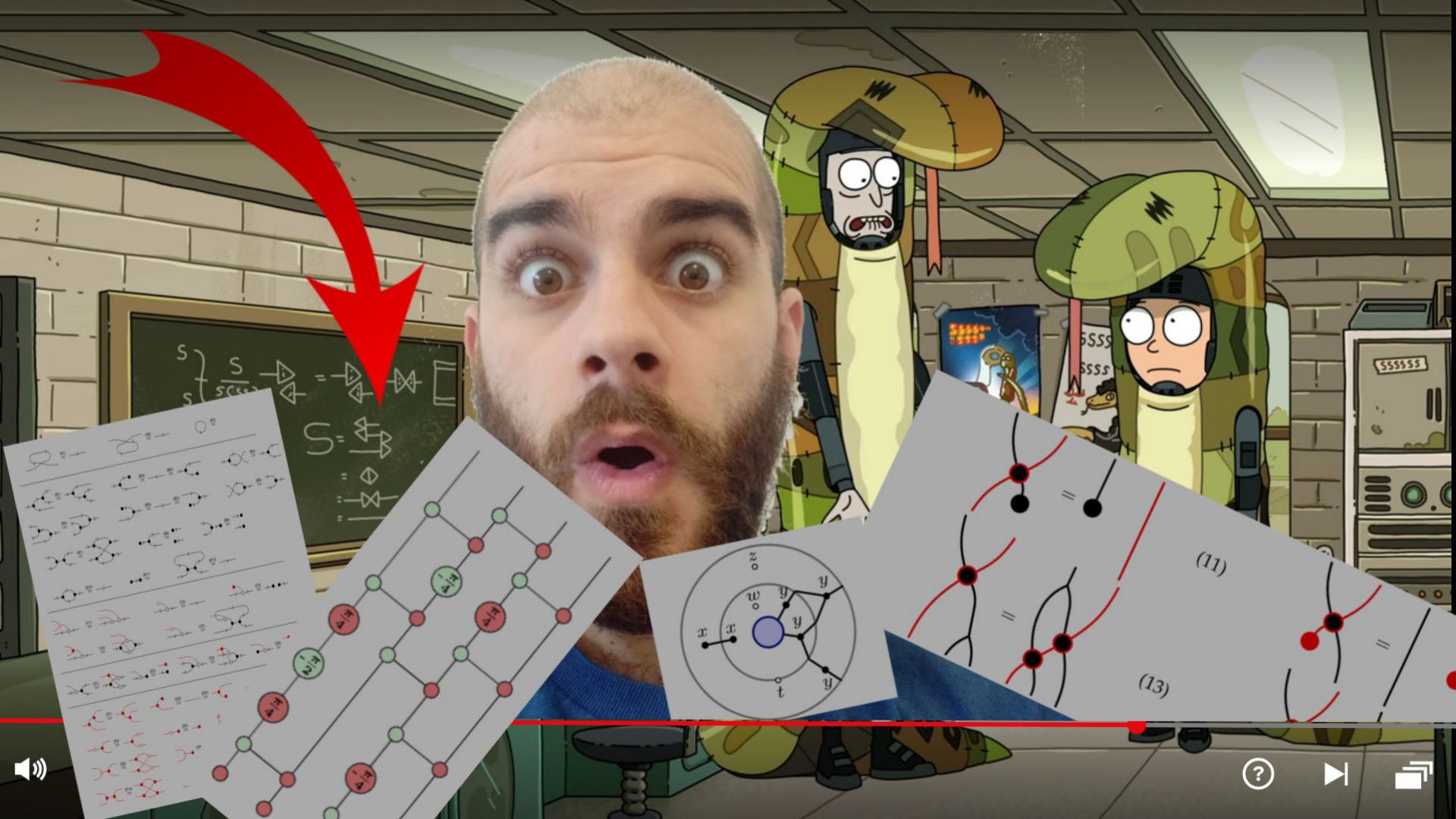
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Abstraction

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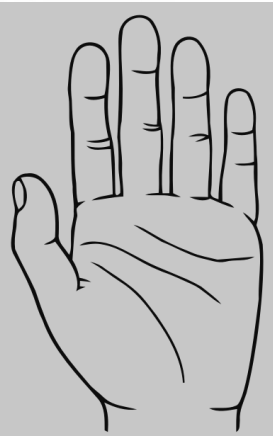

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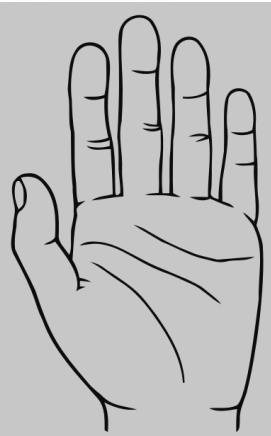

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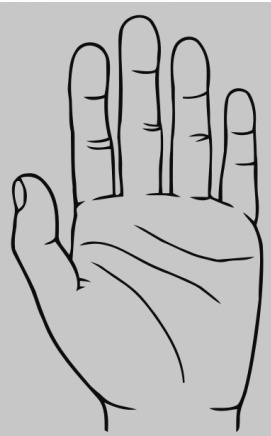

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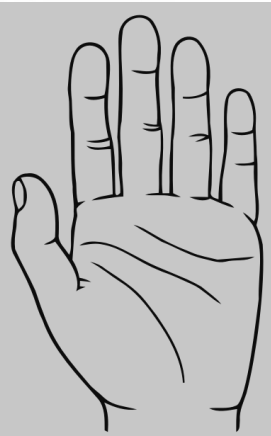

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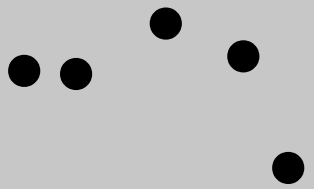
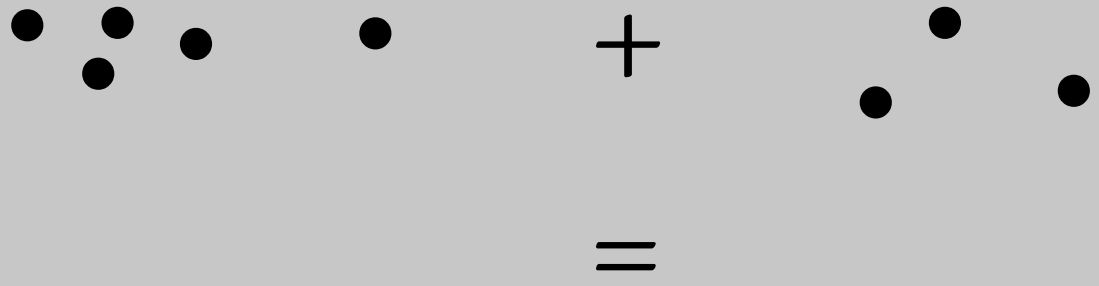
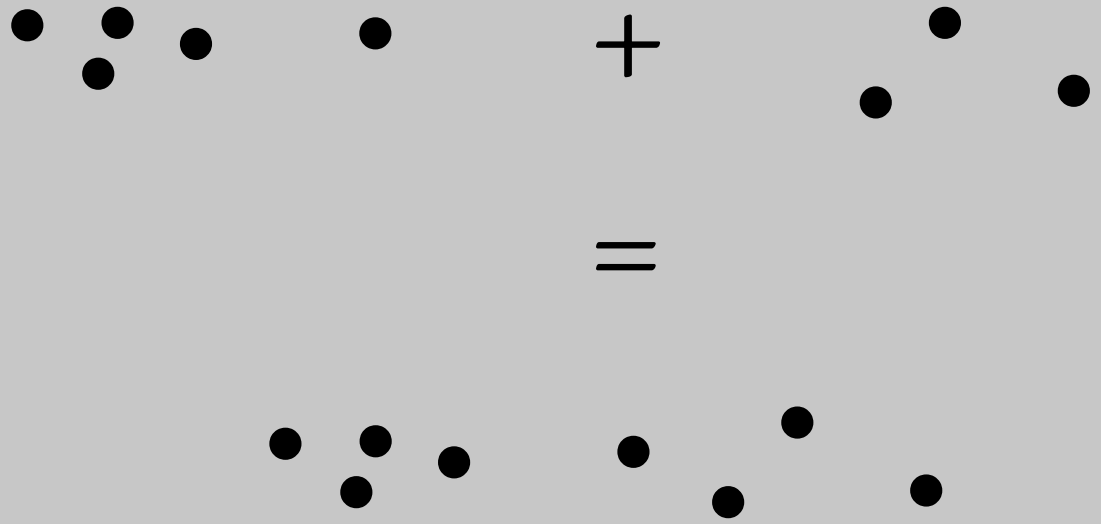


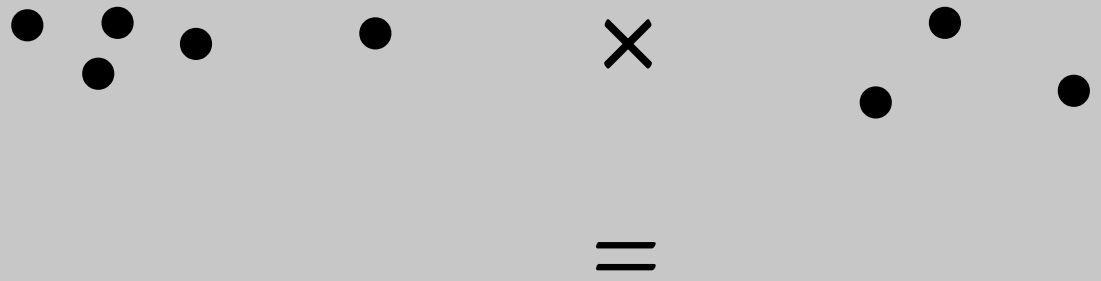
Addition



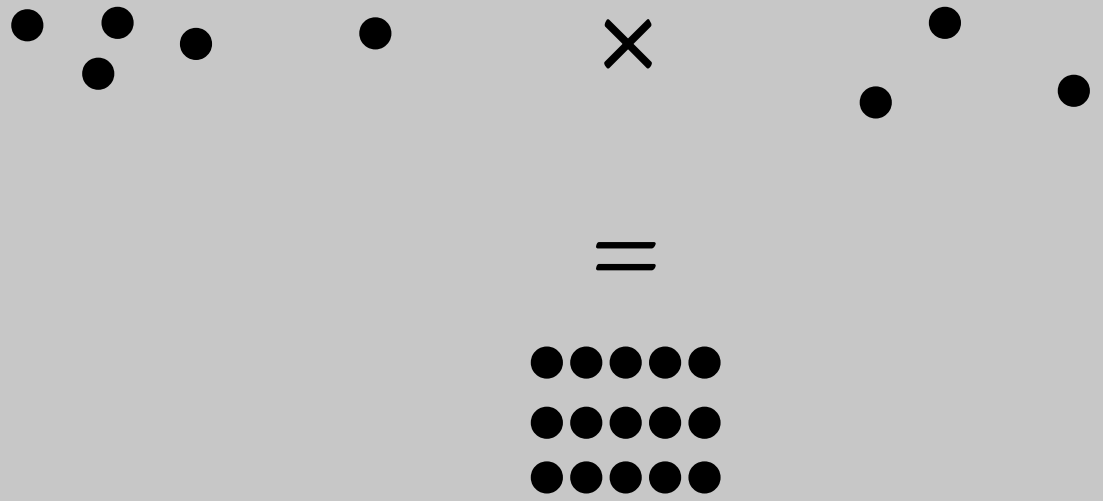
Addition



Multiplication



Multiplication



Rhymes

Rhymes

C'est l'histoire de Loulou Lapierre Une p'tite mère ben ordinaire Qui travaille à temps partiel Comme femme de chambre dans un hôtel	A A B B	
Joyeux calvaire! - Les Cowboys Fringants		

Rhymes

C'est l'histoire de Loulou Lapierre Une p'tite mère ben ordinaire Qui travaille à temps partiel Comme femme de chambre dans un hôtel	A A B B	
Joyeux calvaire! - Les Cowboys Fringants		
ولا في بهالحب مصاري ولا ممكن فيه ليرات ولا ممكن في اراضي ولا فيه مجوهرات	A B A B	
Ziad Rahbani - بلا ولا شي		

Rhymes

C'est l'histoire de Loulou Lapierre Une p'tite mère ben ordinaire Qui travaille à temps partiel Comme femme de chambre dans un hôtel	A A B B	
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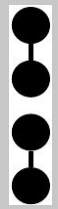
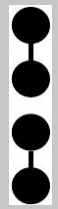
بلا ولا شي - Ziad Rahbani		
There’s something in this sound that takes me far It’s like a special song Can move my mood along But I cannot say you’ll hear through my guitar	A B B A	
It Runs Through Me - Tom Misch		

Rhymes

C'est l'histoire de Loulou Lapierre Une p'tite mère ben ordinaire Qui travaille à temps partiel Comme femme de chambre dans un hôtel	A A B B	
Joyeux calvaire! - Les Cowboys Fringants		
ولا في بهالحب مصاري ولا ممكن فيه ليرات ولا ممكن في اراضي ولا فيه مجوهرات	A B A B	
Ziad Rahbani - بلا ولا شي		
There’s something in this sound that takes me far It’s like a special song Can move my mood along But I cannot say you’ll hear through my guitar	A B B A	
It Runs Through Me - Tom Misch		

Rhymes

C'est l'histoire de Loulou Lapierre Une p'tite mère ben ordinaire Qui travaille à temps partiel Comme femme de chambre dans un hôtel Joyeux calvaire! - Les Cowboys Fringants	A A B B	
ولا في بهالحب مصاري ولا ممكن فيه ليرات ولا ممكن في اراضي ولا فيه مجوهرات Ziad Rahbani - بلا ولا شي	A B A B	
There’s something in this sound that takes me far It’s like a special song Can move my mood along But I cannot say you’ll hear through my guitar It Runs Through Me - Tom Misch	A B B A	

Rhymes

C'est l'histoire de Loulou Lapierre Une p'tite mère ben ordinaire Qui travaille à temps partiel Comme femme de chambre dans un hôtel	A A B B	
Joyeux calvaire! - Les Cowboys Fringants		
ولا في بهالحب مصاري ولا ممكن فيه ليرات ولا ممكن في اراضي ولا فيه مجوهرات	A B A B	
Ziad Rahbani - بلا ولا شي		
There’s something in this sound that takes me far It’s like a special song Can move my mood along But I cannot say you’ll hear through my guitar	A B B A	
It Runs Through Me - Tom Misch		

Story time

TW: category theory!

Theorem: A distributive law between two monads induces a composite monad structure.

Theorem: A distributive law between two monads induces a composite monad structure.

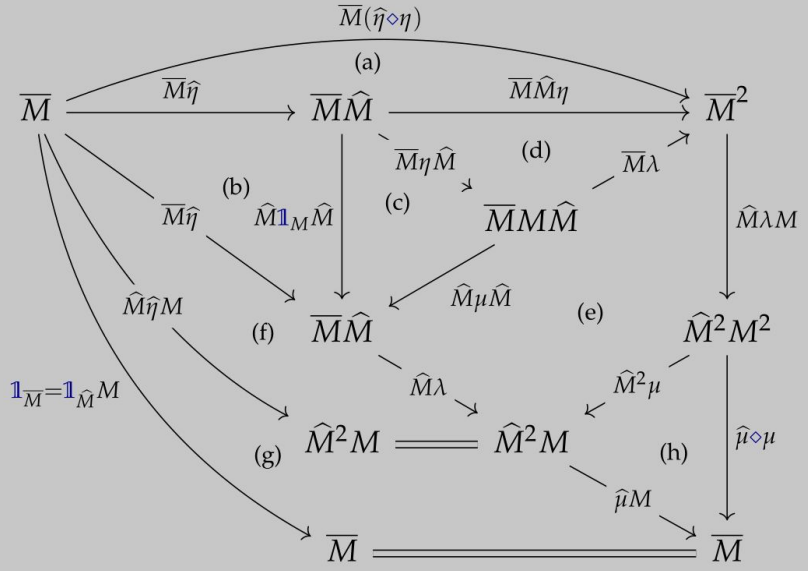
$$(\widehat{\mu} \diamond \mu) \circ \widehat{M}\lambda M \circ \overline{M}(\widehat{\eta} \diamond \eta) = \mathbb{1}_{\overline{M}} \qquad (\widehat{\mu} \diamond \mu) \circ \widehat{M}\lambda M \circ (\widehat{\eta} \diamond \eta)\overline{M} = \mathbb{1}_{\overline{M}}$$

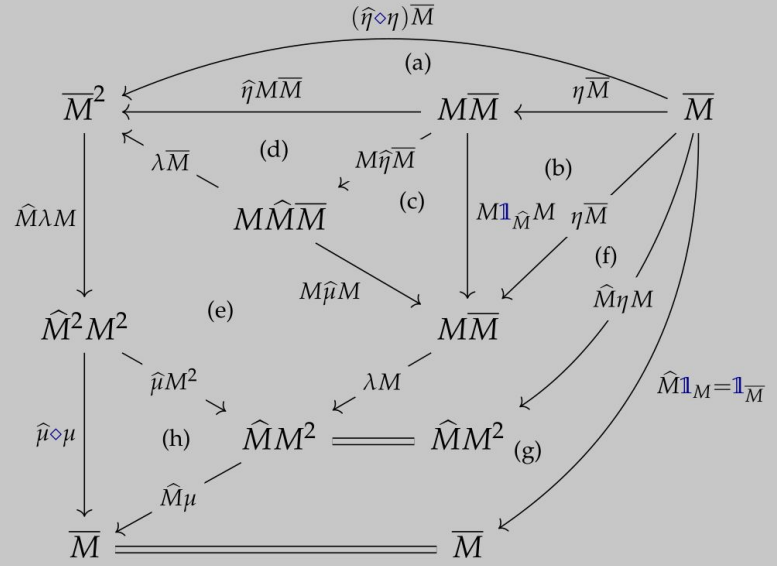
$$(\widehat{\mu} \diamond \mu) \circ \widehat{M}\lambda M \circ (\widehat{\mu} \diamond \mu)\overline{M} \circ \widehat{M}\lambda M\overline{M} = (\widehat{\mu} \diamond \mu) \circ \widehat{M}\lambda M \circ \overline{M}(\widehat{\mu} \diamond \mu) \circ \overline{M}\widehat{M}\lambda M$$

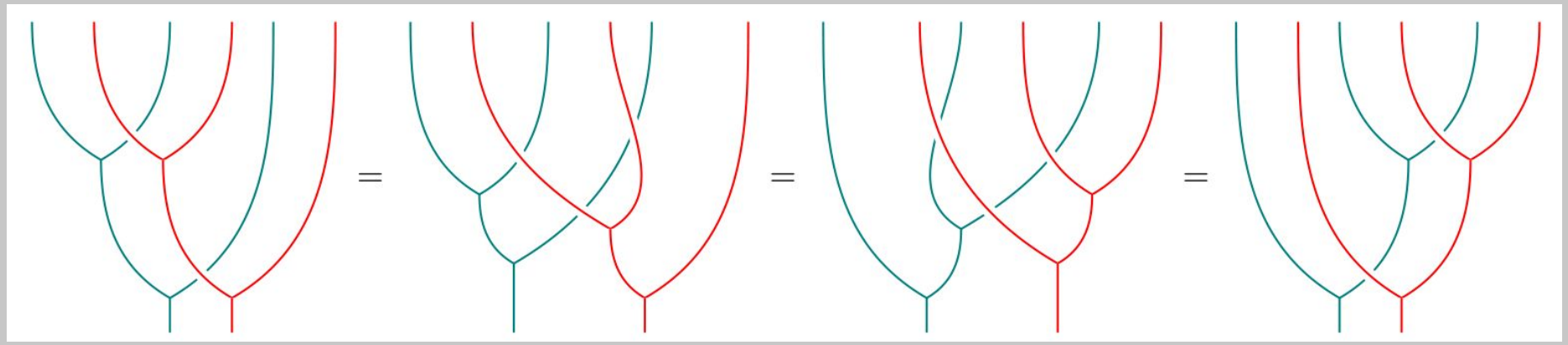
Theorem: A distributive law between two monads induces a composite monad structure.

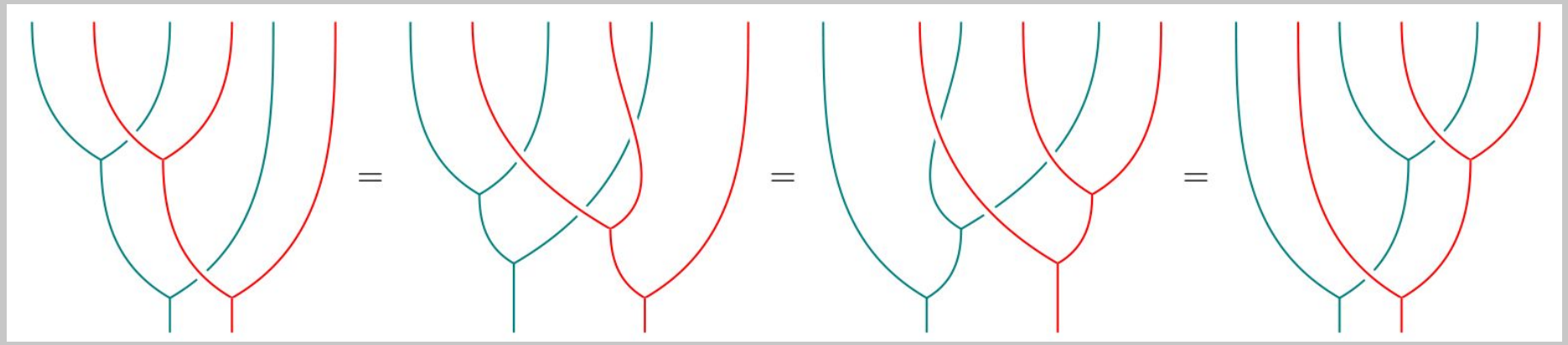
$$(\widehat{\mu} \diamond \mu) \circ \widehat{M}\lambda M \circ \overline{M}(\widehat{\eta} \diamond \eta) = \mathbb{1}_{\overline{M}}$$

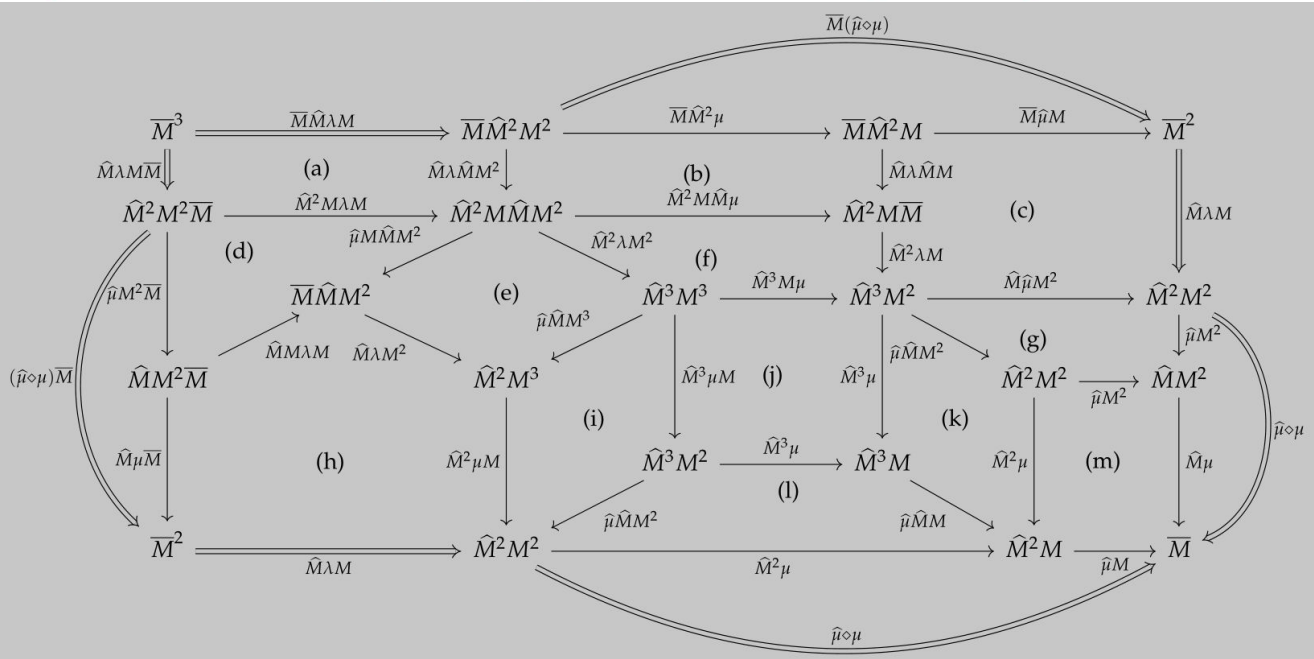
$$(\widehat{\mu} \diamond \mu) \circ \widehat{M}\lambda M \circ (\widehat{\eta} \diamond \eta)\overline{M} = \mathbb{1}_{\overline{M}}$$







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$\widehat{M}^3M$
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$\overline{M}\widehat{M}^2\mu$
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$\widehat{M}\lambda M\overline{M}$
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$\widehat{M}\lambda\widehat{M}M$
$\widehat{M}\lambda M$
$\widehat{M}^2M\lambda M$
$\widehat{M}^2M\widehat{M}\mu$
$\widehat{\mu}M\widehat{M}M^2$
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$\widehat{M}^2\lambda M$
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$\widehat{\mu}\widehat{M}M^3$
$\widehat{\mu}M^2$
$(\widehat{\mu}\diamond\mu)\overline{M}$
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$\widehat{M}\lambda M^2$
$\widehat{M}^3M$
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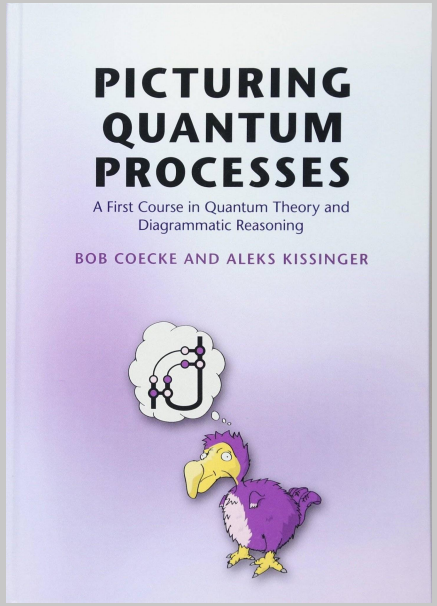
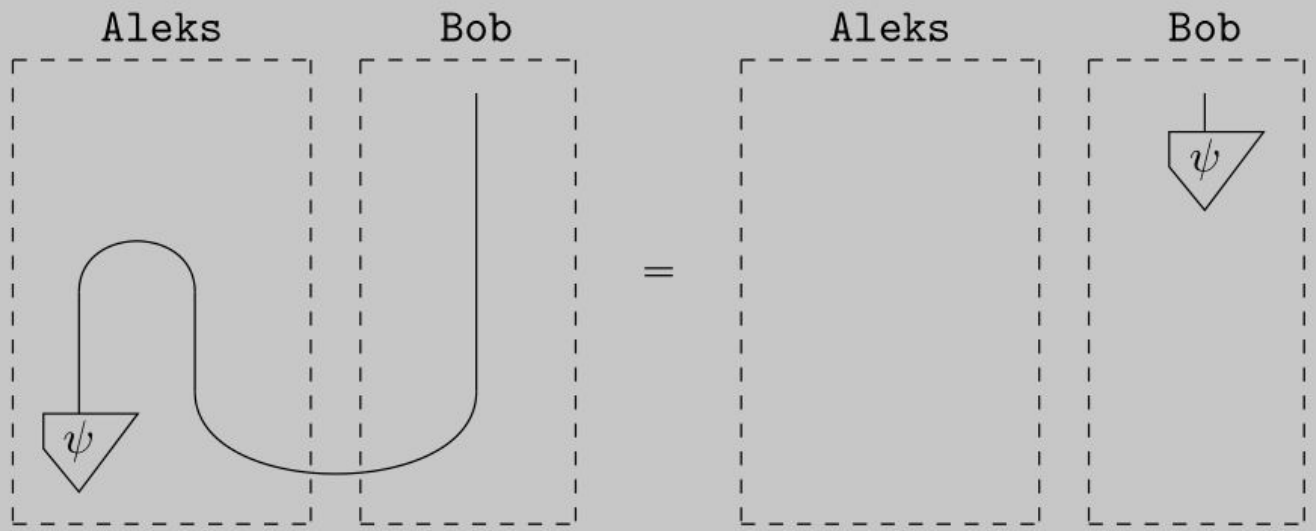
Examples

Quantum Processes



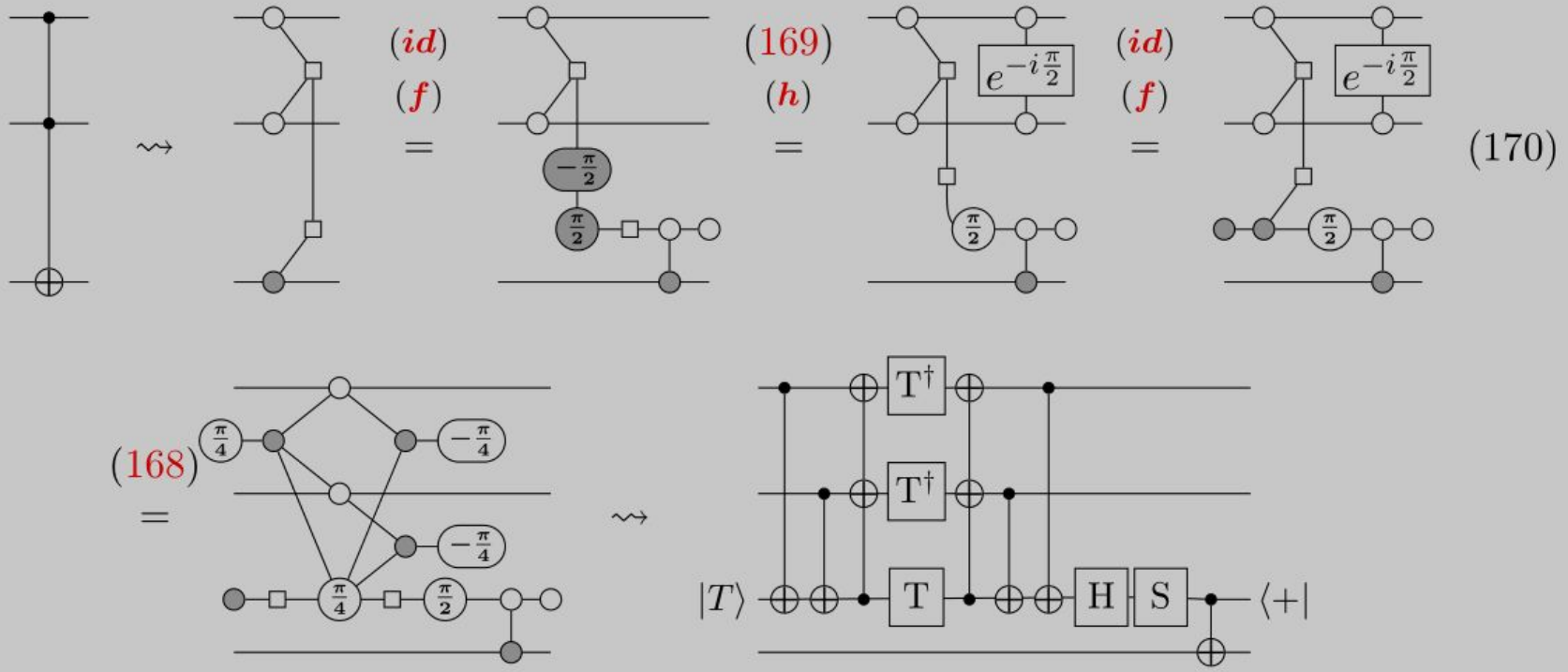
Quantum Teleportation



Links: paper, book, quantum NLP, graphical linear algebra

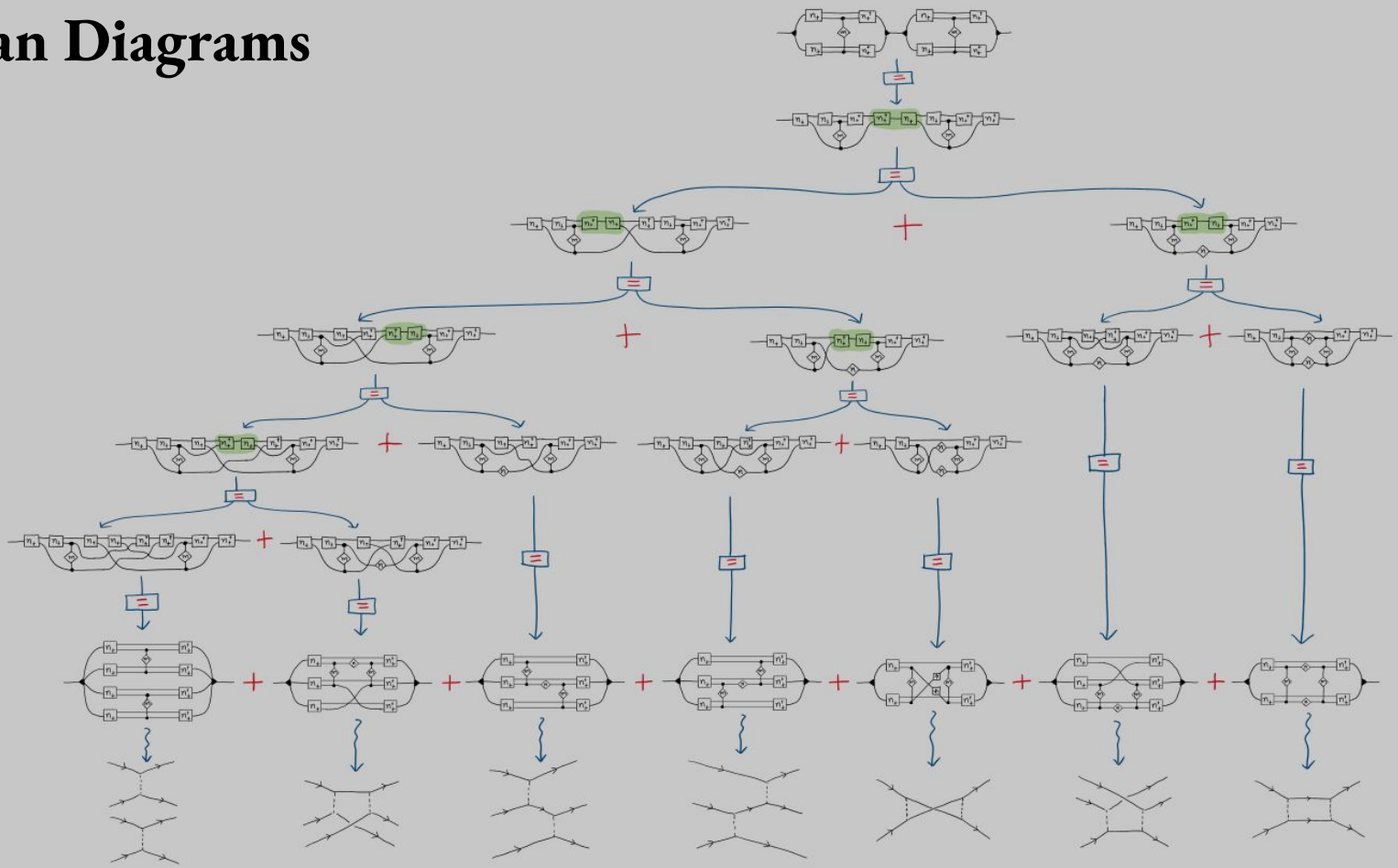
Quantum Circuits

We can now rewrite the Toffoli gate to a more efficient construction:



Links: paper, community, Julia implementation, Python implementation

Feynman Diagrams



Links: paper

Figure 1. Composition of categorical Feynman diagrams, cf. Section 4.4.

Game Theory

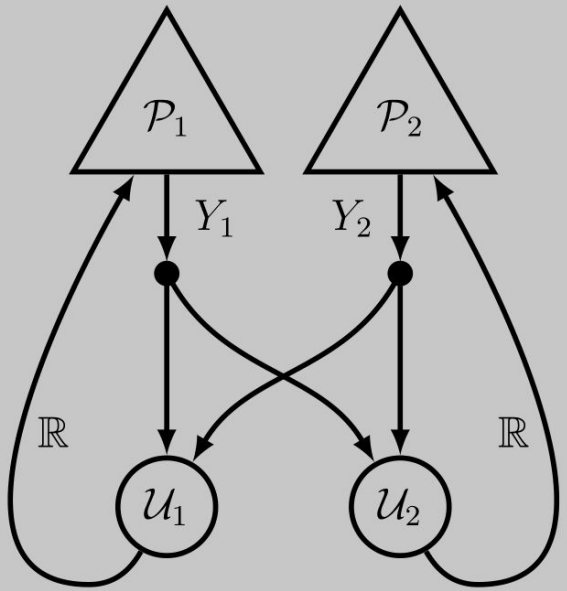


Figure 26: Bimatrix Game

Links: paper, paper (games on graphs)

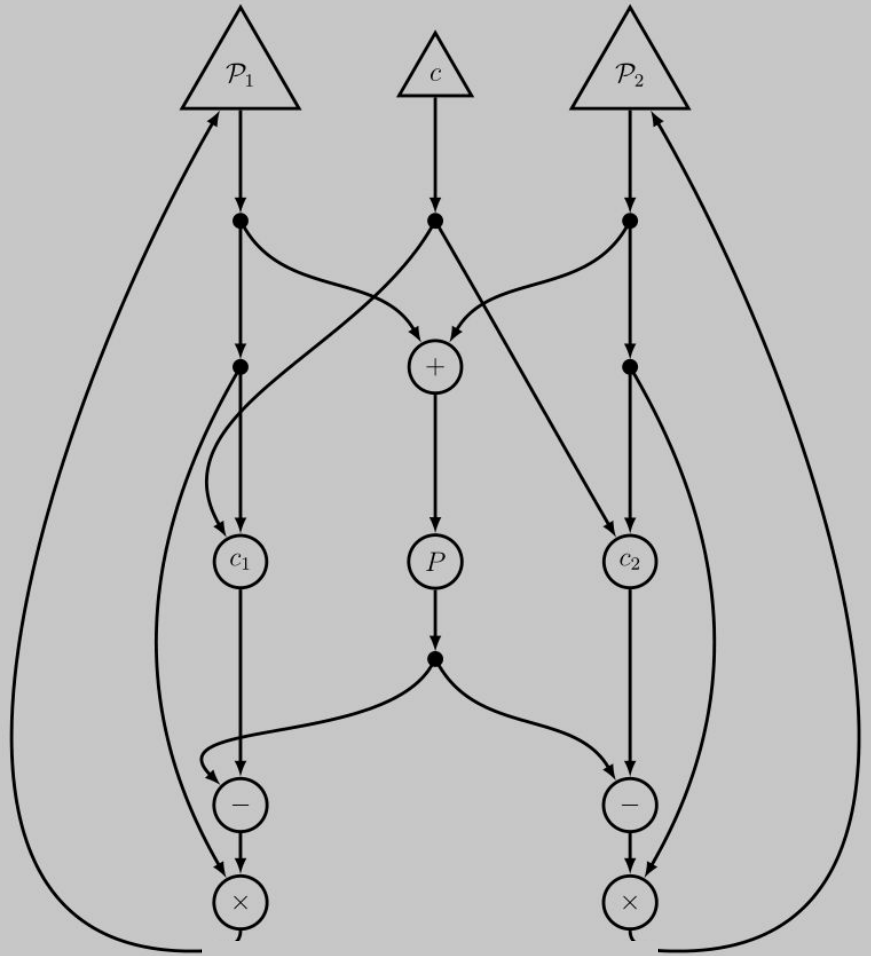
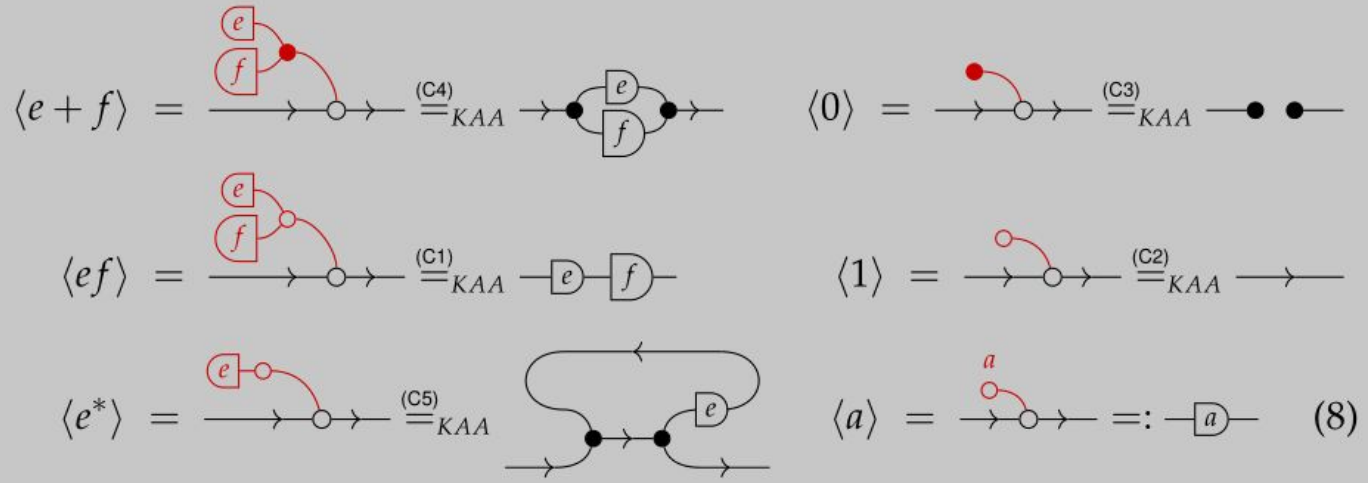
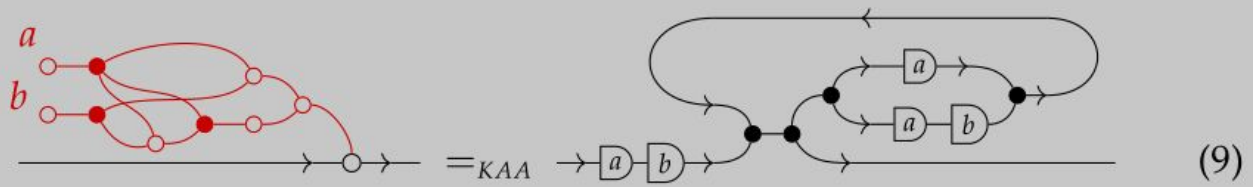


Figure 30: Cournot Duopoly

Automata



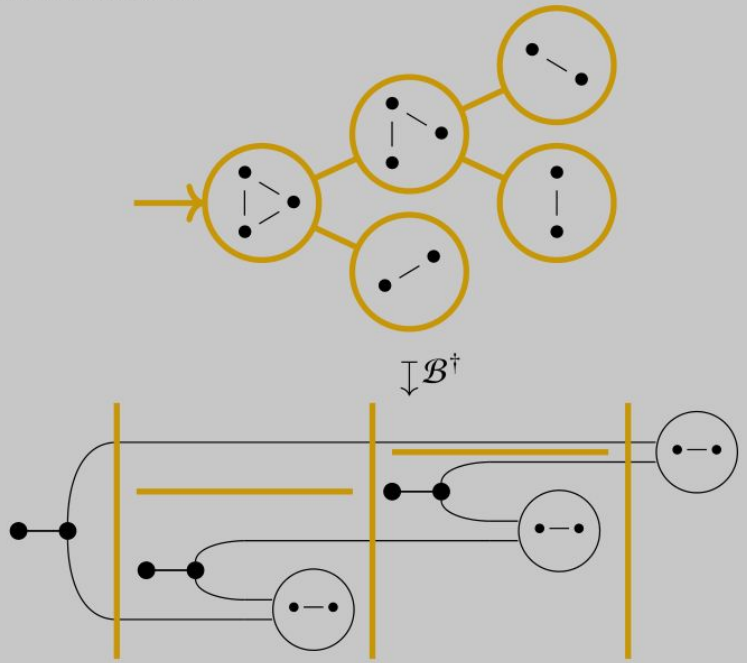
For example, $\langle ab(a+ab)^* \rangle$ =



Links: [paper](), [paper (probabilistic automata)]()

Monoidal Width

Example 5.16. *The 3-clique has a branch decomposition as shown on the top. The corresponding monoidal decomposition is shown below it.*



Theorems

$$\mathsf{twd}(G) \leq \mathsf{mtwd}(g) \leq 2 \cdot \mathsf{twd}(G)$$

$$\tfrac{1}{2} \cdot \mathsf{bwd}(G) \leq \mathsf{mwd}(g) \leq \mathsf{bwd}(G) + 1$$

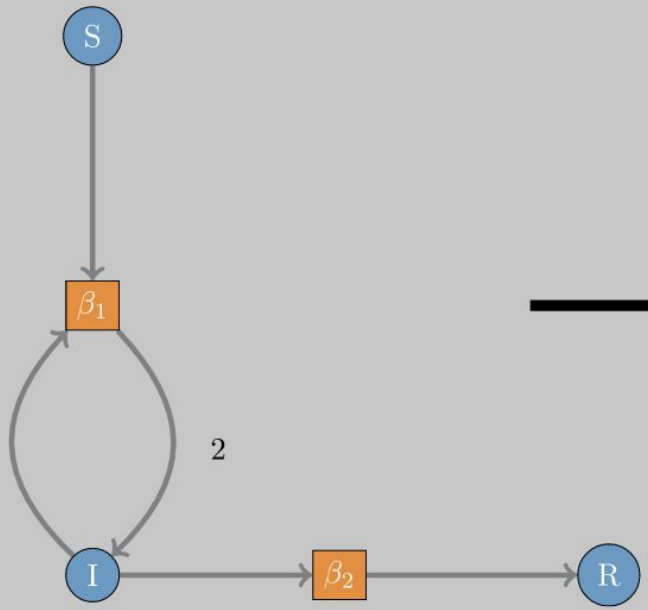
$$\mathsf{pwd}(G) = \mathsf{mpwd}(g)$$

Links: paper, 2nd paper

Scientific Modelling

Petri

Dynam



F

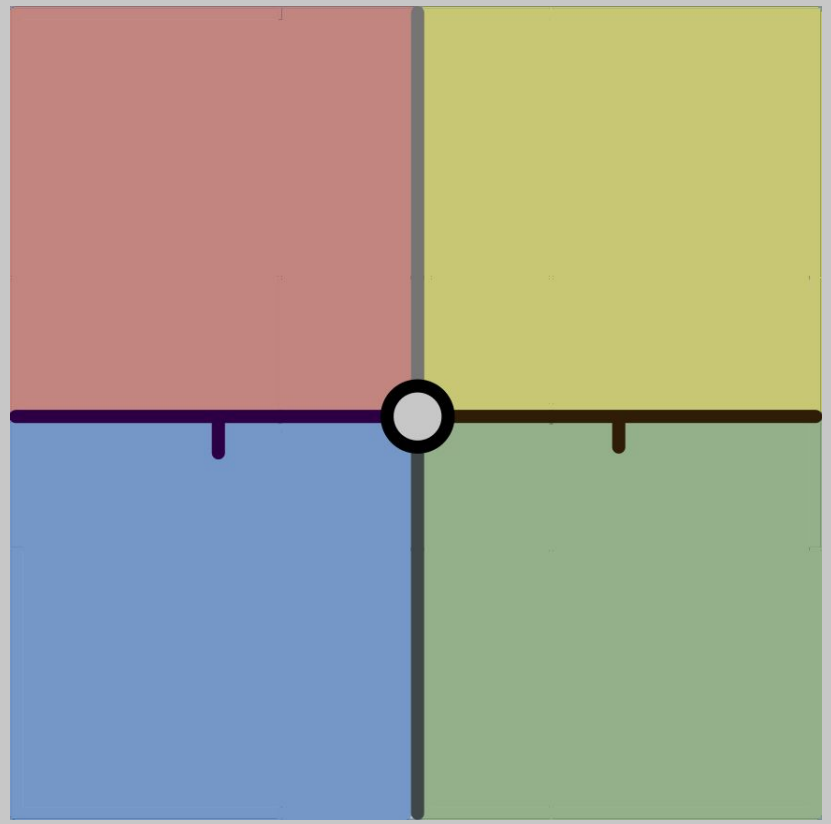
$$\dot{S} = \beta_1 SI$$

$$\dot{I} = \beta_1 SI - \beta_2 I$$

$$\dot{R} = \beta_2 I$$

Links: paper, blogpost, AlgebraicJulia

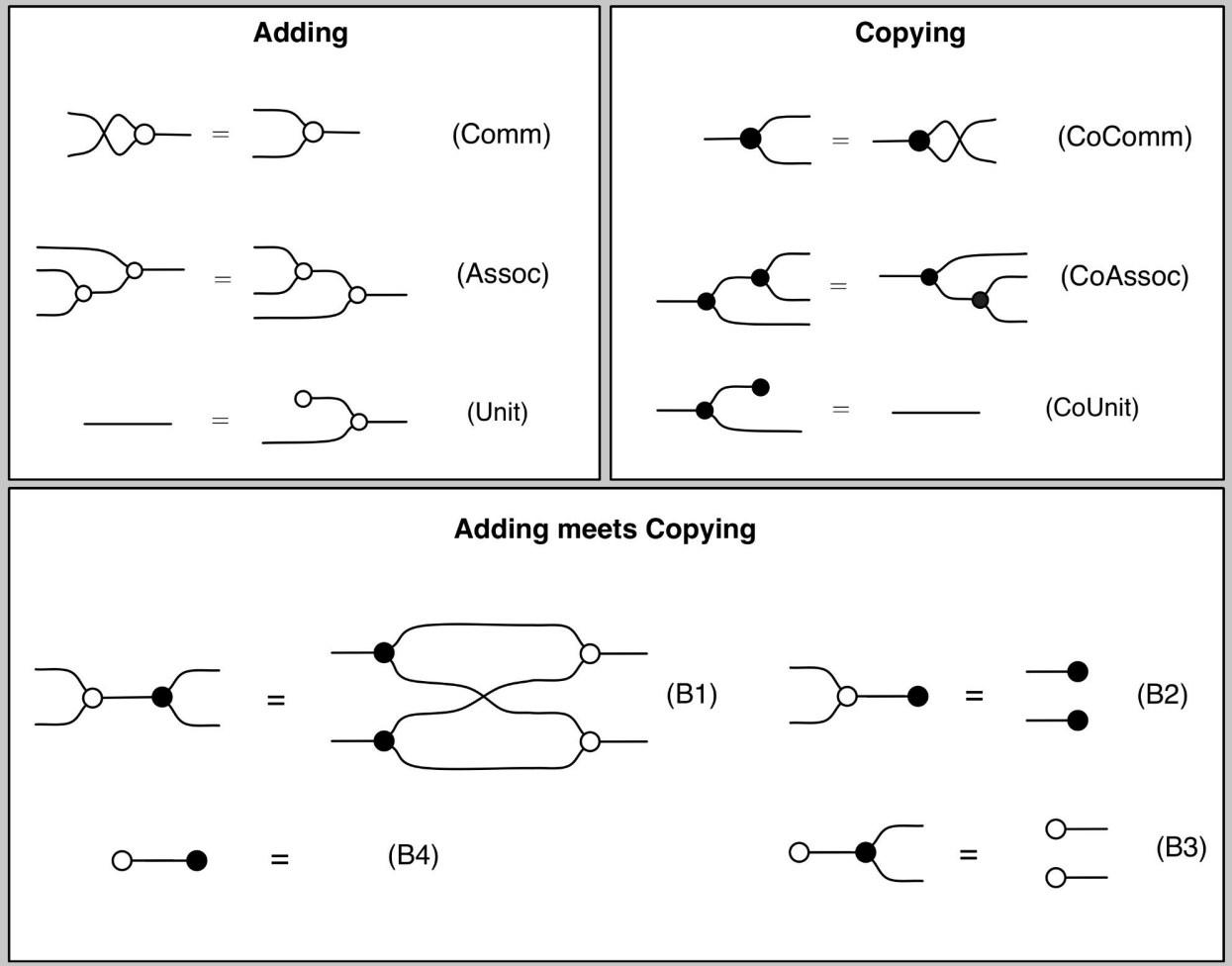
Logic in Color



$$\frac{a\ R\ b}{f(a)\ S\ g(b)}$$

Links: [présentation vidéo](), [paper](), [Christian Williams]()

Demo !


Adding
(Comm)
(Assoc)
(Unit)
Copying
(CoComm)
(CoAssoc)
(CoUnit)
Adding meets Copying
(B1)
(B2)
(B4)
(B3)

Source: GLA

Merci !