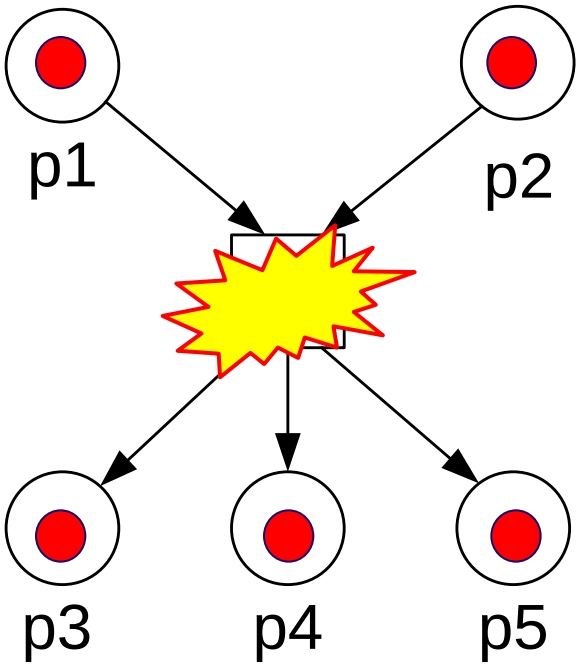
Enabling and firing



- Transition t1 is enabled if each input place contains a token.
- An enabled transition can fire by consuming a token from each input place and producing a token for each output place

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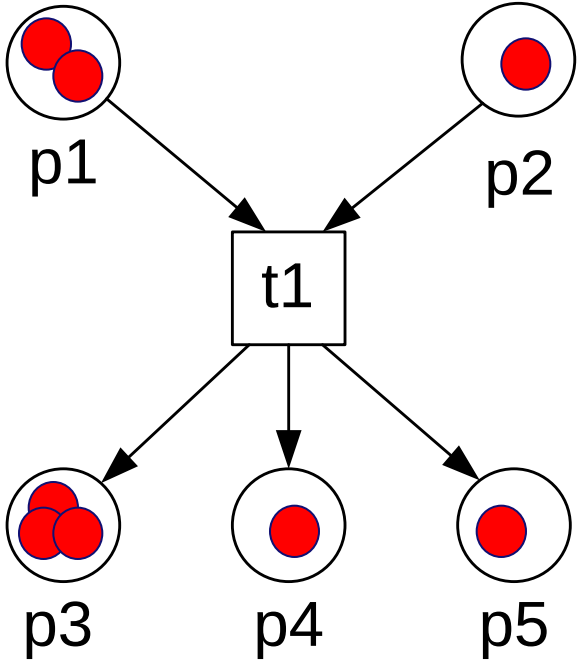
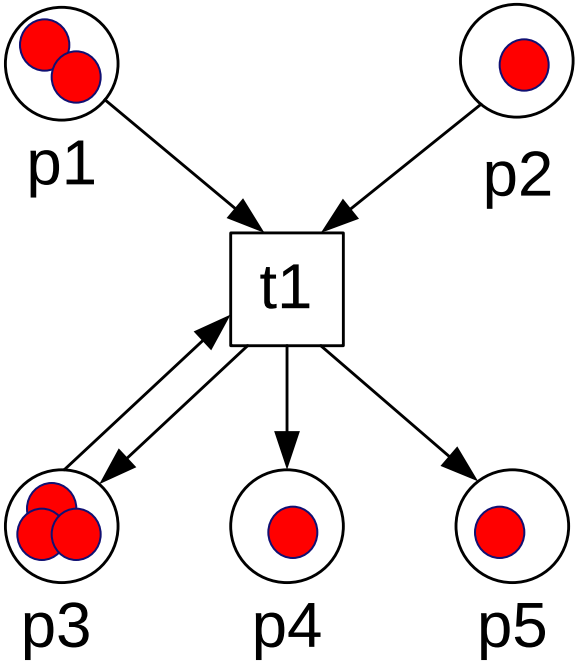
What if there are more tokens?



What if a place is both input and output?



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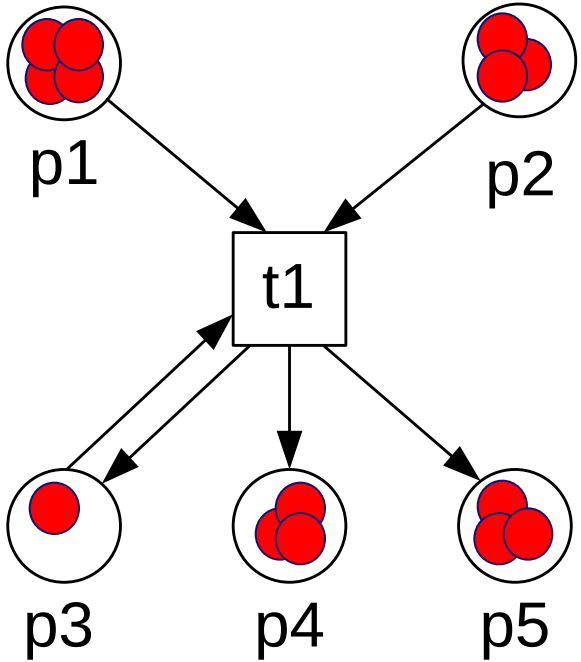
How many times can t1 fire and what is the final marking?

3 times



Firing is atomic!

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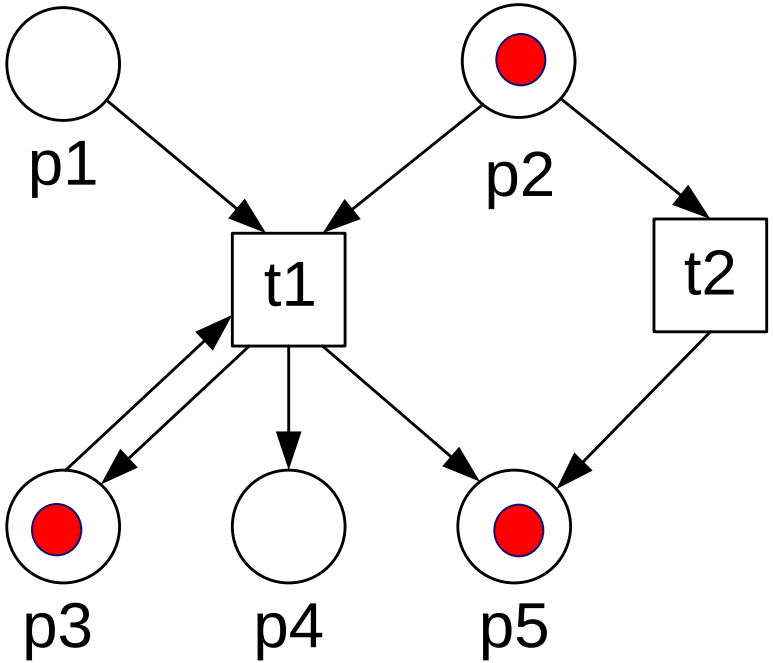
What if there are multiple transitions?



t1 is not enabled, so t2 fires

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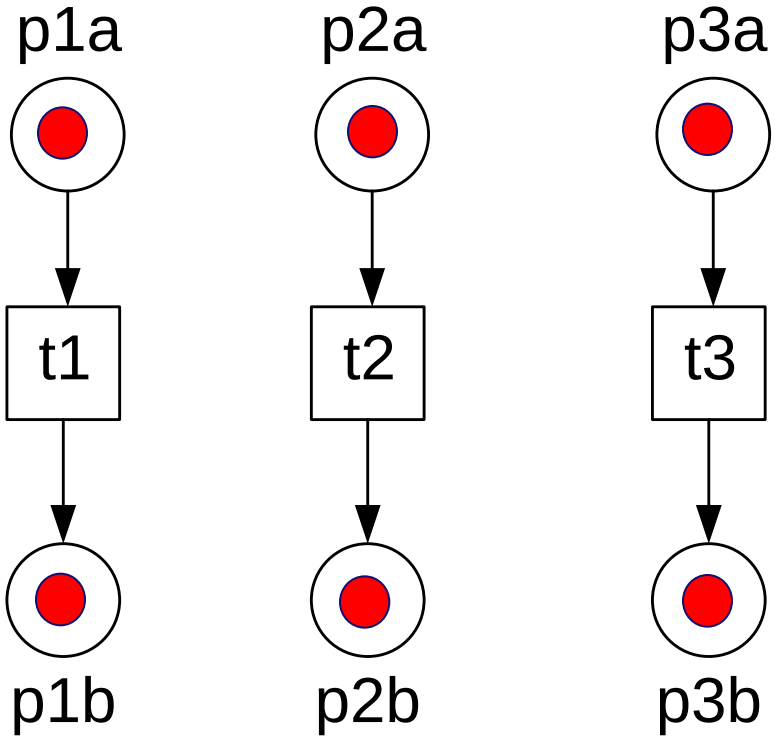
What if there are multiple transitions?



all three transitions are enabled and can fire in any order or even concurrently

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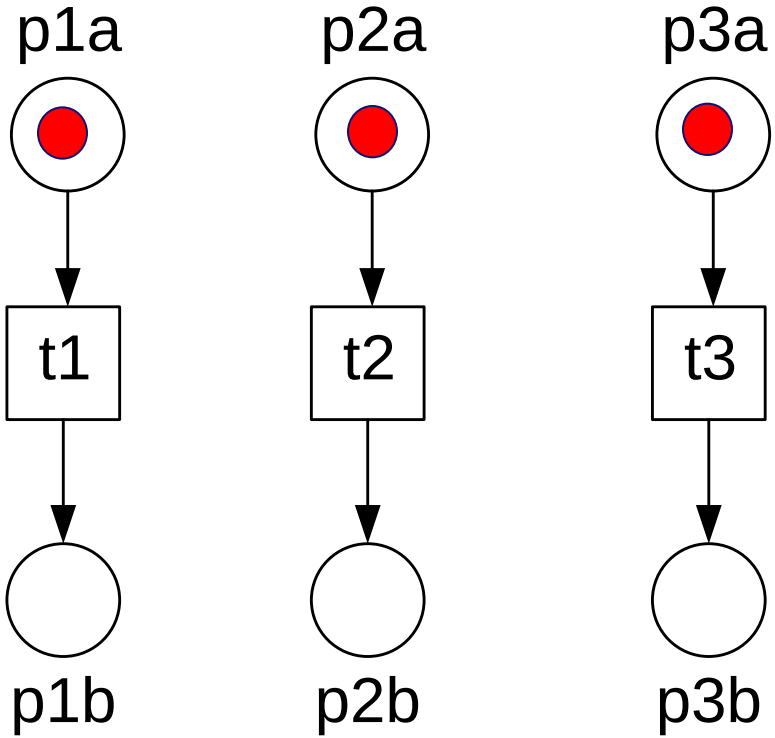
What if there are multiple transitions?



2x2x2 = 8 reachable states

In this course we assume interleaving semantics (no real limitation).

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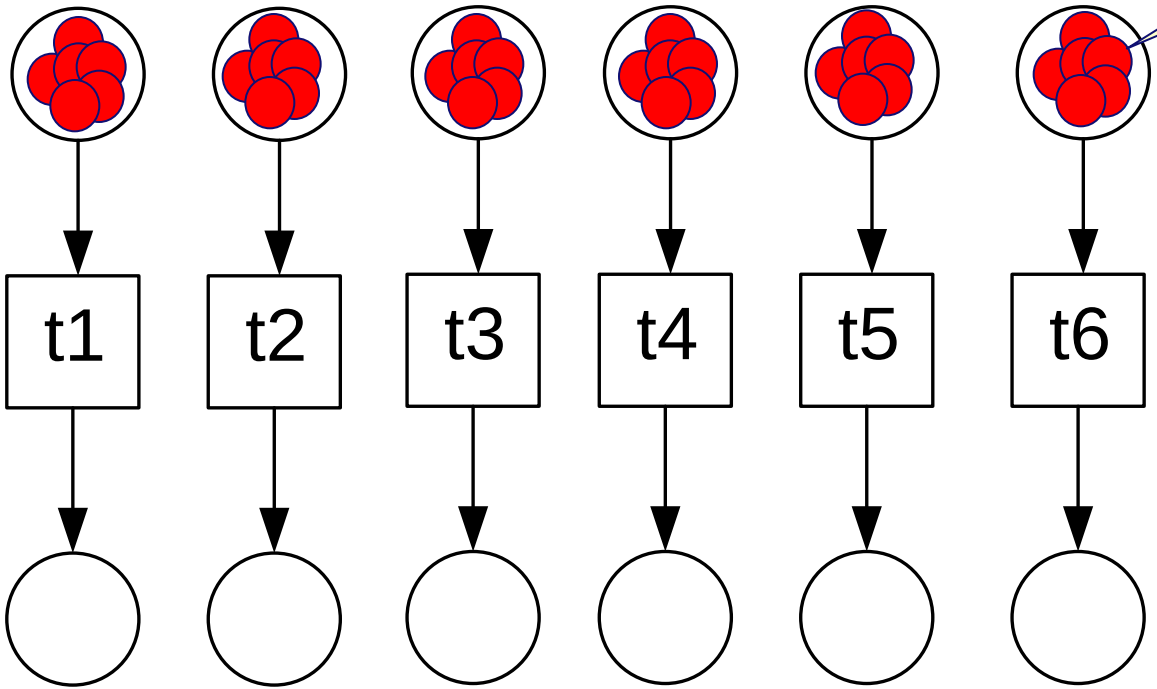
State explosion



$7^6 = 117649$
reachable states

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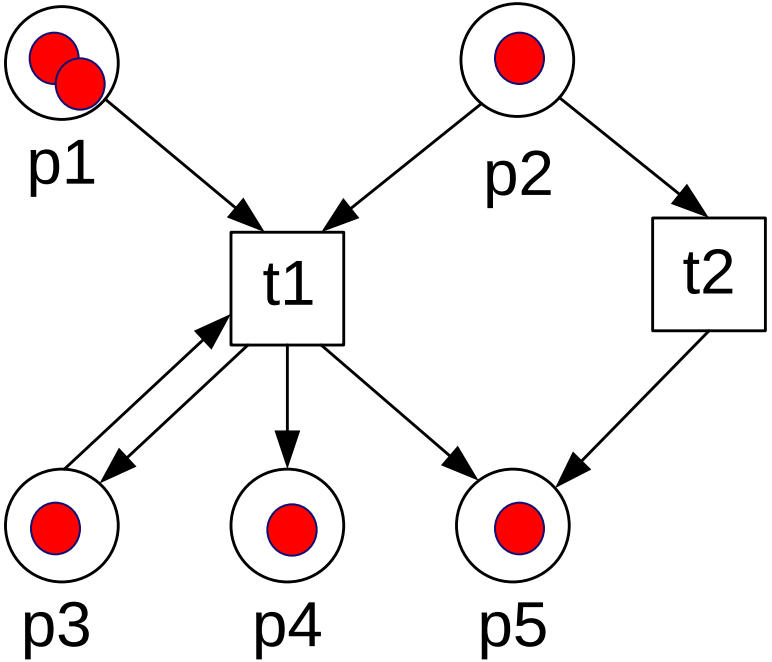
What if there are multiple transitions?



both are enabled but only one can fire

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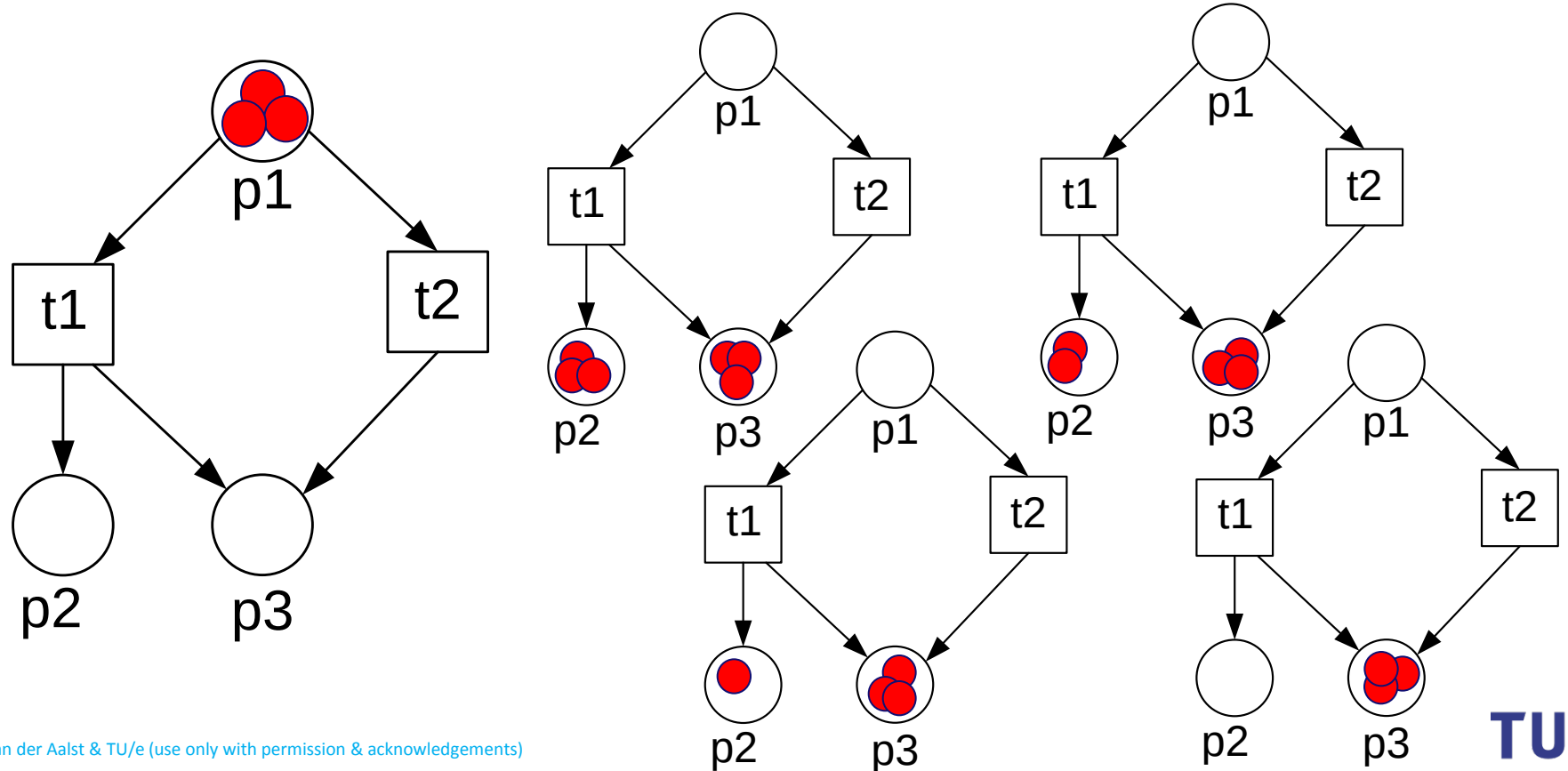
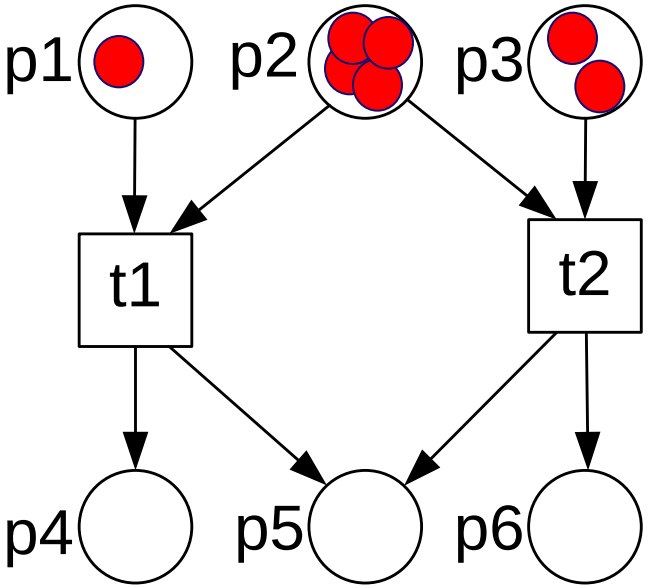
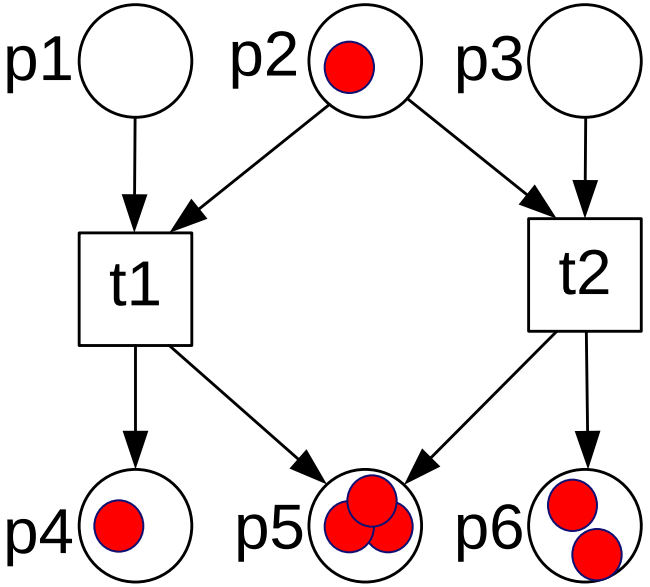
Give all possible final markings



TU/e

Give all possible final markings





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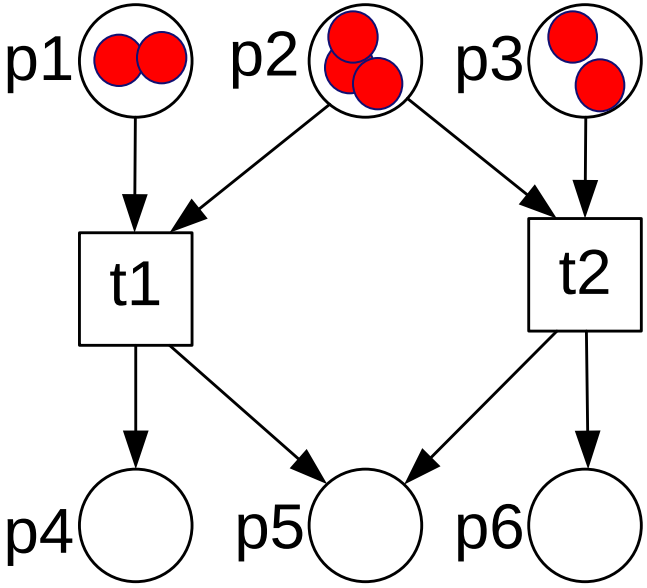
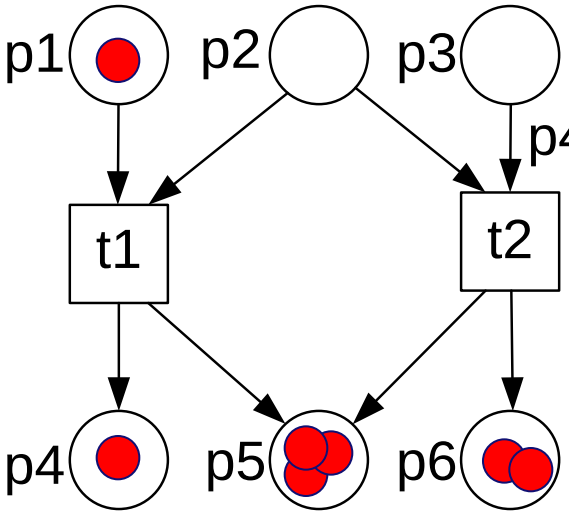
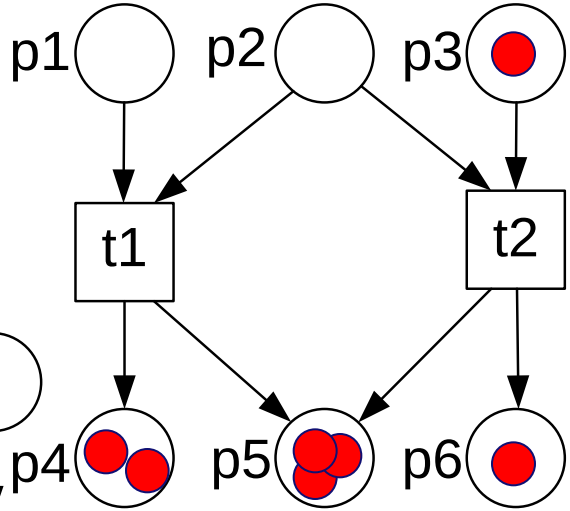
Give all possible final markings







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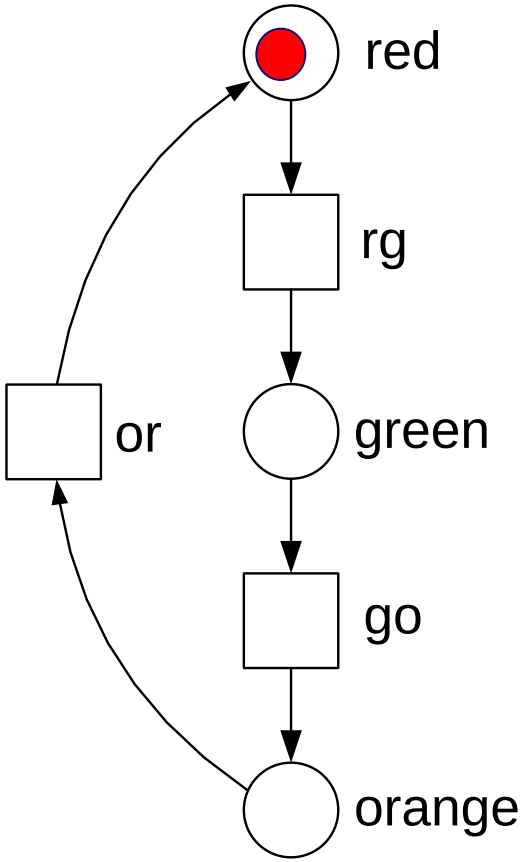
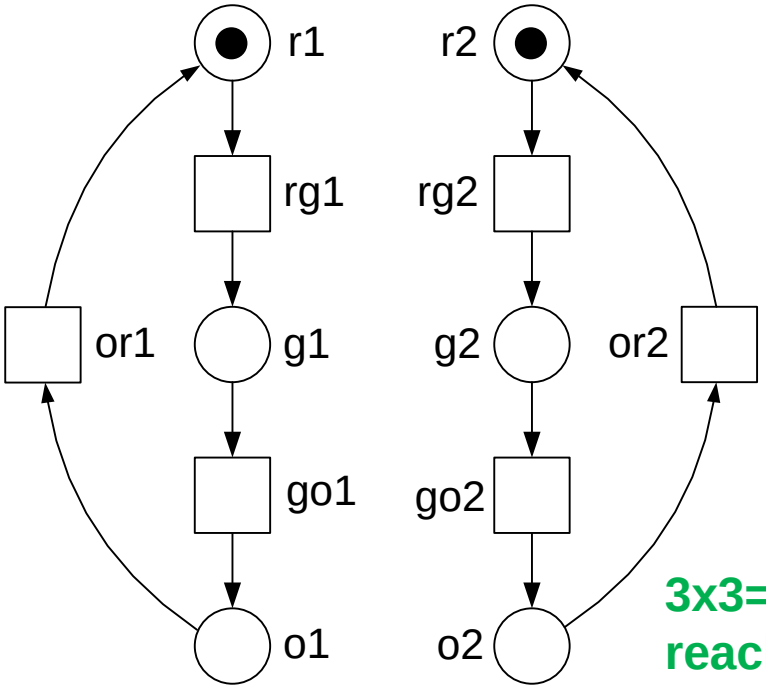
How to model two traffic lights?

2x

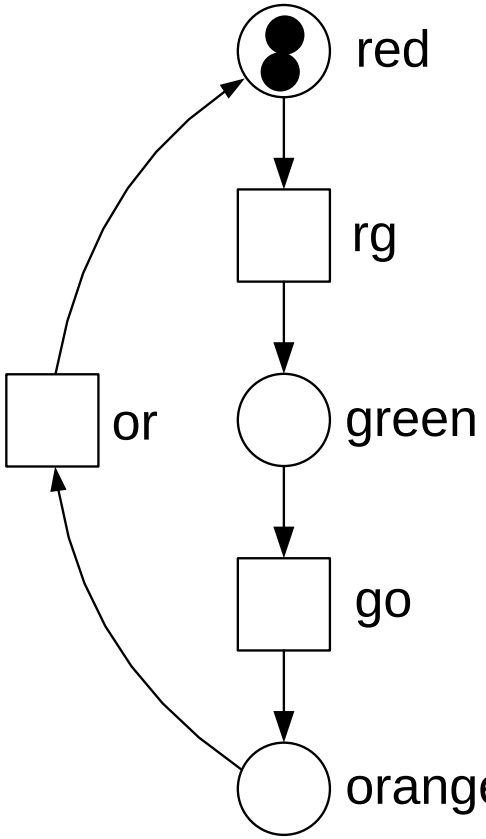


Two traffic lights



3x3=9 reachable markings

OR



6 reachable markings

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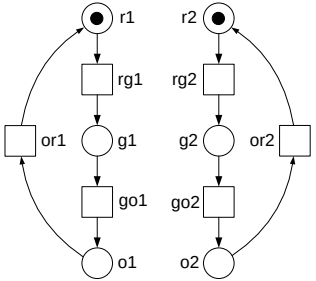
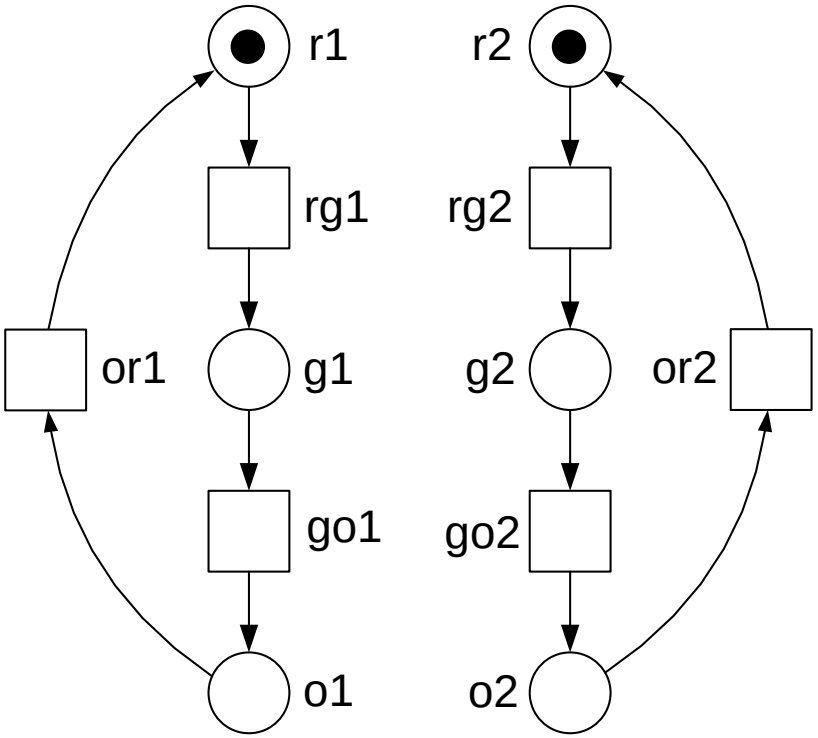
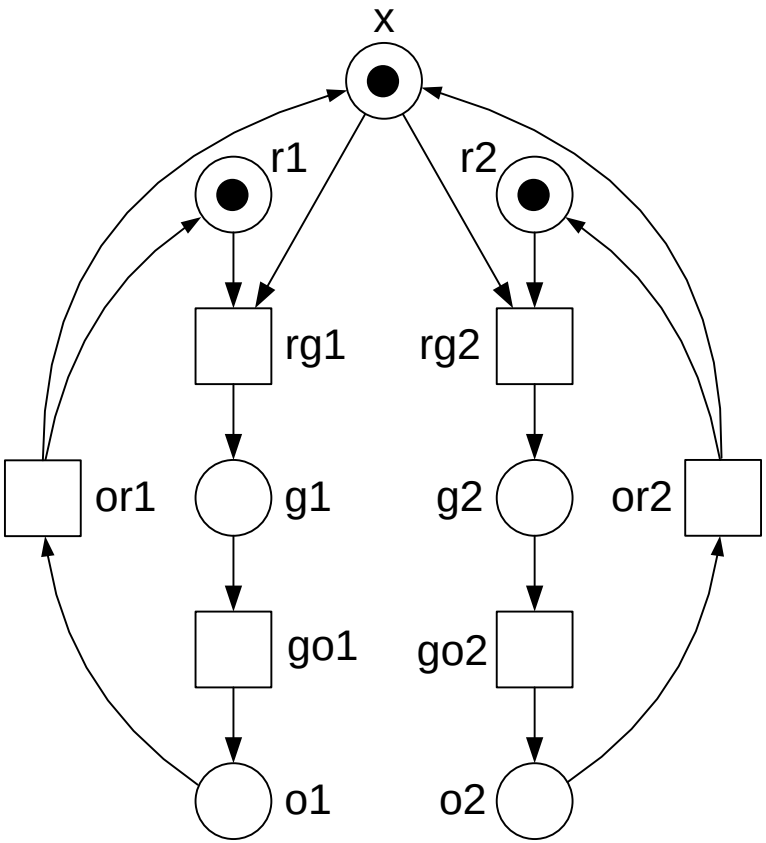
Problem



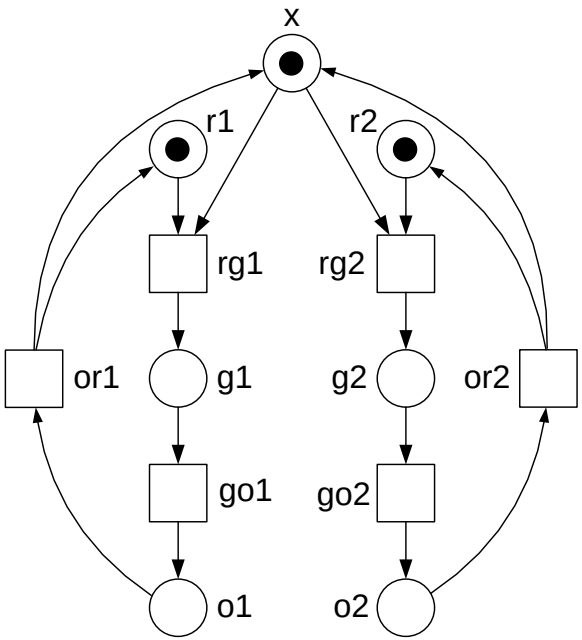
How to make them safe?

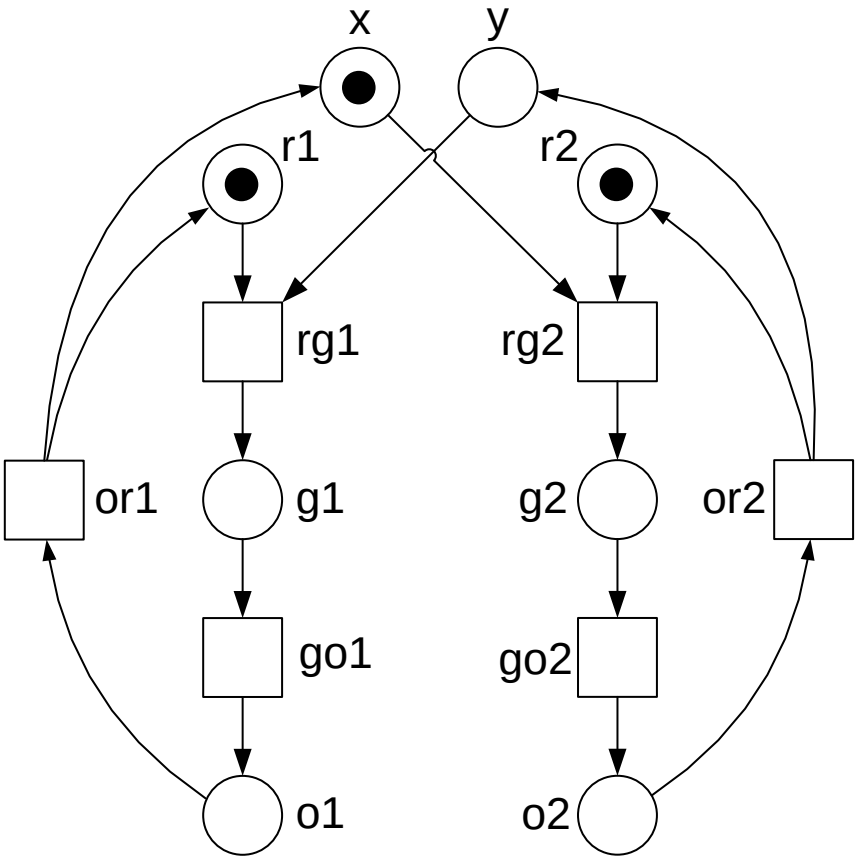


Safe traffic lights (non-deterministic)



How to make them alternate?





Part I: Preliminaries

- Chapter 1: Introduction
- Chapter 2: Process Modeling and Analysis
- Chapter 3: Data Mining

Part II: From Event Logs to Process Models

- Chapter 4: Getting the Data
- Chapter 5: Process Discovery: An Introduction
- Chapter 6: Advanced Process Discovery Techniques

Part III: Beyond Process Discovery

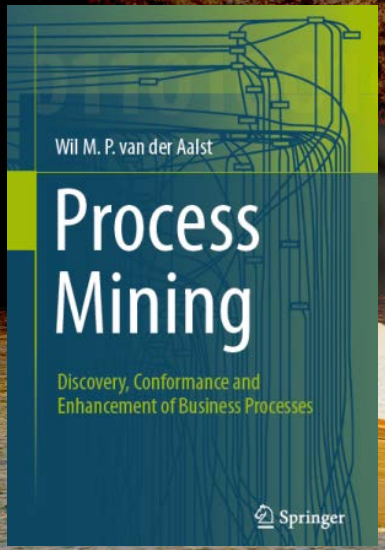
- Chapter 7: Conformance Checking
- Chapter 8: Mining Additional Perspectives
- Chapter 9: Operational Support

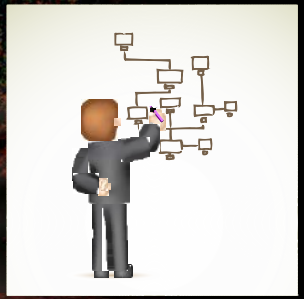
Part IV: Putting Process Mining to Work

- Chapter 10: Tool Support
- Chapter 11: Analyzing "Lasagna Processes"
- Chapter 12: Analyzing "Spaghetti Processes"

Part V: Reflection

- Chapter 13: Cartography and Navigation
- Chapter 14: Epilogue





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