

La Máquina Universal de Turing

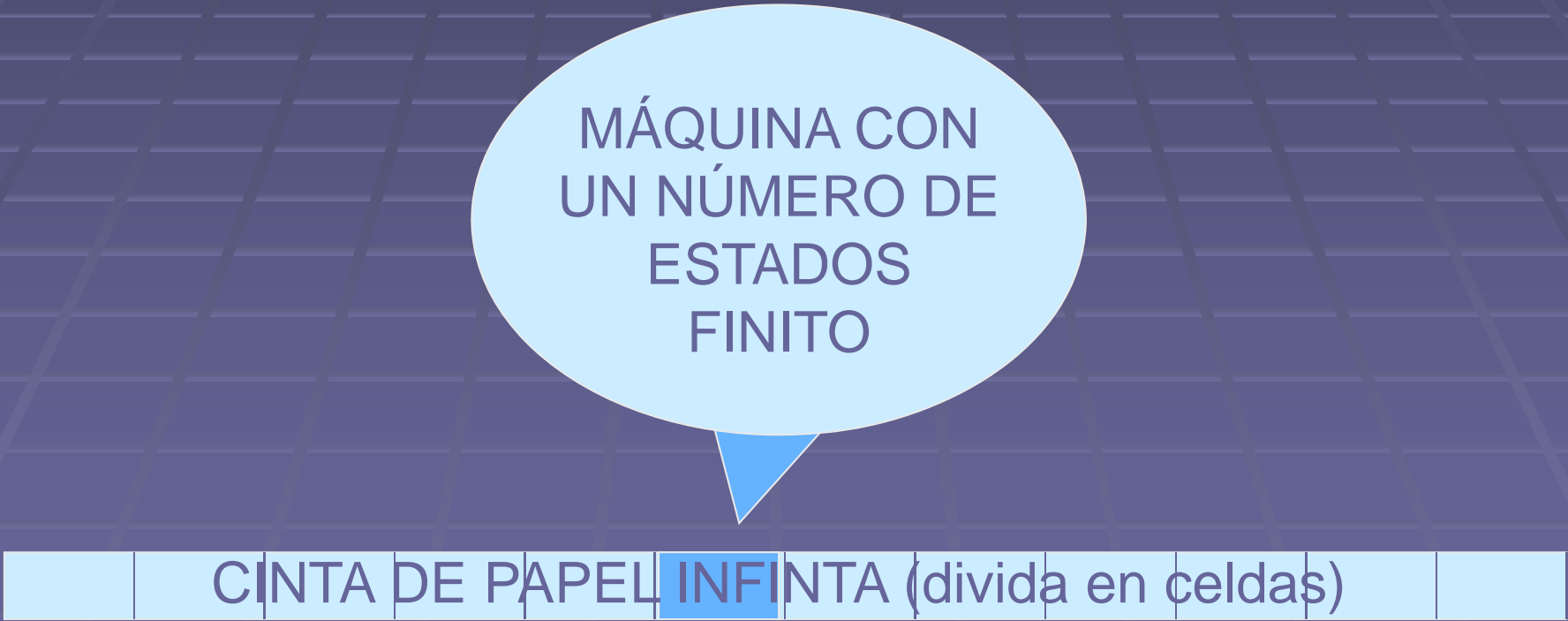
Roberto Freijo Herraiz
Alfonso de Lucas David

La máquina de Turing Universal (I)

- *“...encontrar un procedimiento efectivo para hacer un problema es equivalente a encontrar una máquina de Turing que lo resuelva...”*
- ¿Existe alguna ‘SuperMáquina’ que nos pueda resolver todos los problemas?

La máquina de Turing Universal (II)

- Una máquina de Turing cualquiera:

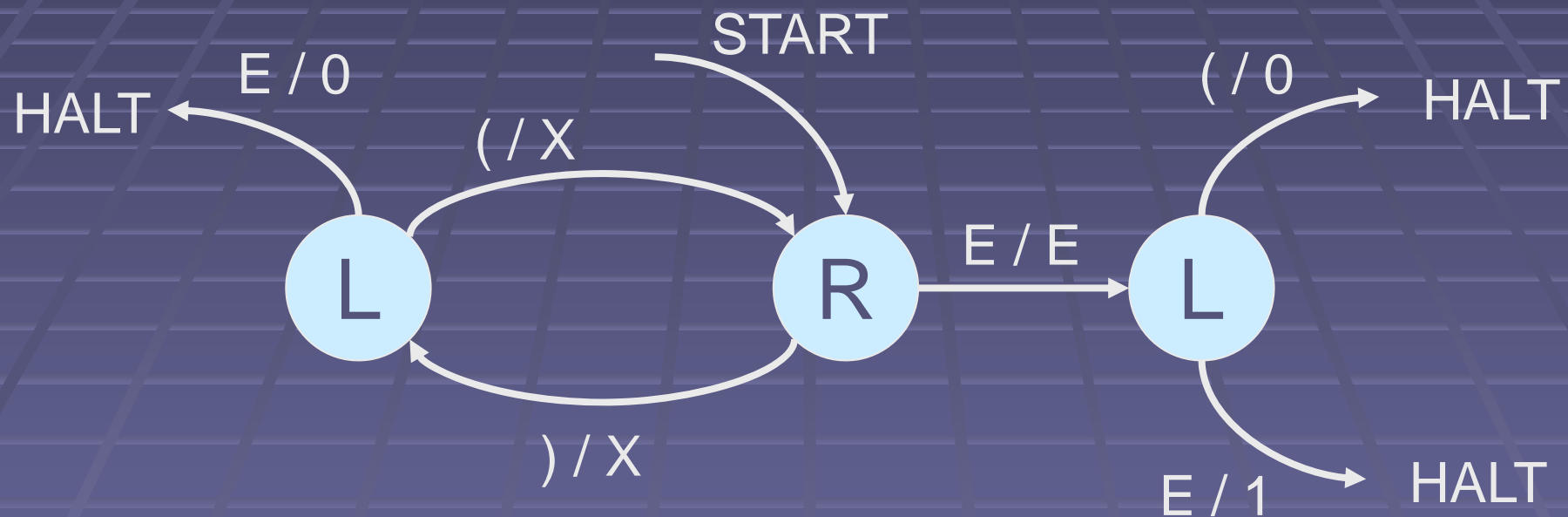


MÁQUINA CON
UN NÚMERO DE
ESTADOS
FINITO

The diagram illustrates the components of a Turing Machine. A light blue speech bubble with a dark blue border contains the text 'MÁQUINA CON UN NÚMERO DE ESTADOS FINITO'. A blue triangular pointer extends from the bottom of the bubble to a horizontal bar representing the tape. The bar is divided into segments by vertical lines. The text 'CINTA DE PAPEL INFINTA (divida en celdas)' is written across the bar, with the word 'INFINTA' highlighted in a darker blue segment.

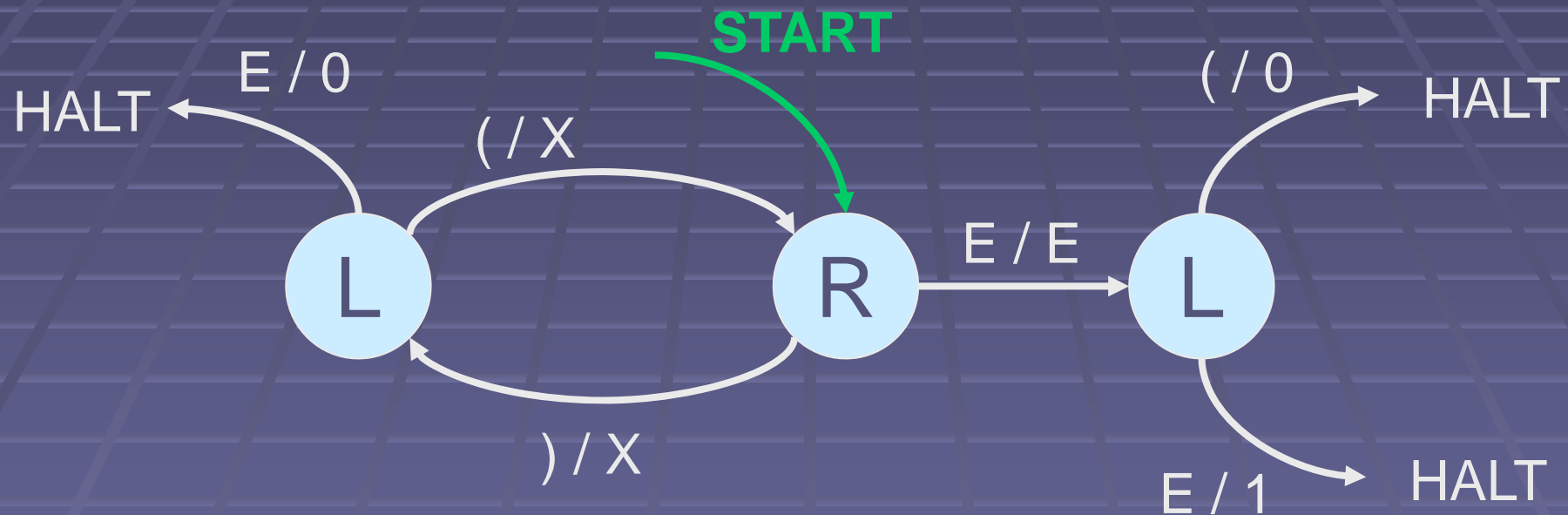
CINTA DE PAPEL INFINTA (divida en celdas)

Comprobador de Paréntesis



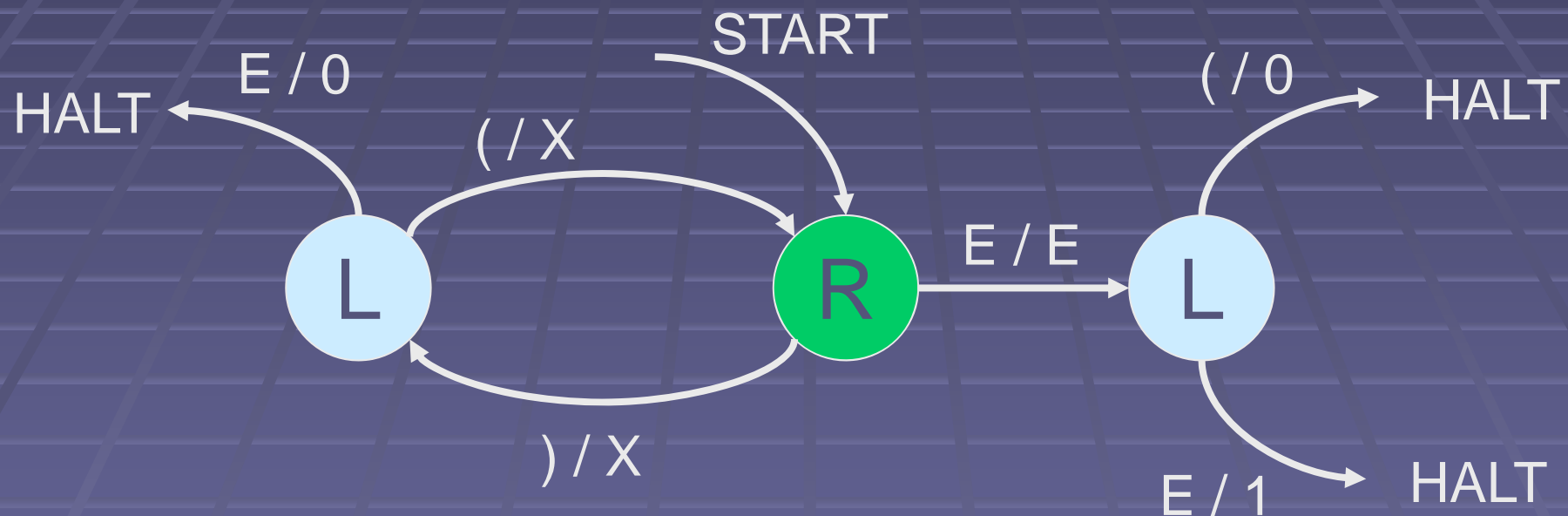
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Comprobador de Paréntesis

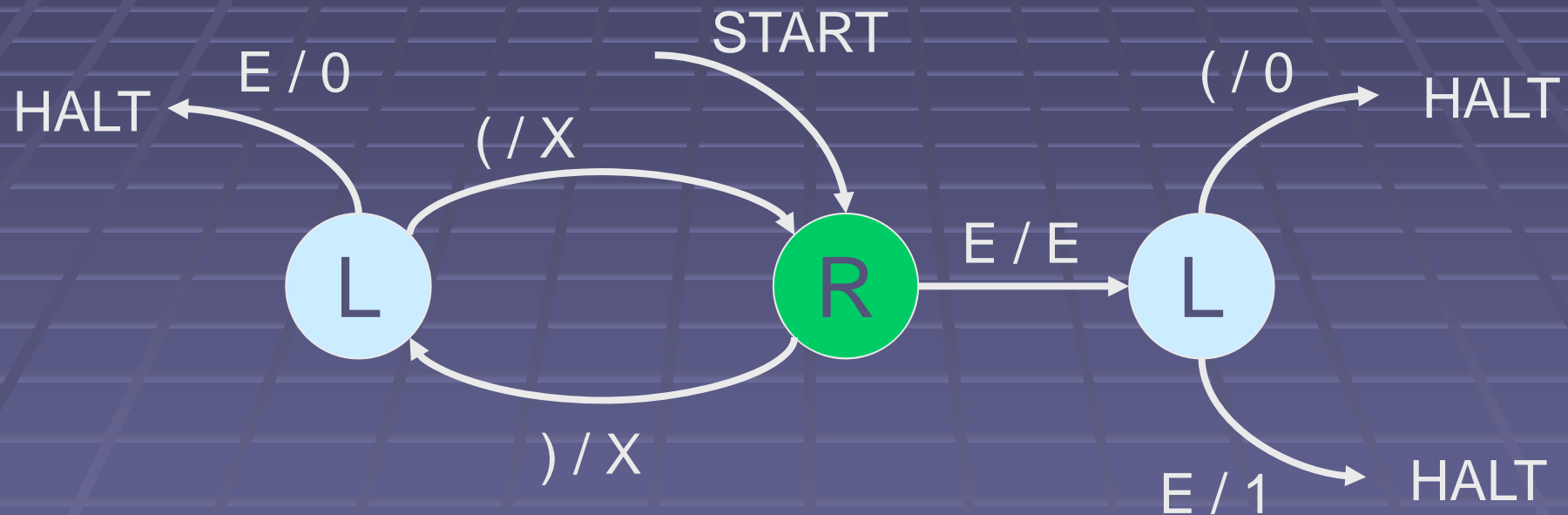


E	(())	()	(()))	(()	E
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Comprobador de Paréntesis

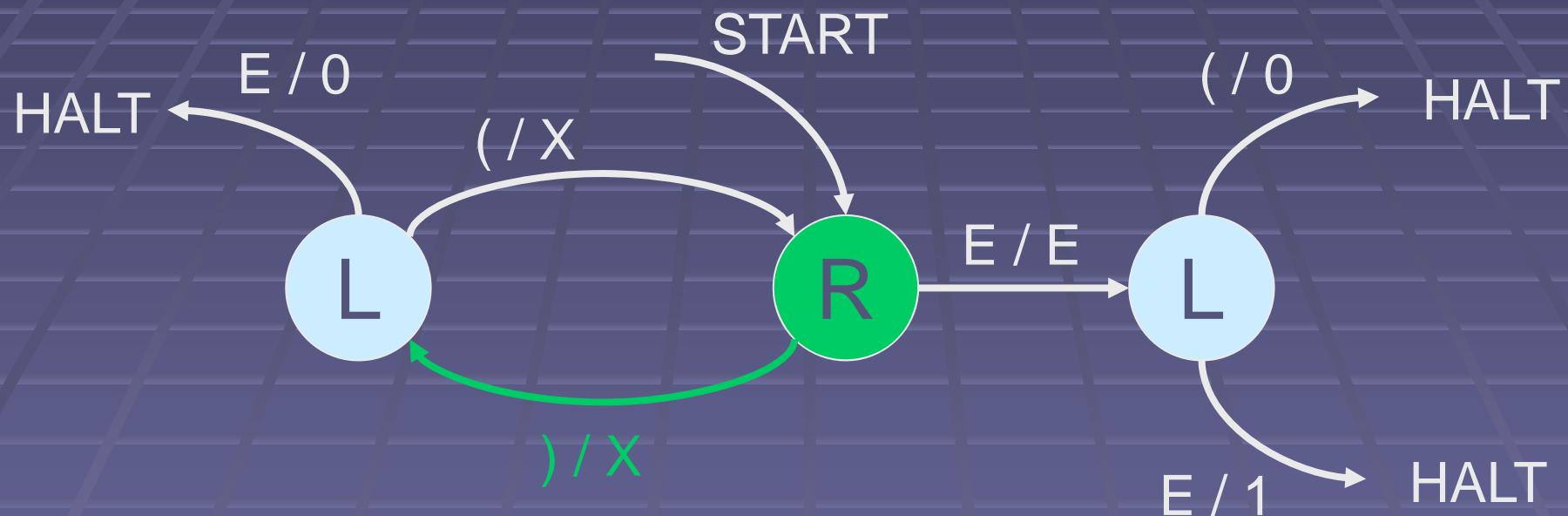


Comprobador de Paréntesis



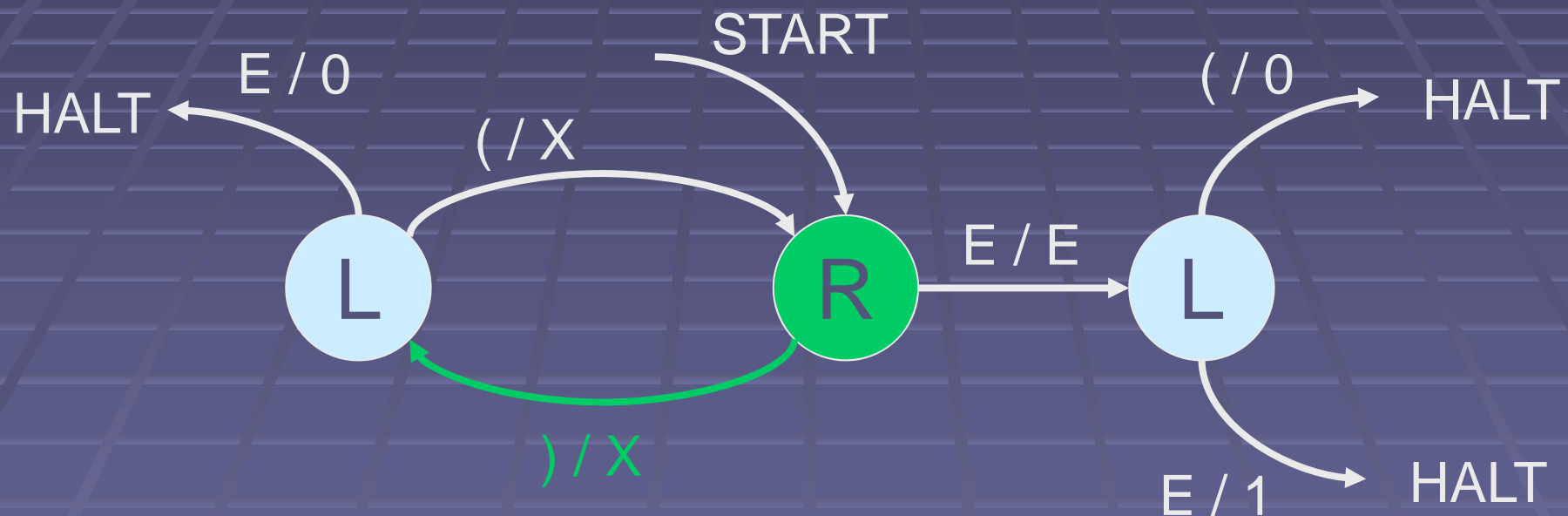
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Comprobador de Paréntesis

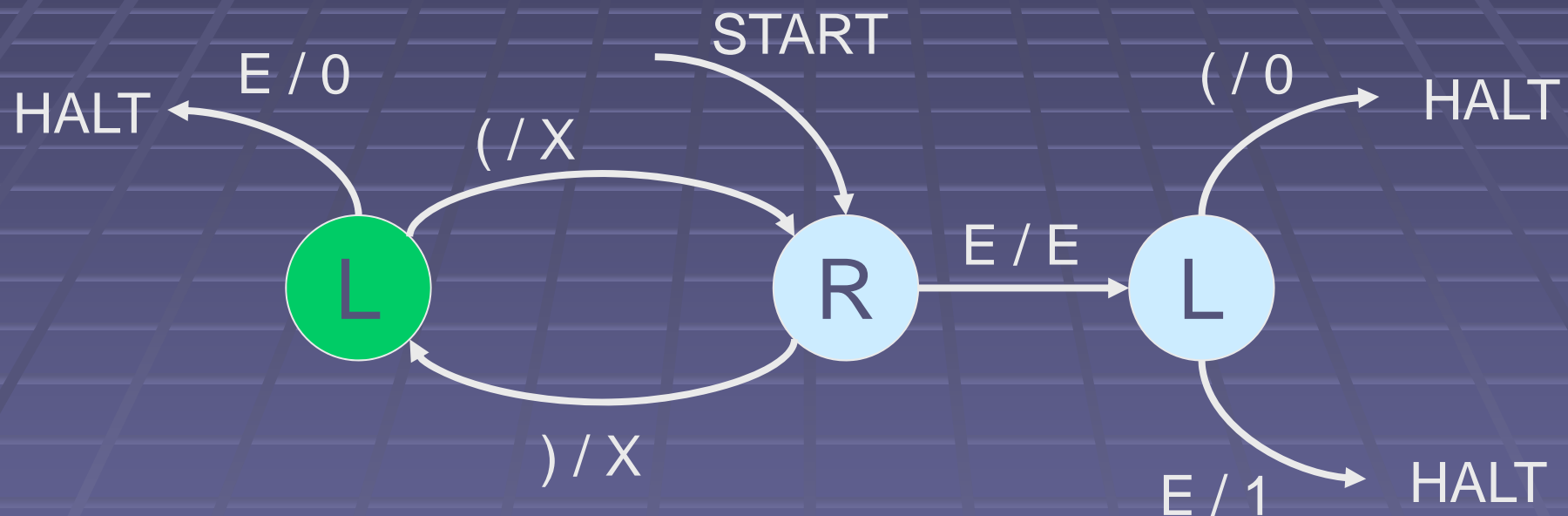


E	(())	()	(()))	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Comprobador de Paréntesis

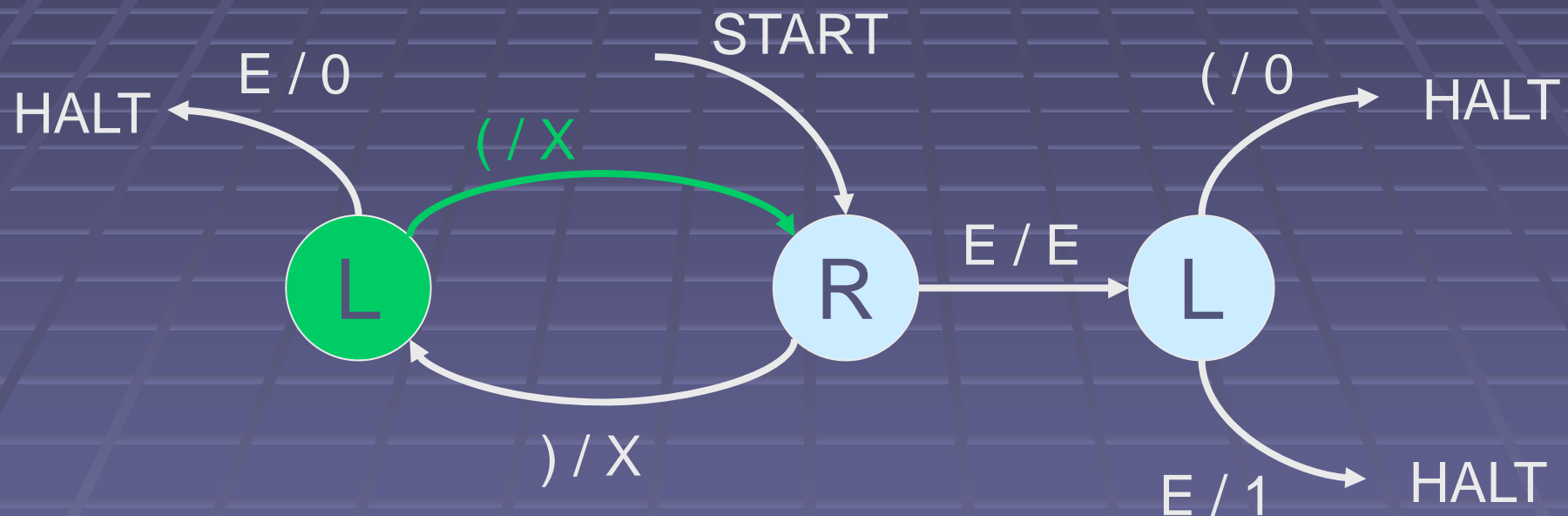


Comprobador de Paréntesis

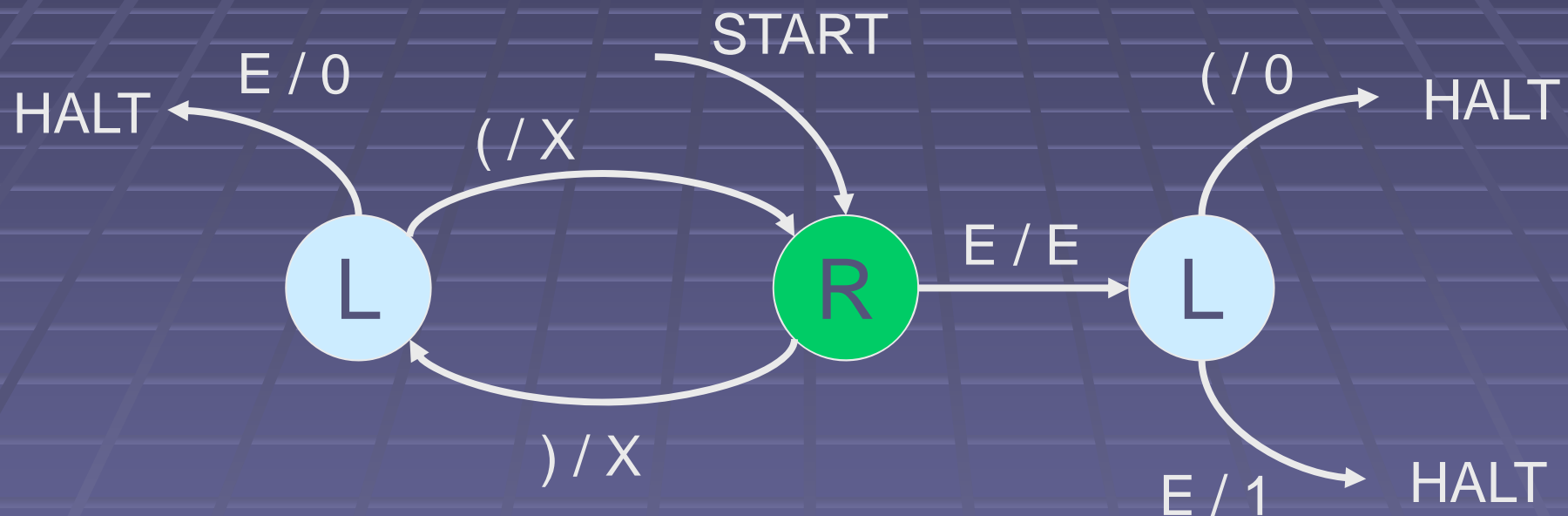


E	((X)	()	(()))	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

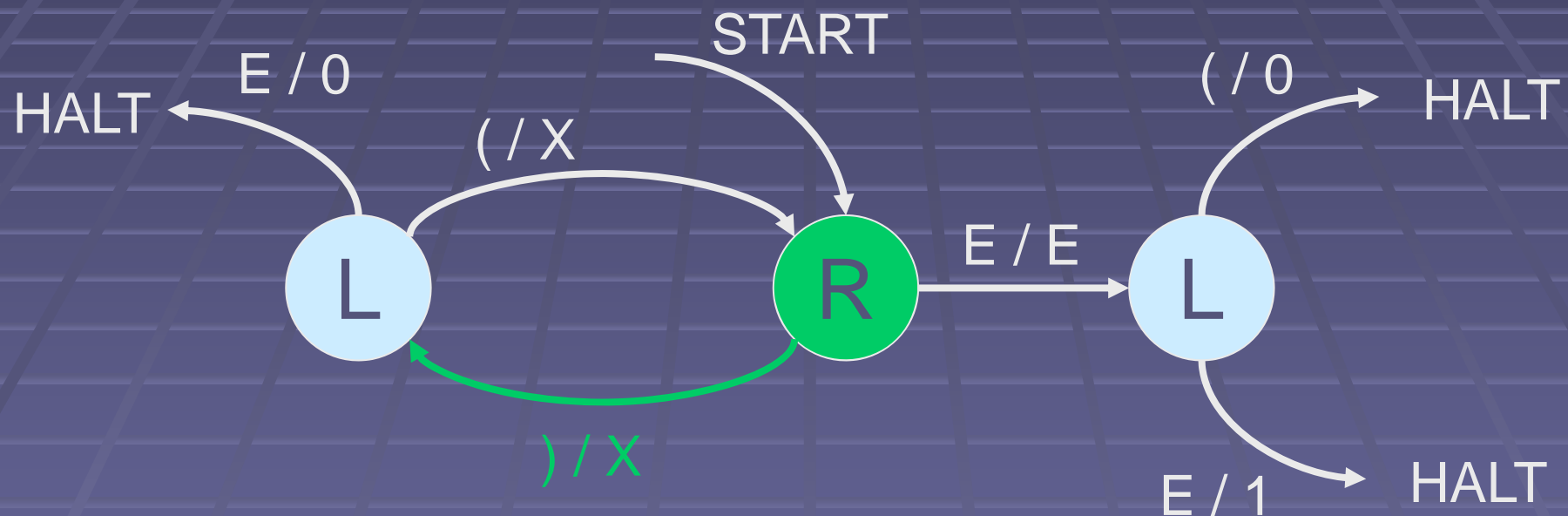
Comprobador de Paréntesis



Comprobador de Paréntesis

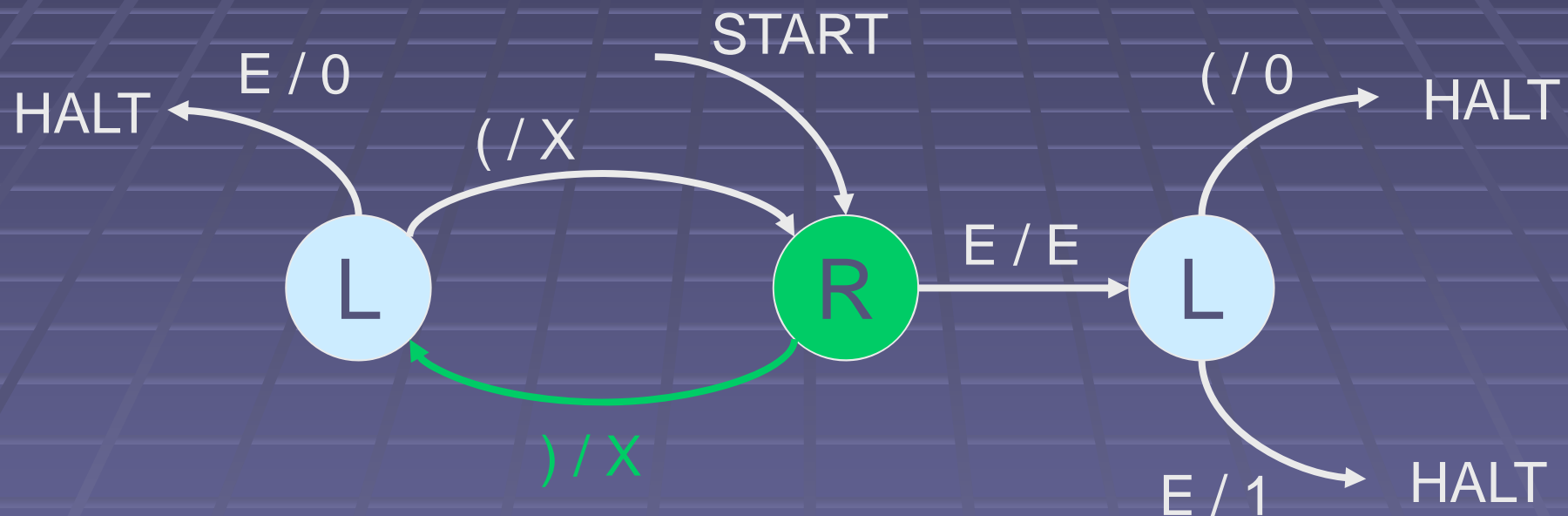


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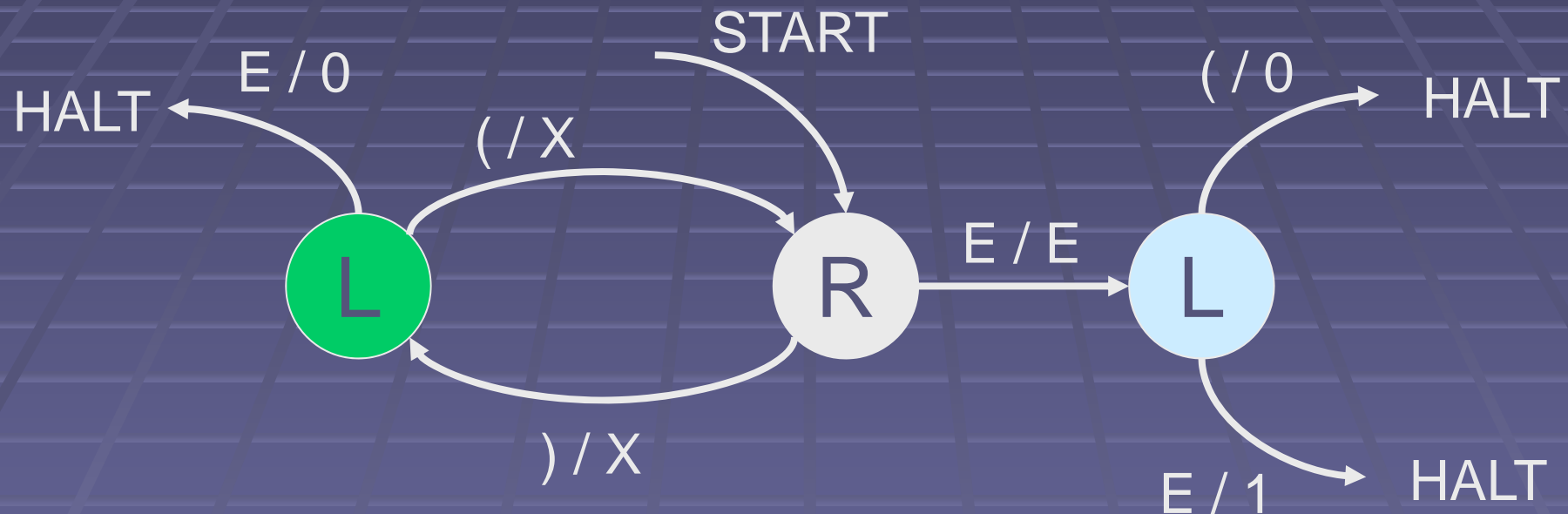
E	(X	X)	()	(()))	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Comprobador de Paréntesis

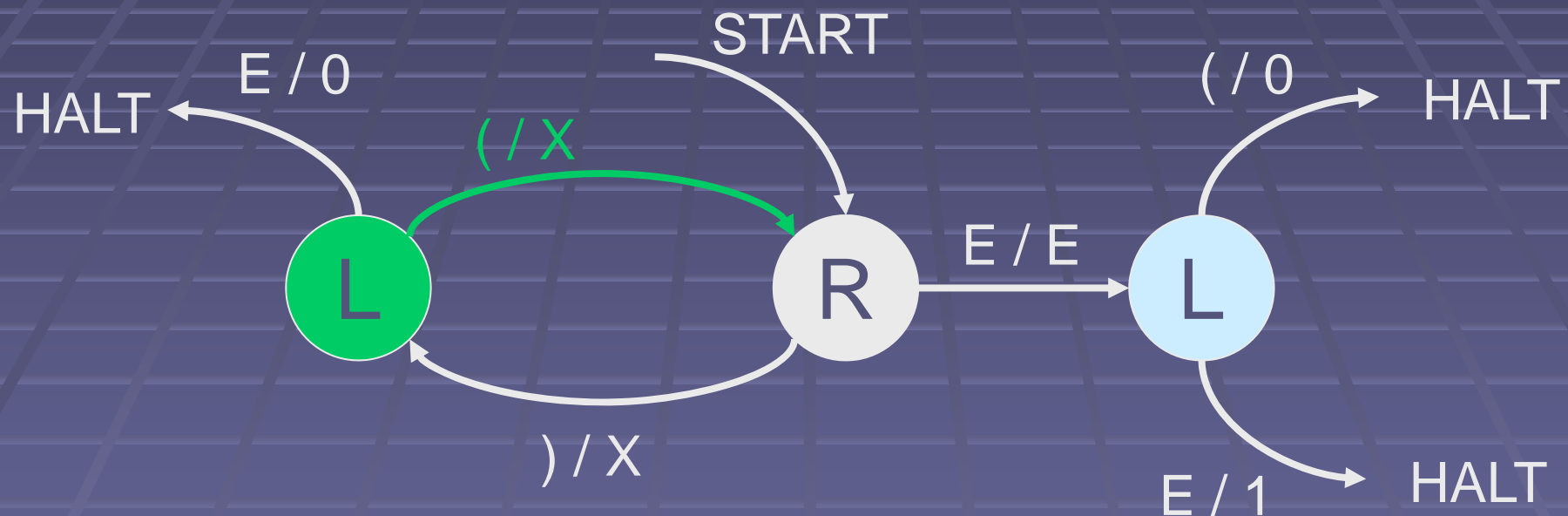


E	(X	X	X	()	(()))	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

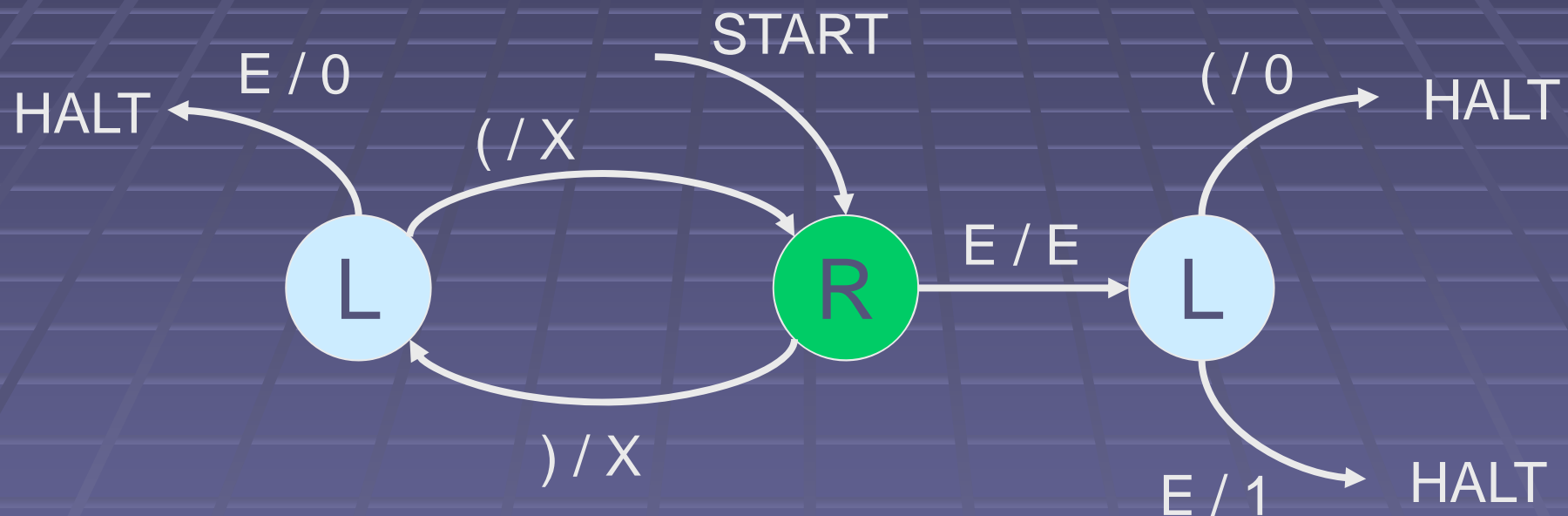
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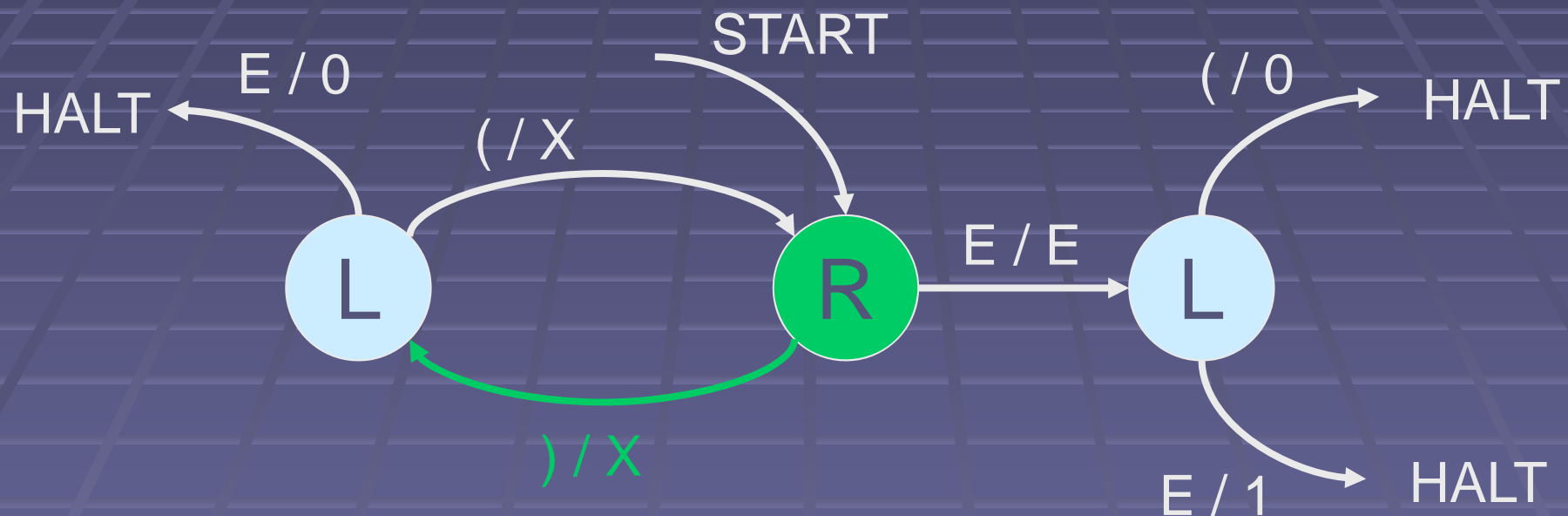
Comprobador de Paréntesis



Comprobador de Paréntesis

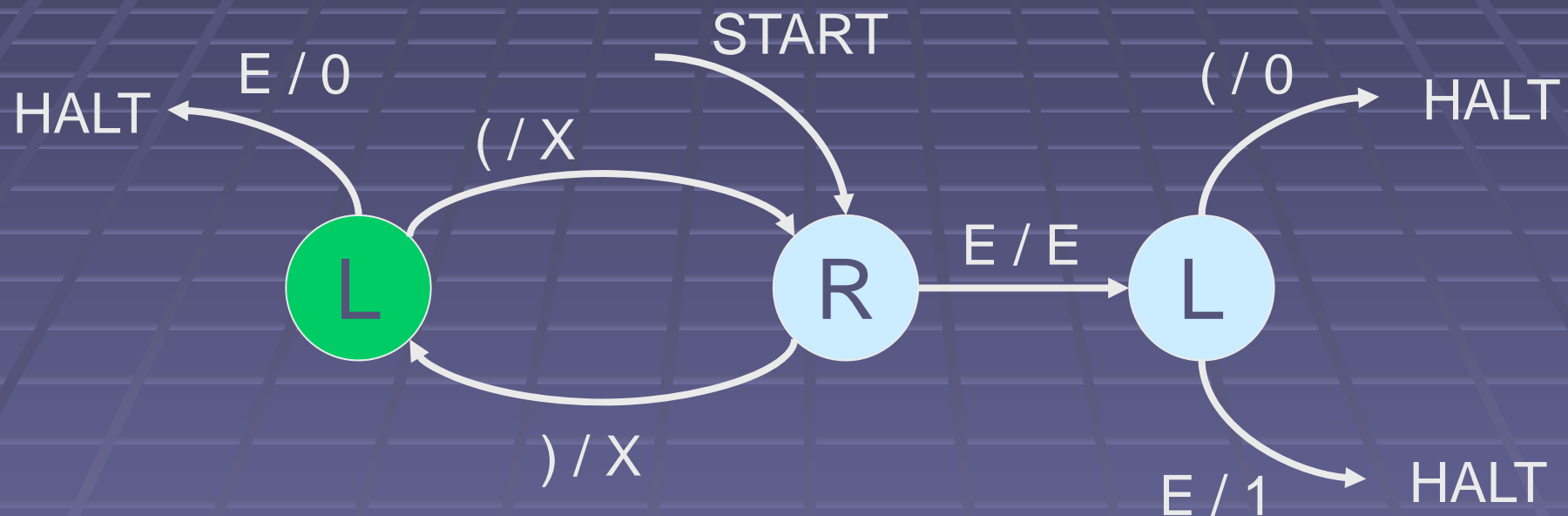


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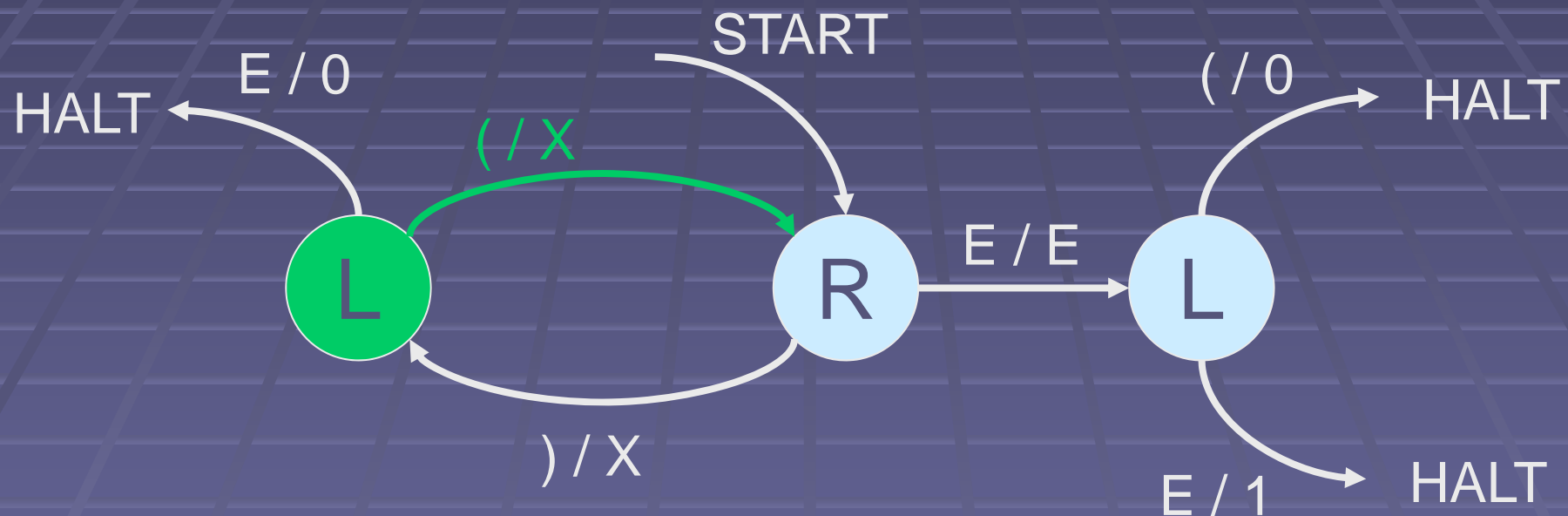
E	X	X	X	X	()	(()))	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Comprobador de Paréntesis



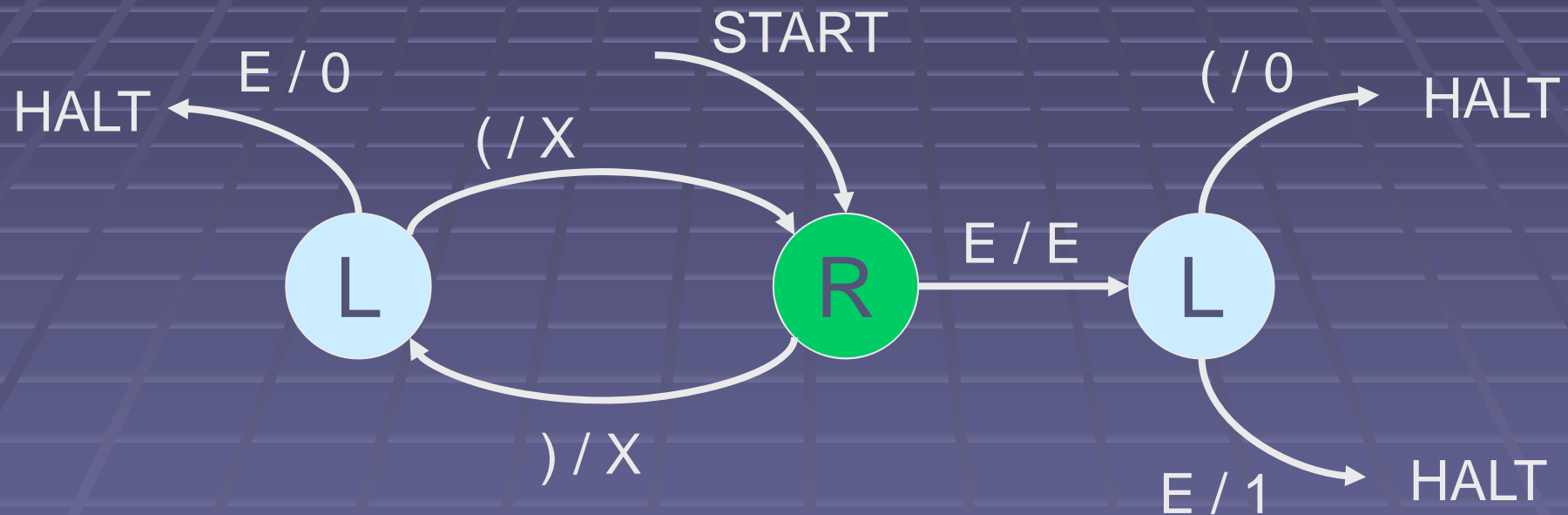
E	X	X	X	X	(X	(()))	(()	E
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Comprobador de Paréntesis

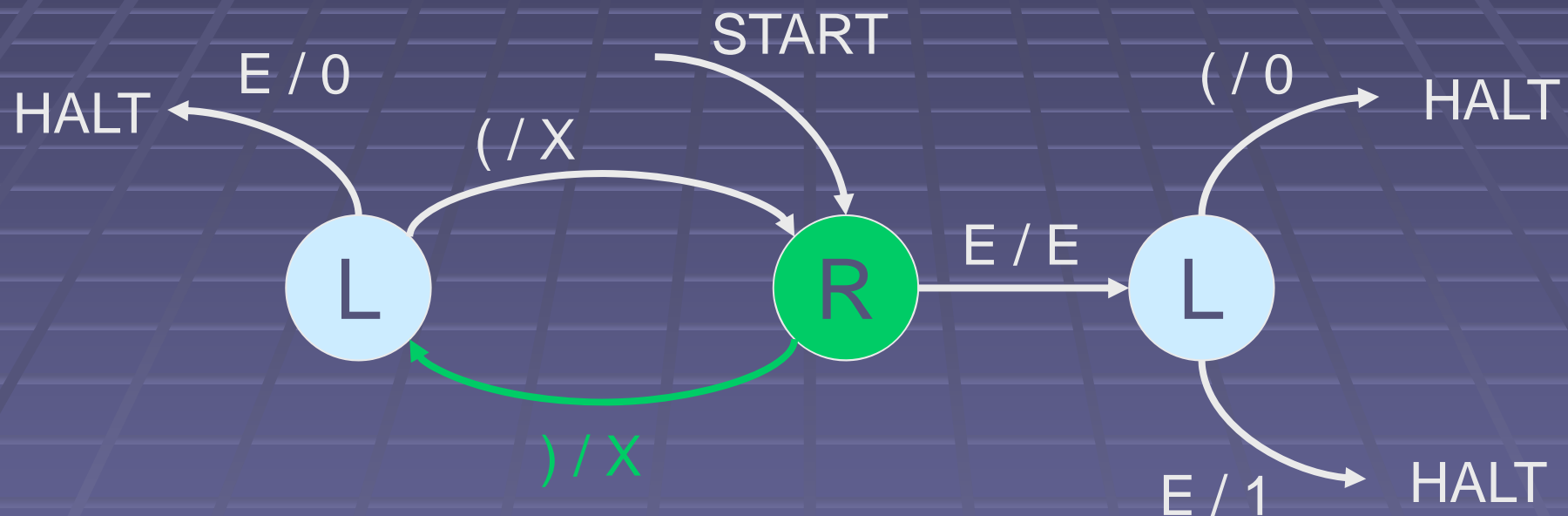


E	X	X	X	X	(X	(()))	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Comprobador de Paréntesis

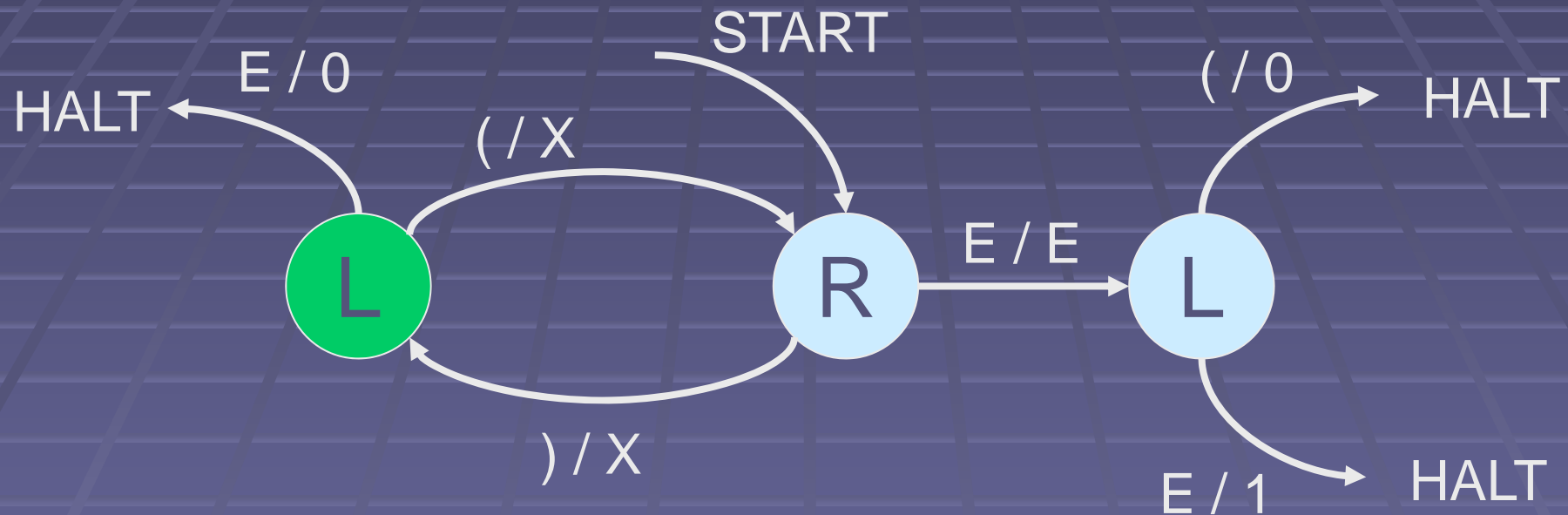


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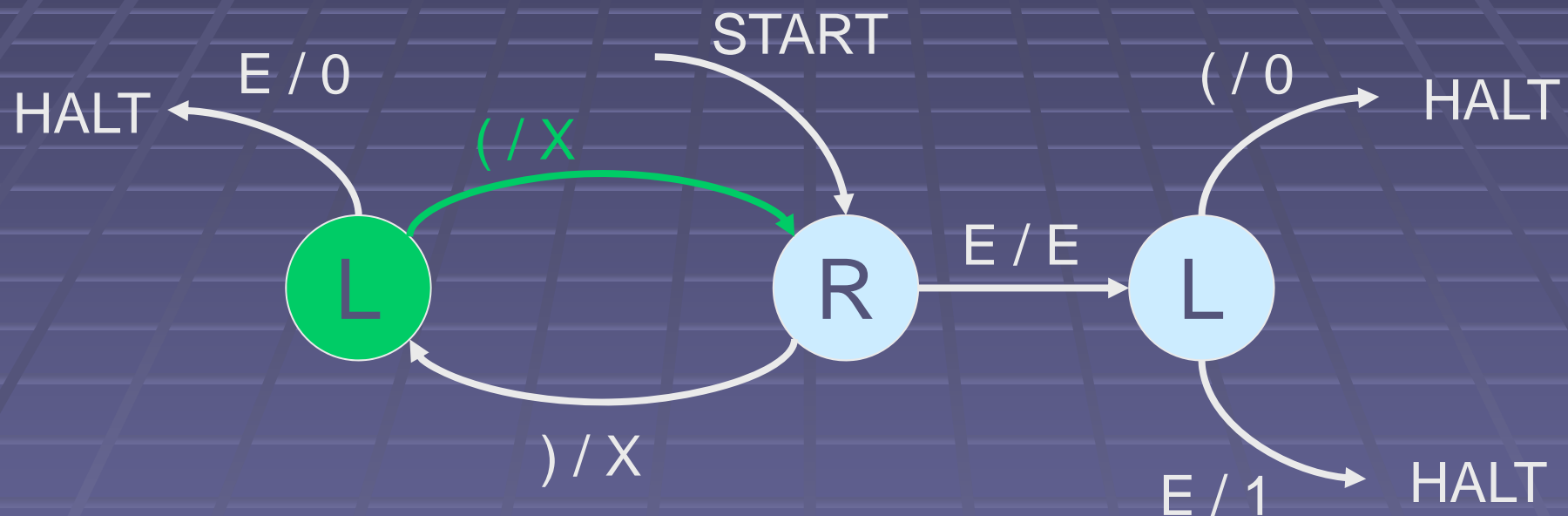
E	X	X	X	X	X	X	(()))	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Comprobador de Paréntesis



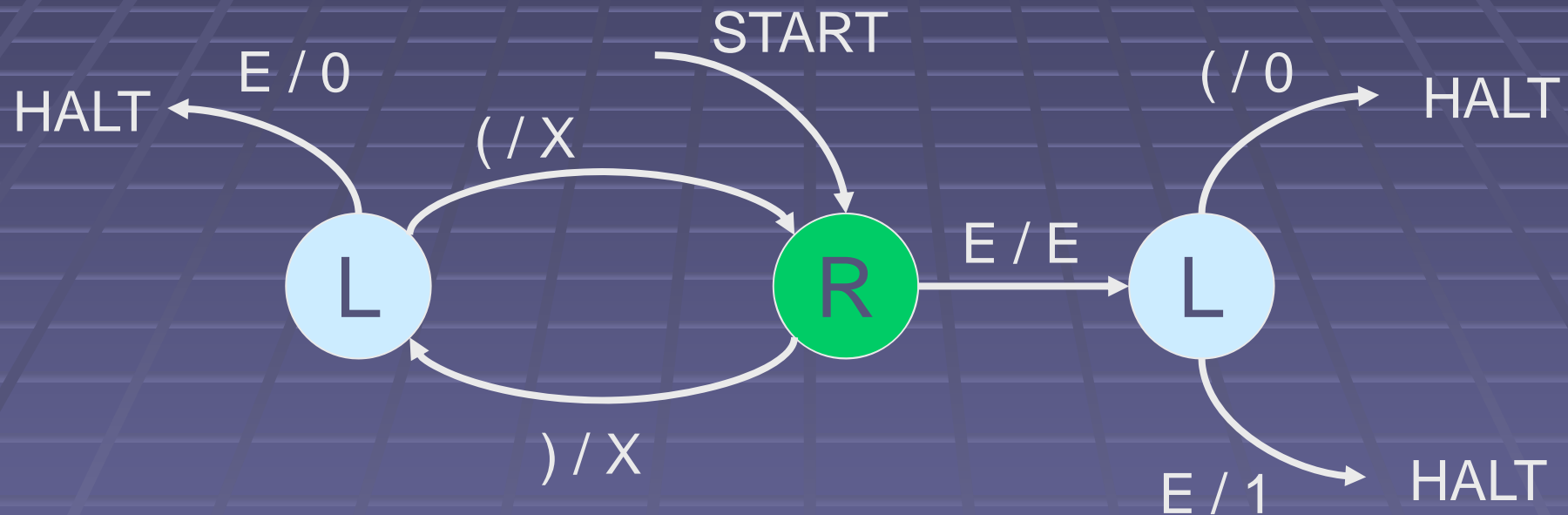
E	X	X	X	X	X	X	((X))	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Comprobador de Paréntesis



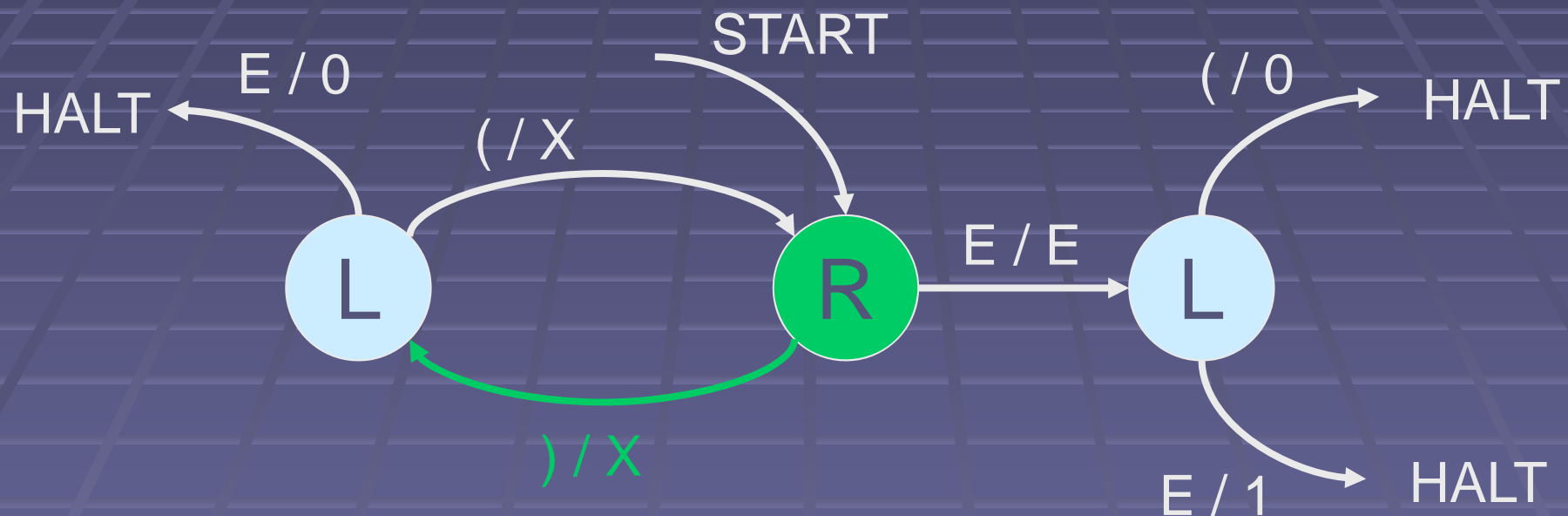
E	X	X	X	X	X	X	((X))	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Comprobador de Paréntesis

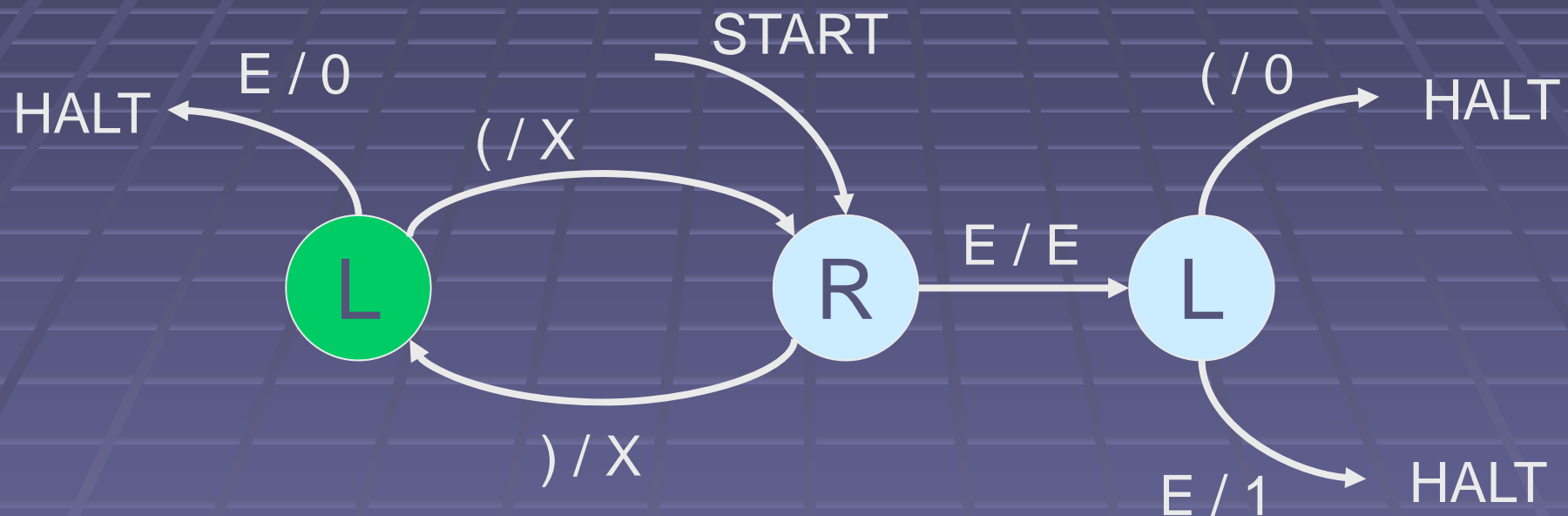


E	X	X	X	X	X	X	(X	X))	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Comprobador de Paréntesis

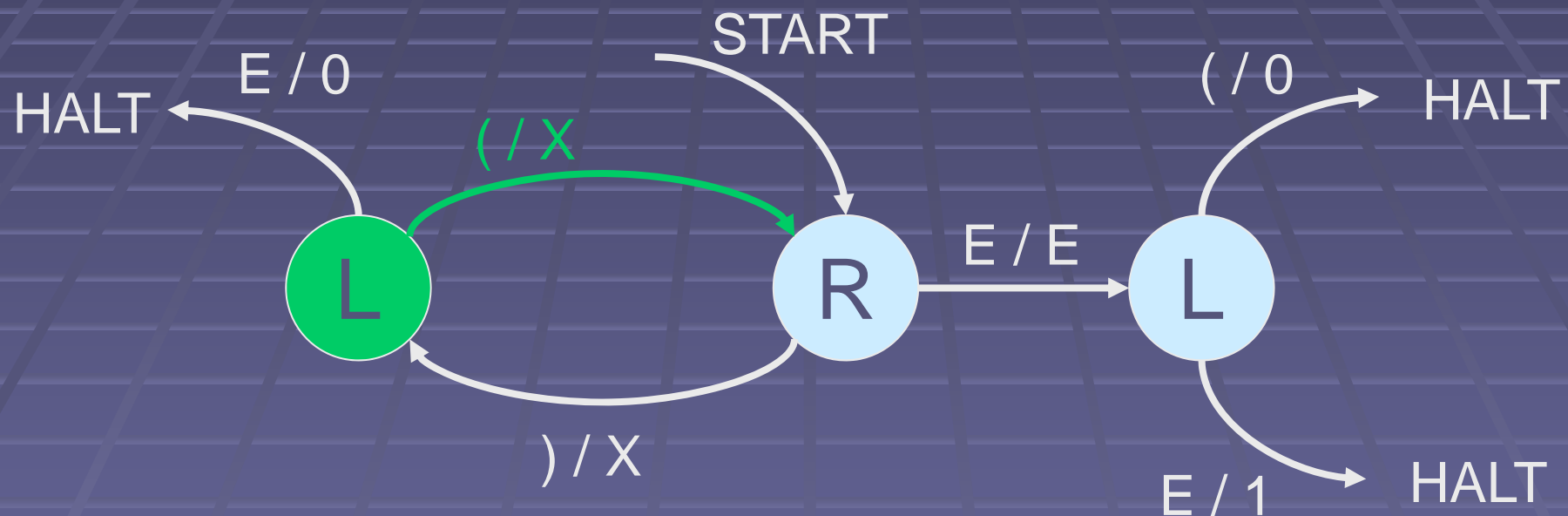


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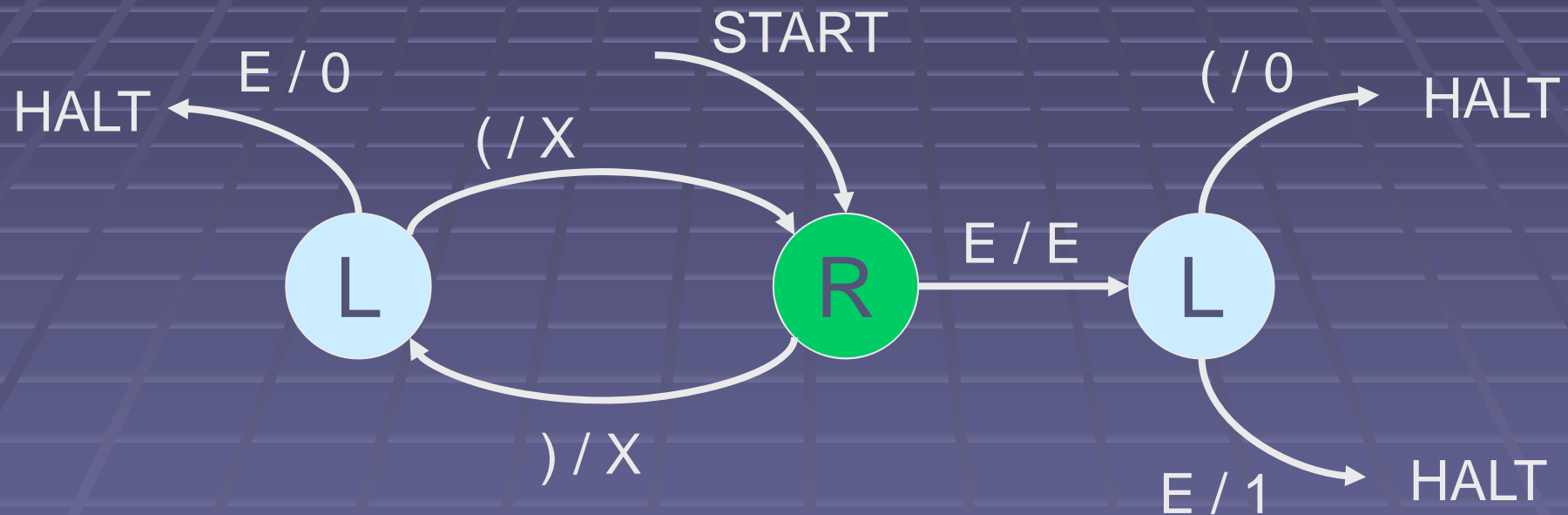


E	X	X	X	X	X	X	(X	X	X)	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

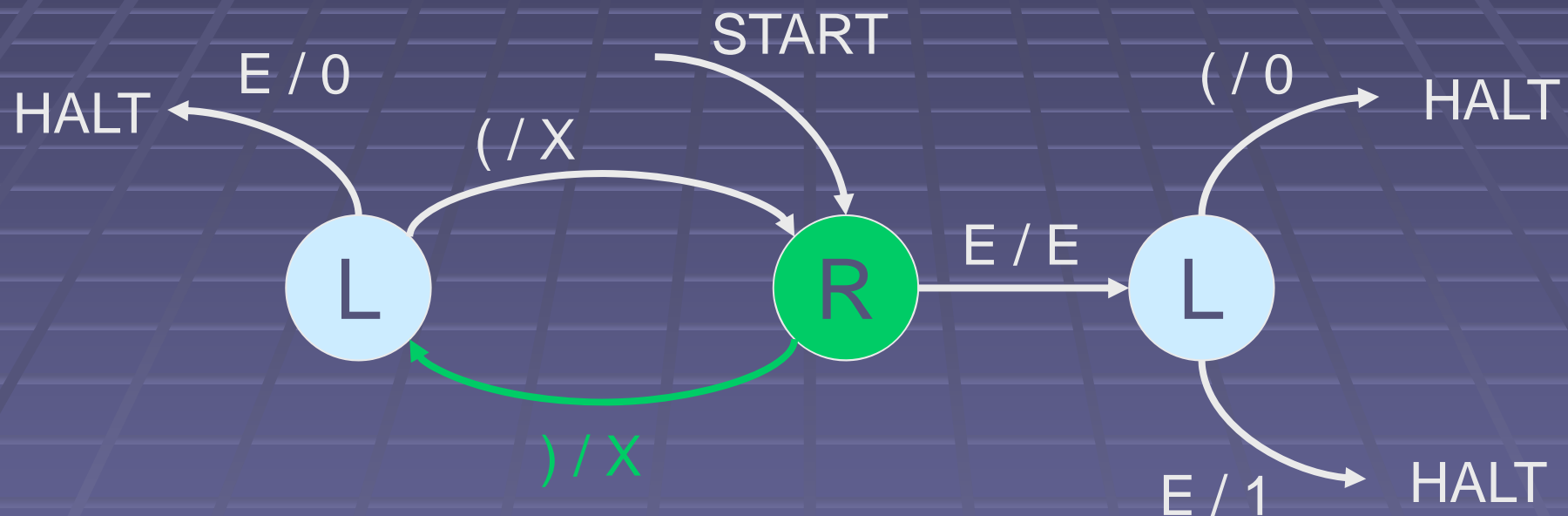
Comprobador de Paréntesis



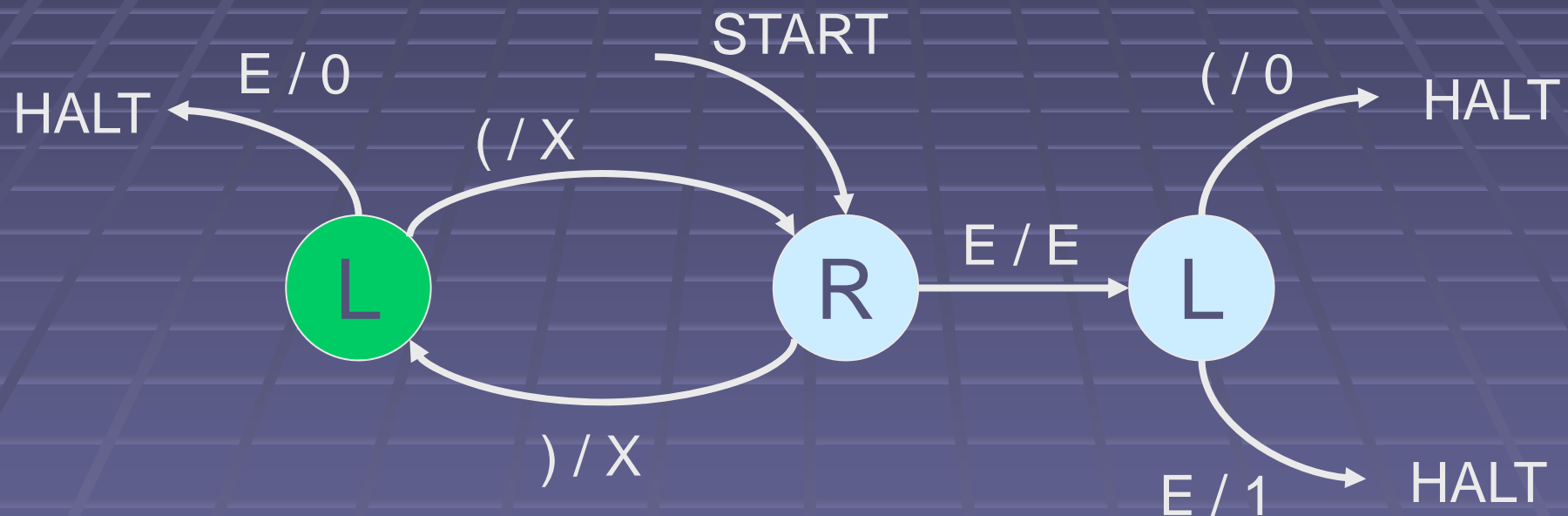
Comprobador de Paréntesis



Comprobador de Paréntesis

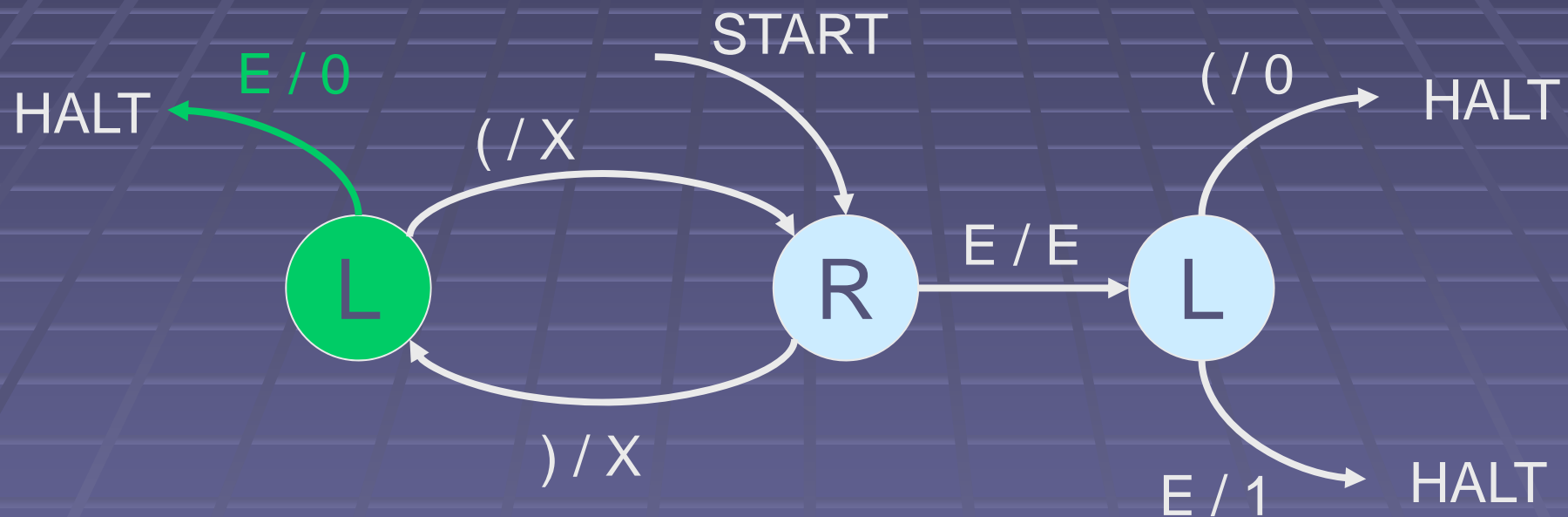


Comprobador de Paréntesis

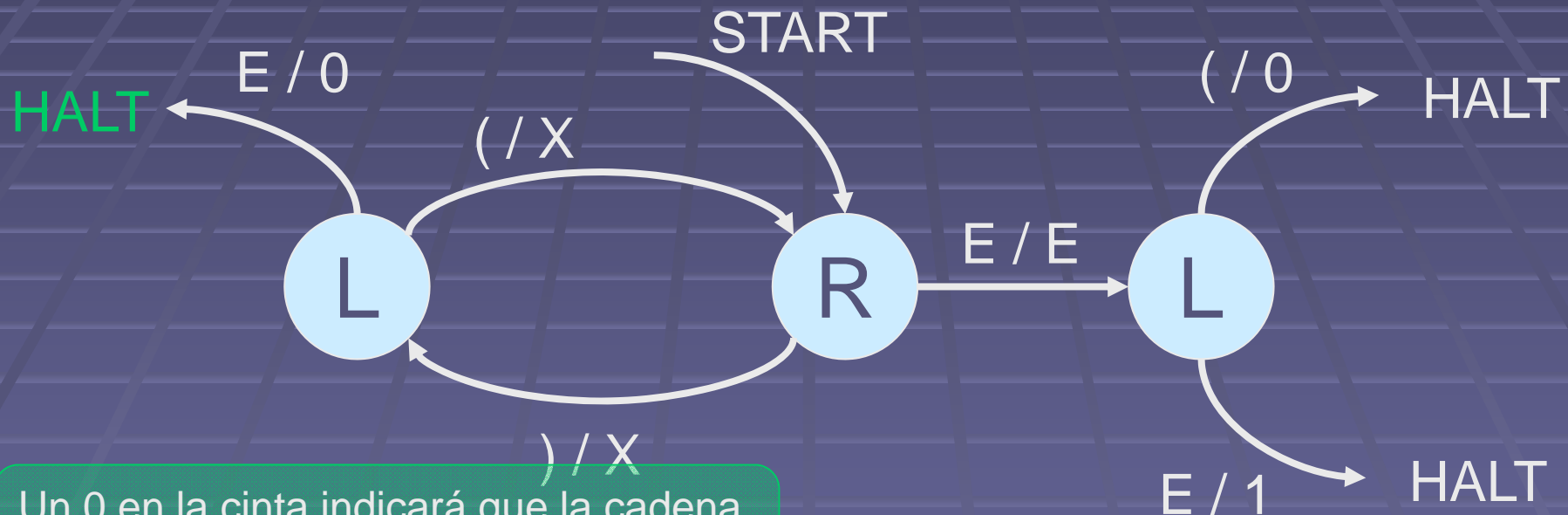


E	X	X	X	X	X	X	X	X	X	X	X	X	(()	E
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Comprobador de Paréntesis



Comprobador de Paréntesis

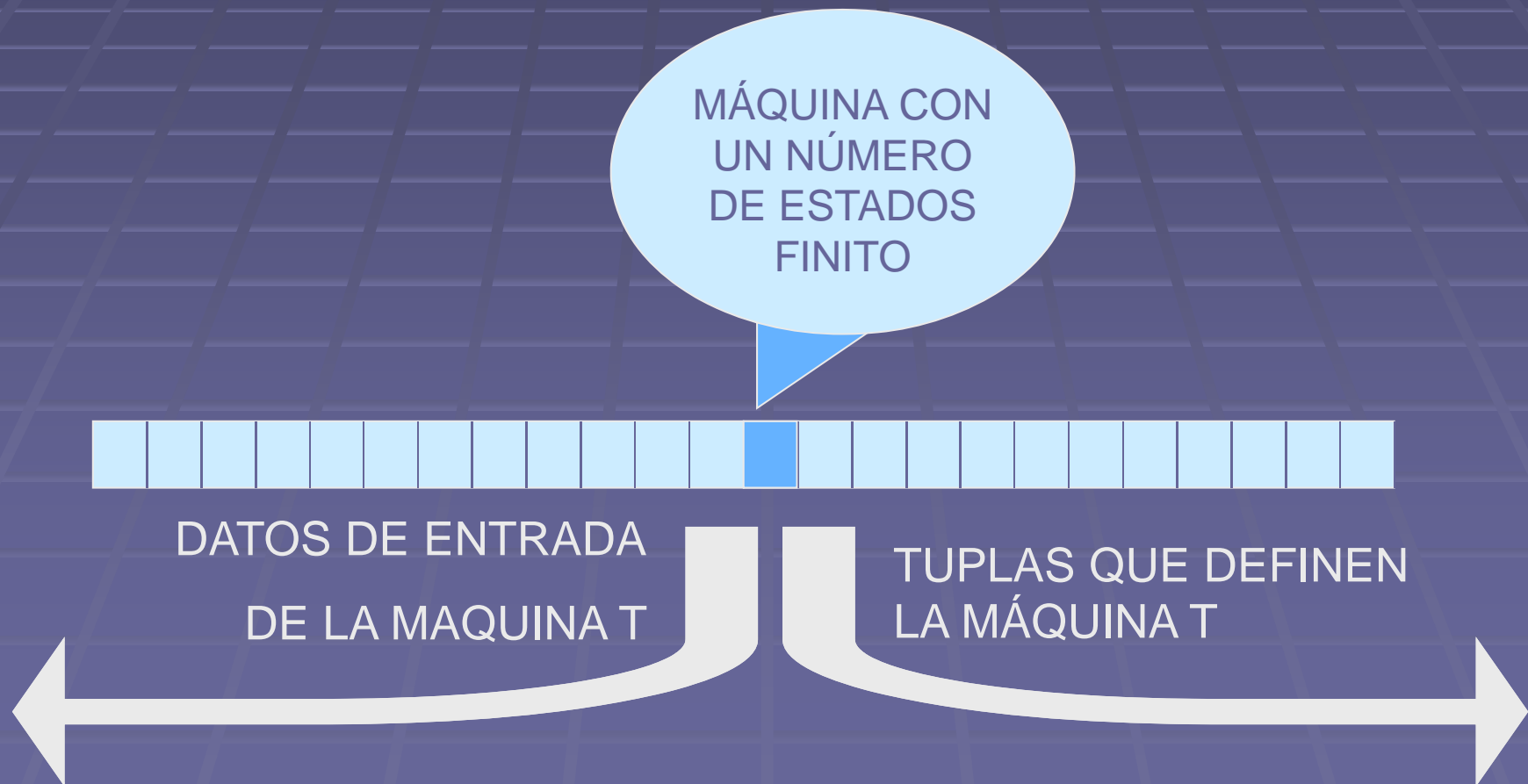


Un 0 en la cinta indicará que la cadena de paréntesis no es correcta.



La máquina de Turing Universal (III)

- Una “*máquina de máquinas*”:



La máquina de Turing Universal (IV)

- Cada tupla viene definida por:

INICIAL		FINAL		
Estado	Lectura	Estado	Escritura	Movimiento
Q_i	S_i	Q_j	S_j	D (izq ó der)

La máquina de Turing Universal (V)

- Cinta de entrada de la MUT

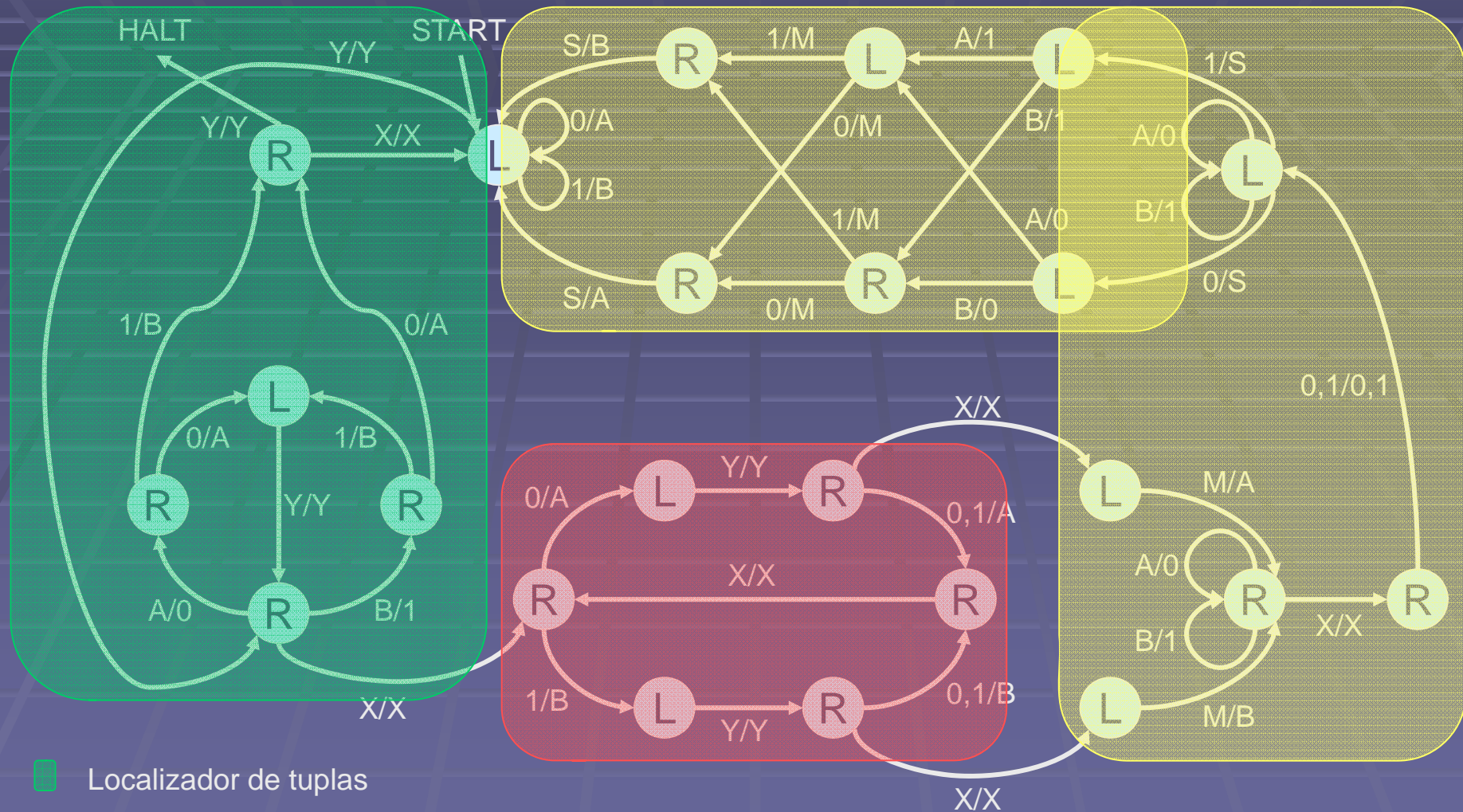
.....	M		Estado de T	Símbolo de T	Descripción de T
-------	---	--	-------------	--------------	------------------

posición inicial de la cinta



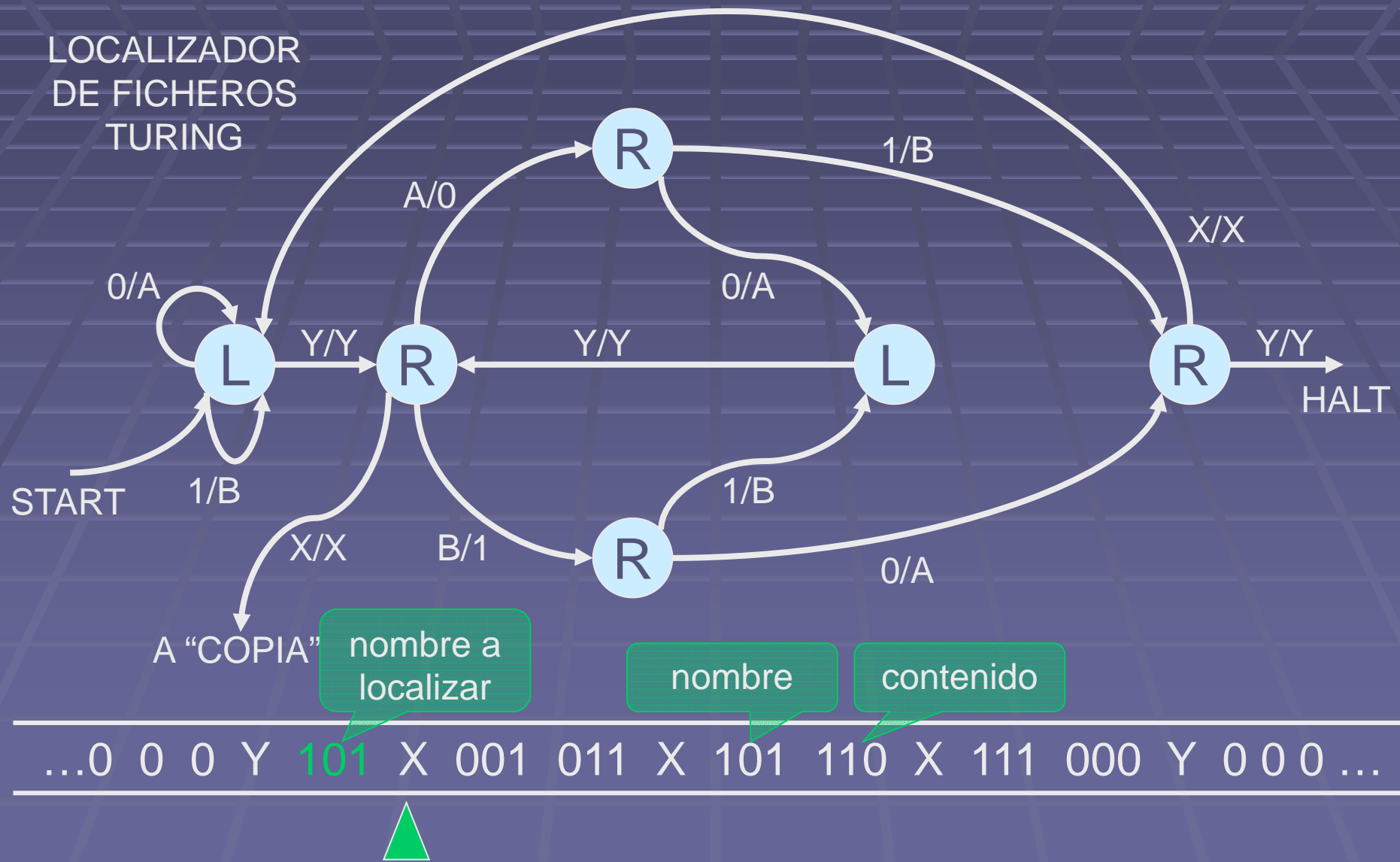
X	0	0	0	0	0	0	0	X	.	.	.	0	0	0	0	0	0	0	X	.	.	0	0	0
	1	1	1	1	1	1	1					1	1	1	1	1	1	1				1	1	1
Q ₁		S ₁	Q ₁₁		S ₁₁	D ₁₁						Q _i		S _j	Q _{ij}		S _{ij}	D _{ij}						

Máquina de Turing Universal

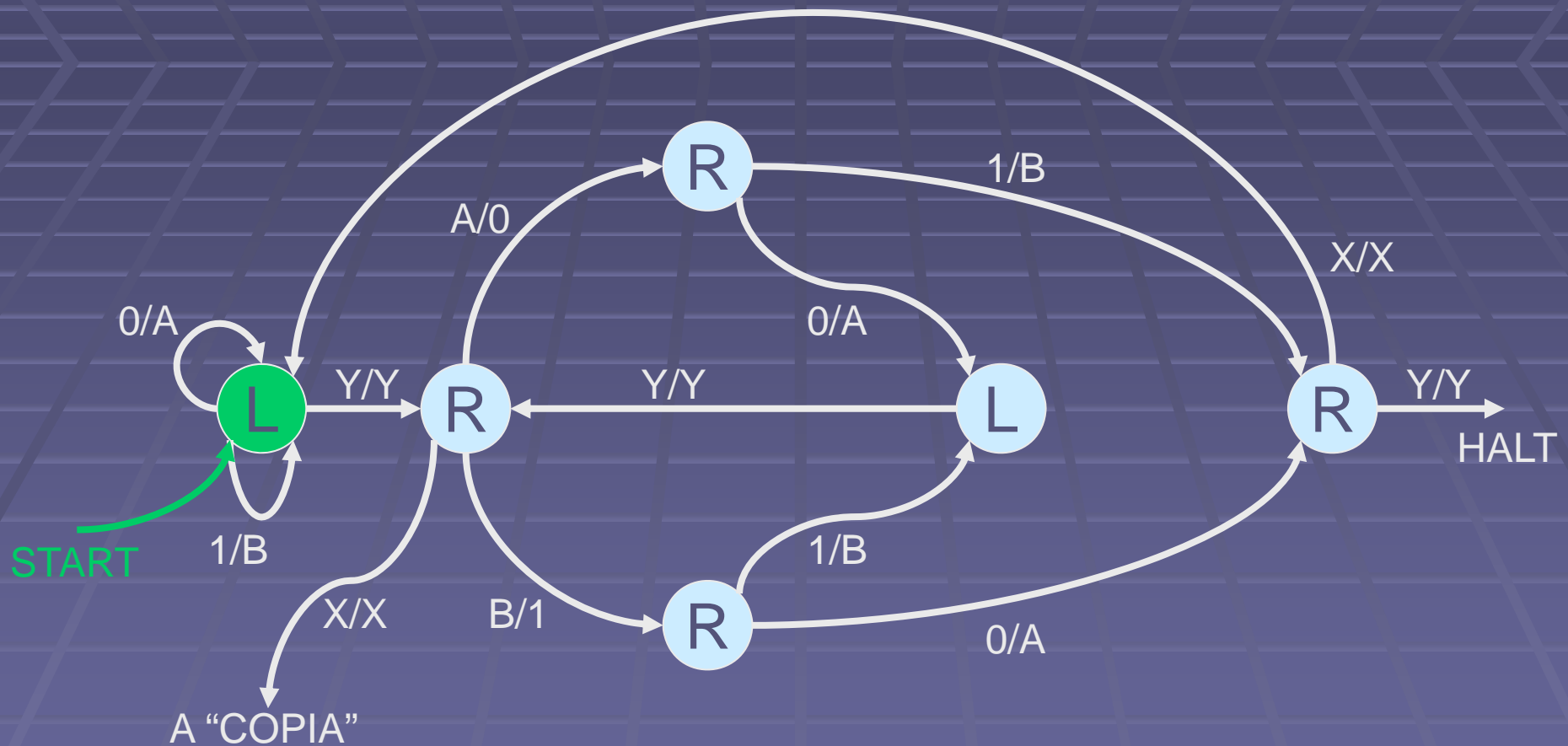


- Localizador de tuplas
- Copiador
- Desplazamiento de cabezal

Máquina Localizadora

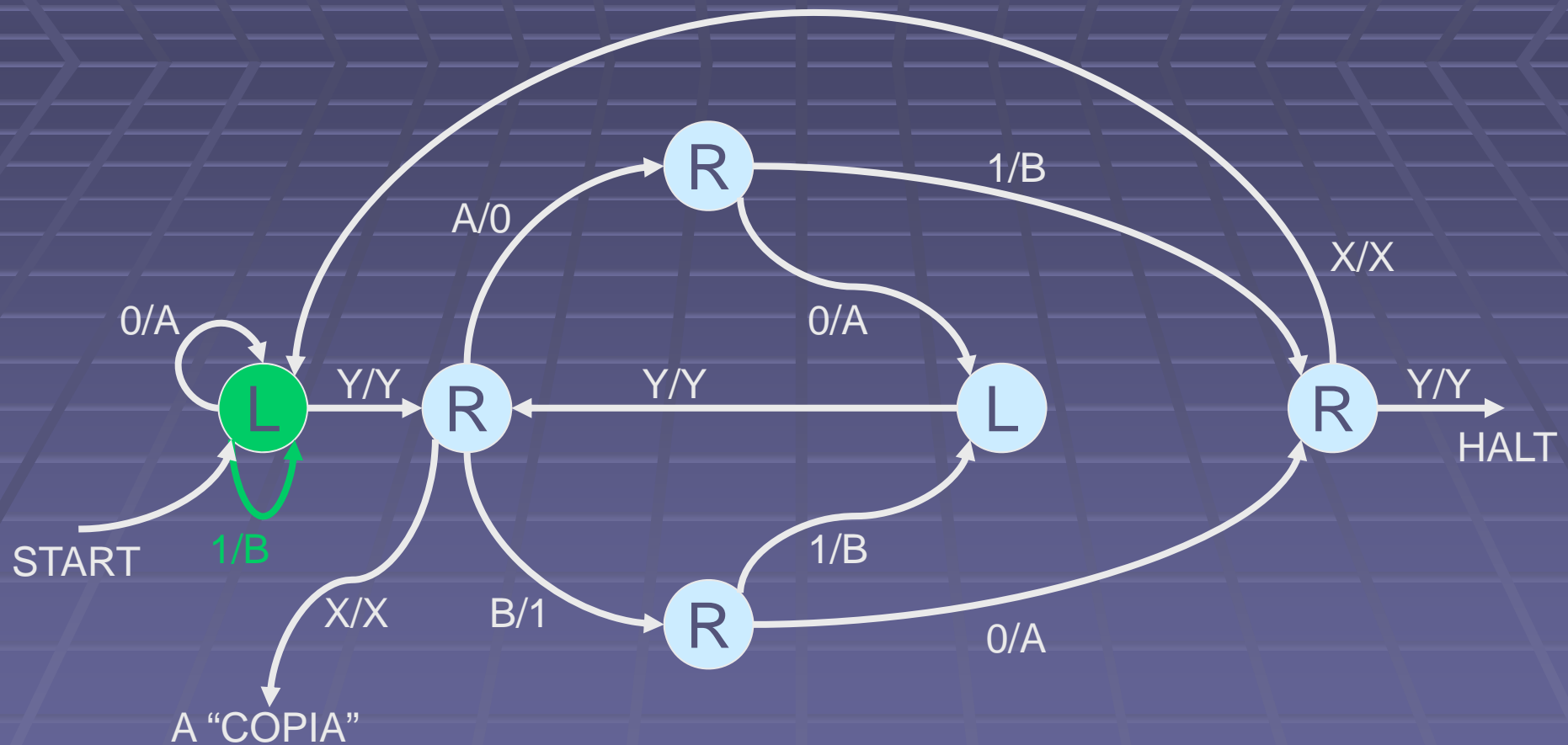


Máquina Localizadora



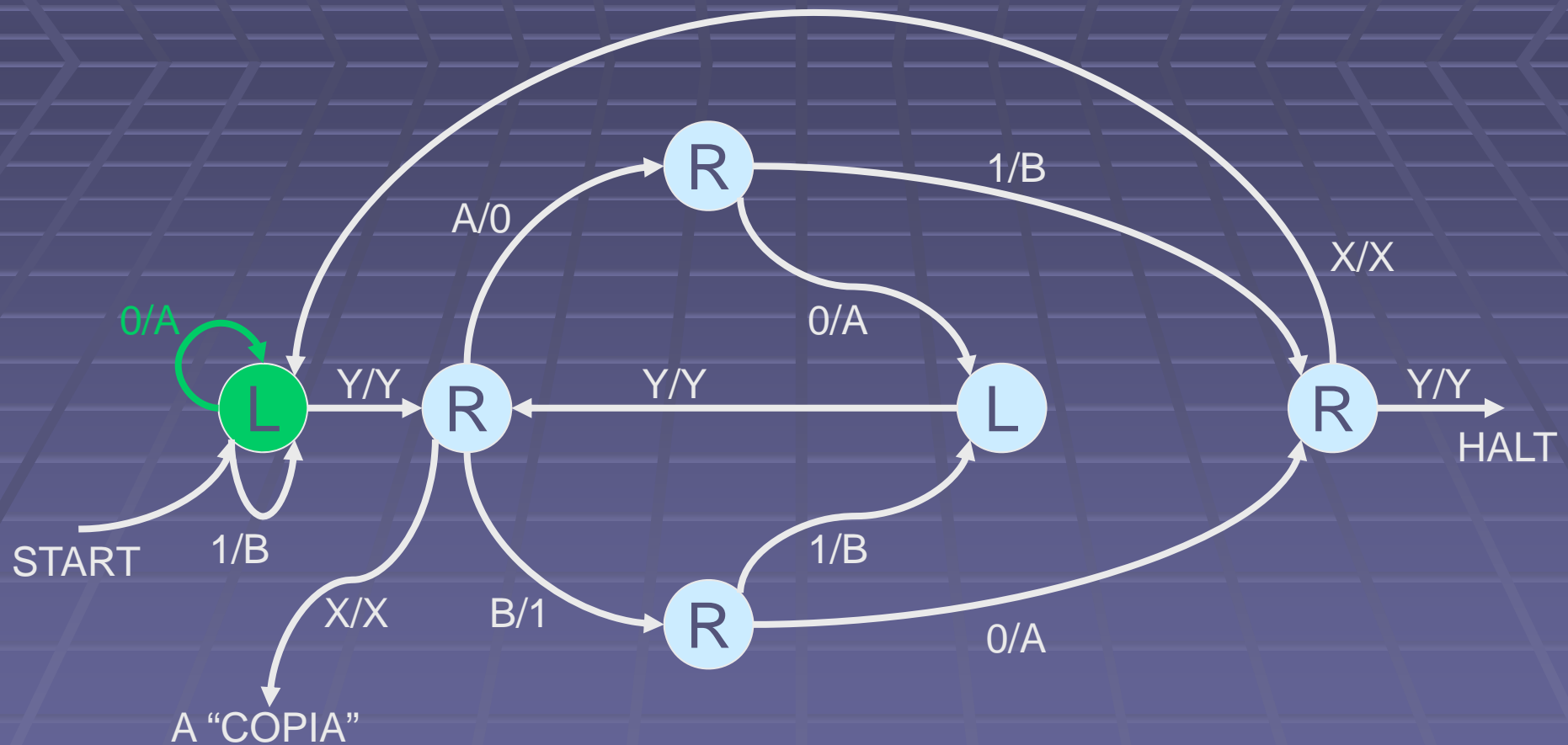
...0 0 0 Y 101 X 001 011 X 101 110 X 111 000 Y 0 0 0 ...

Máquina Localizadora



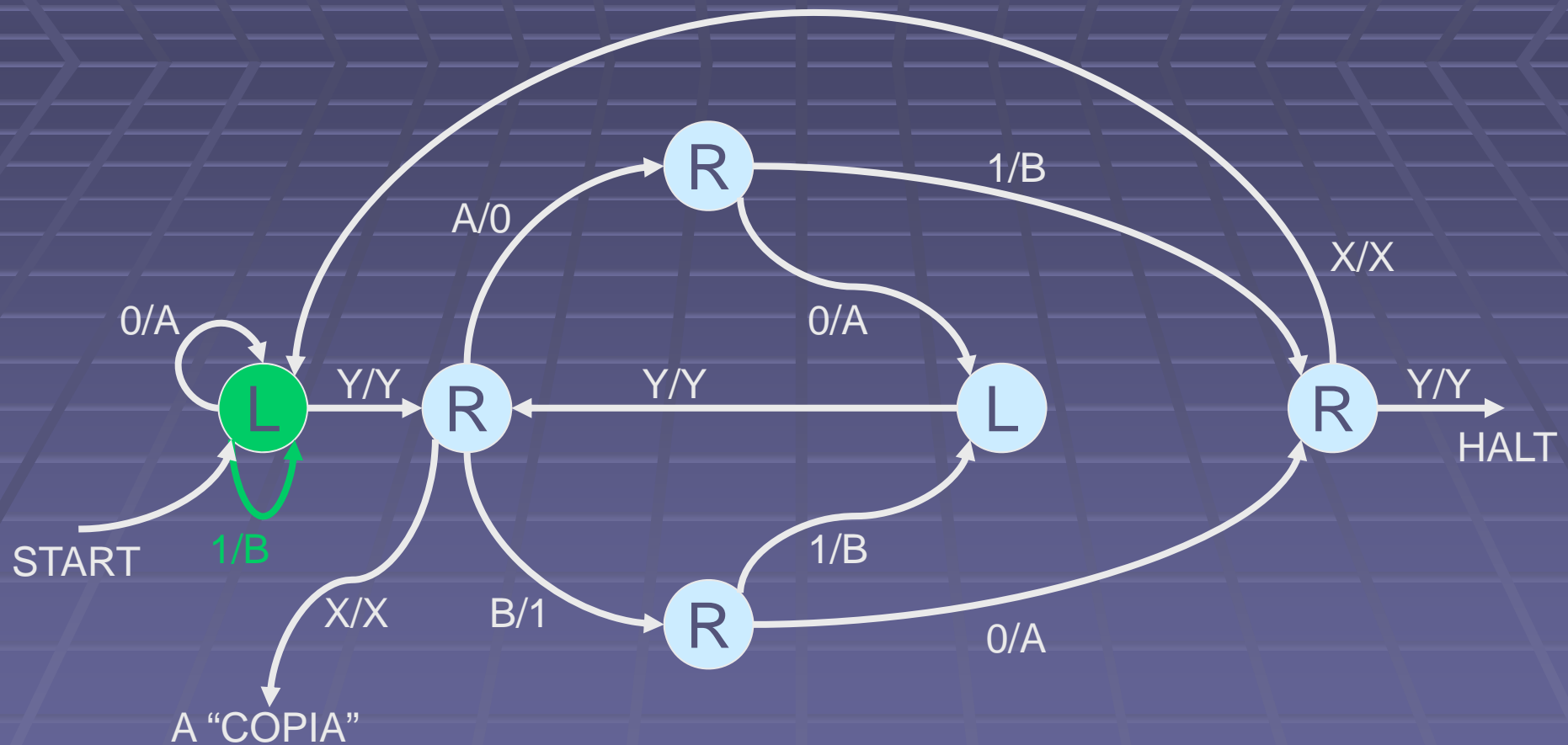
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Máquina Localizadora



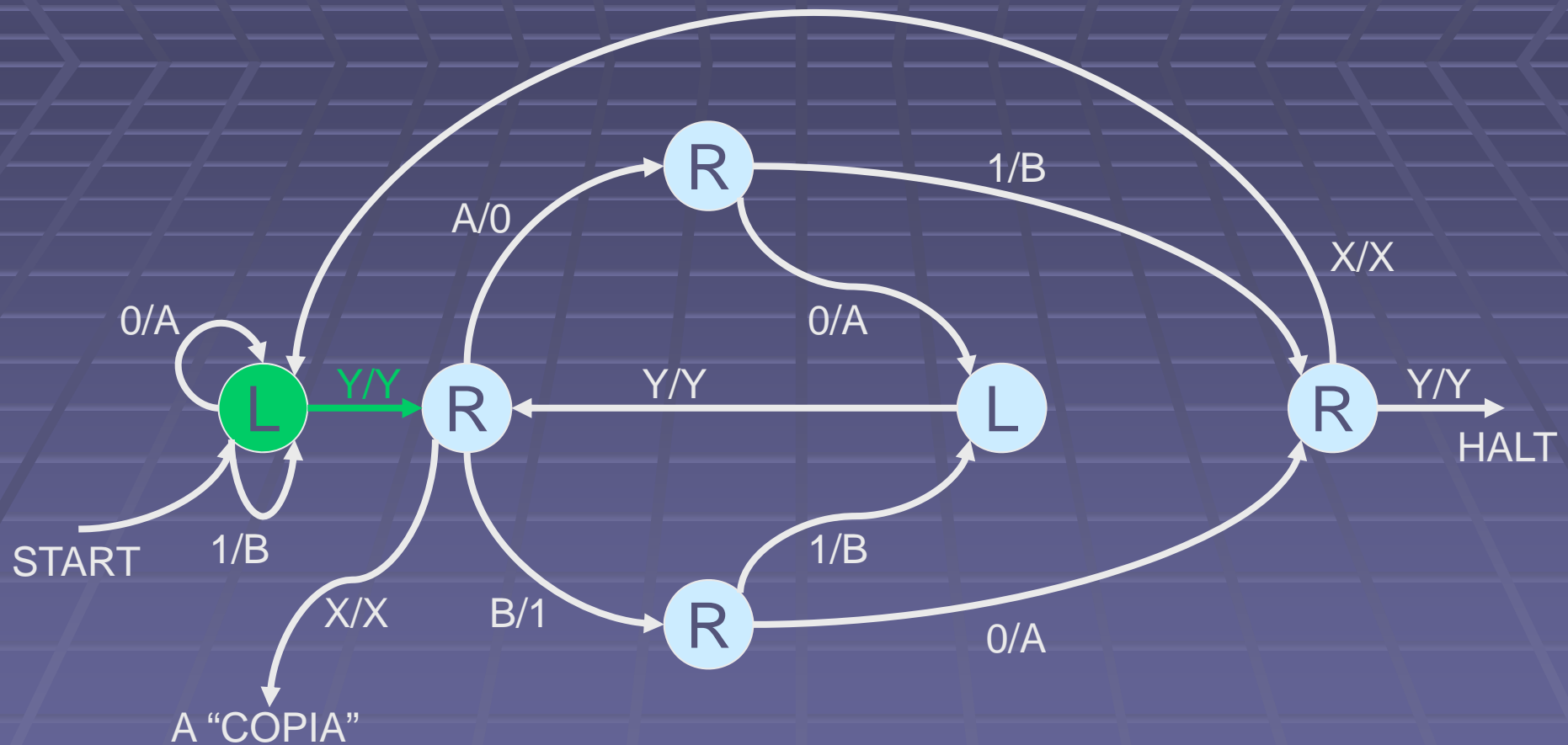
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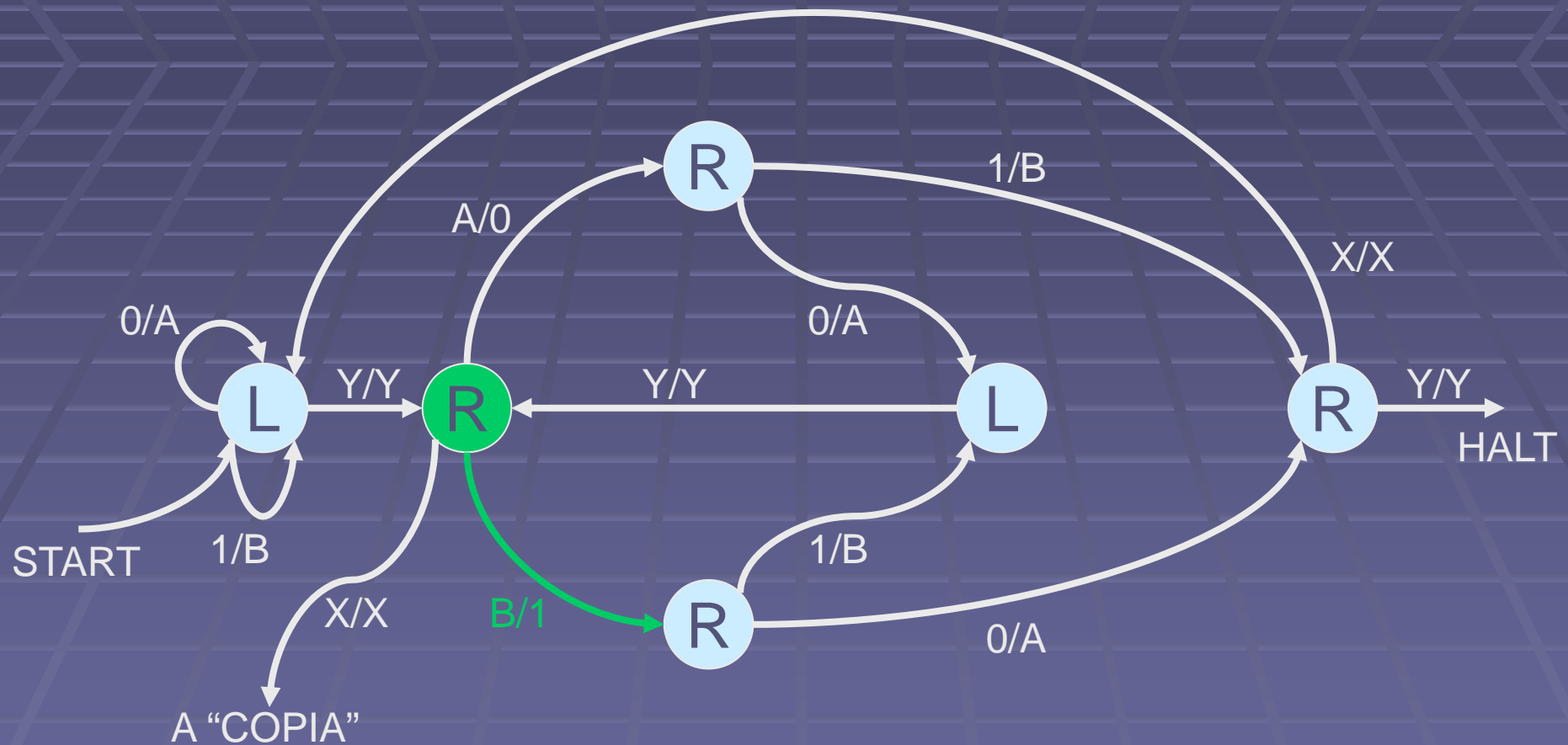


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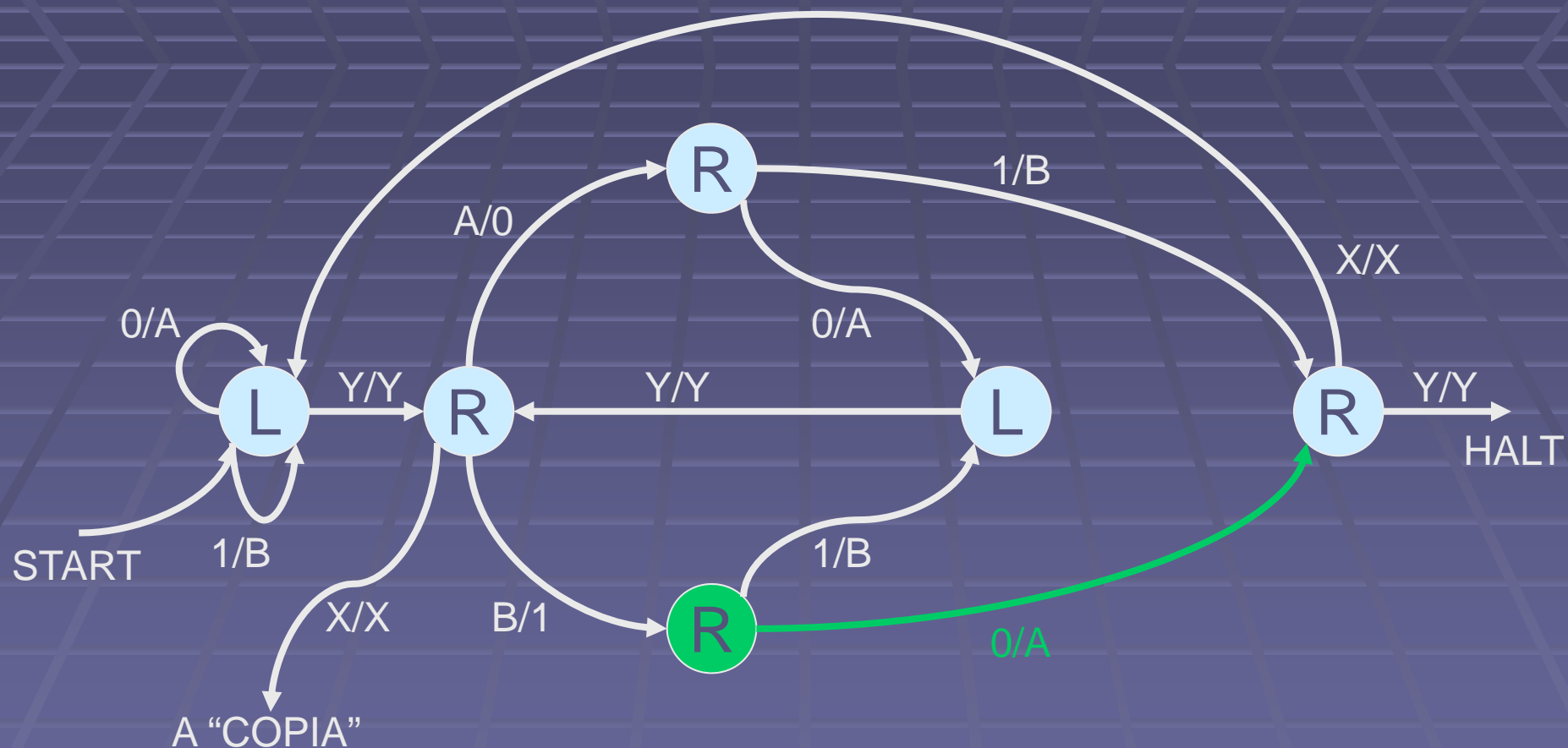


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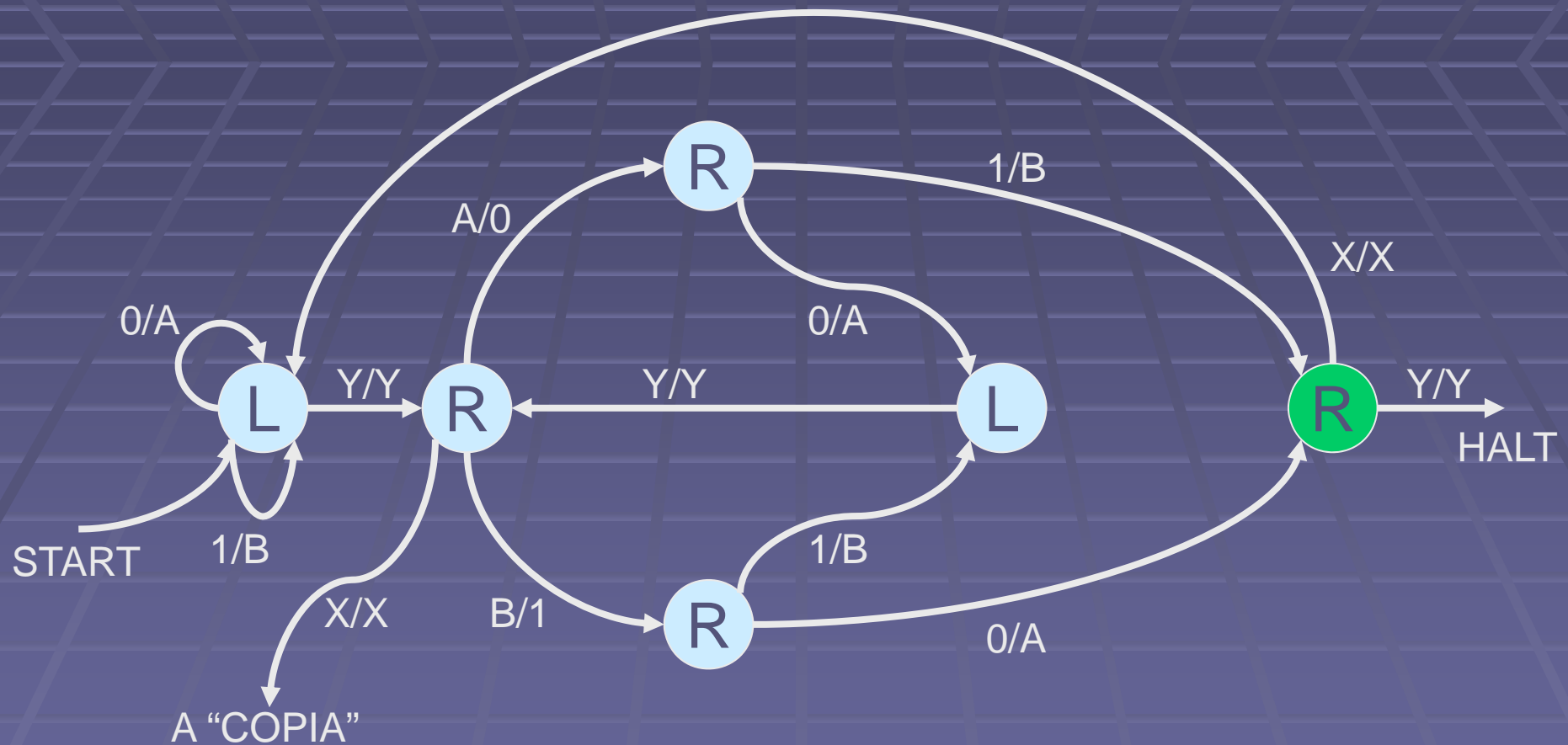
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Máquina Localizadora



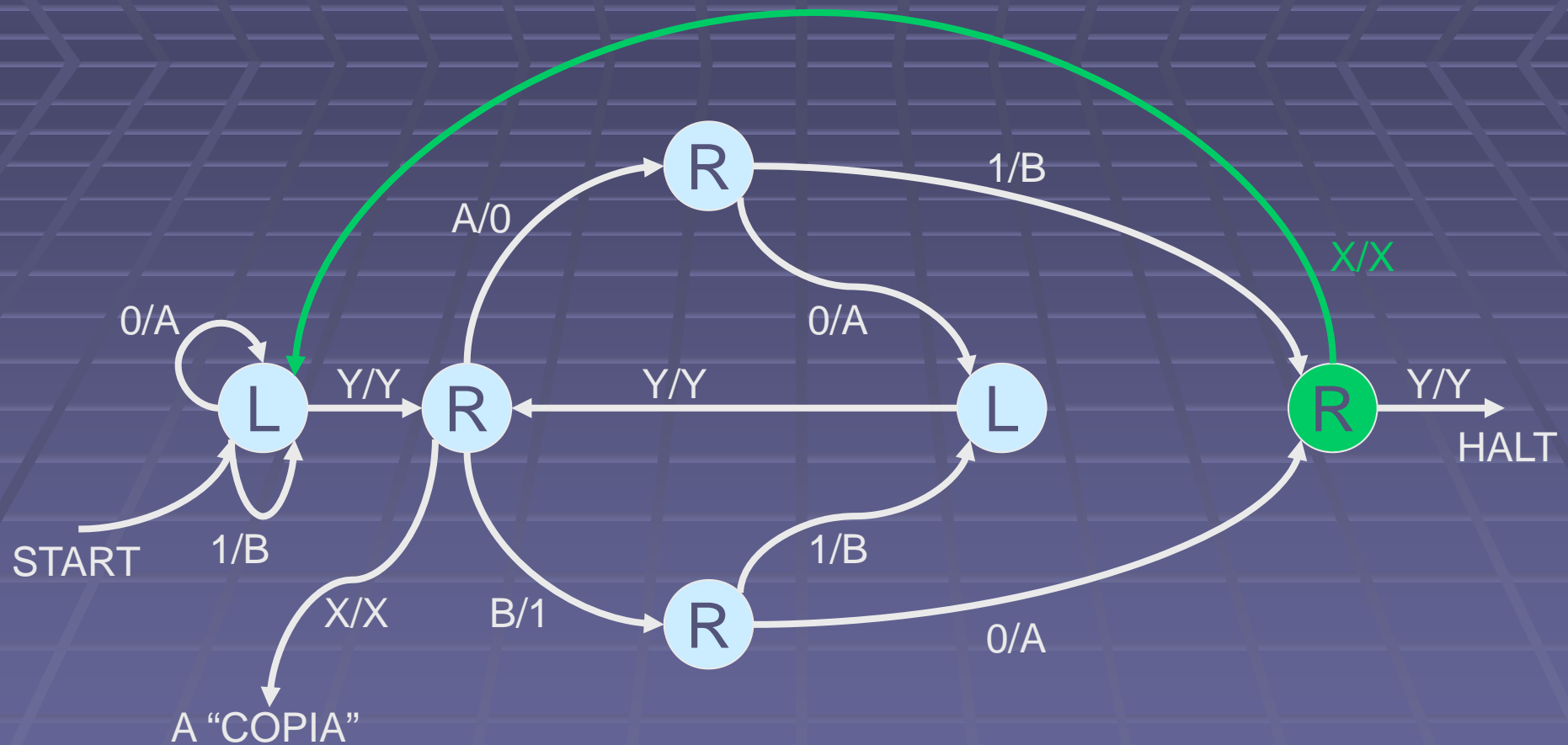
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Máquina Localizadora



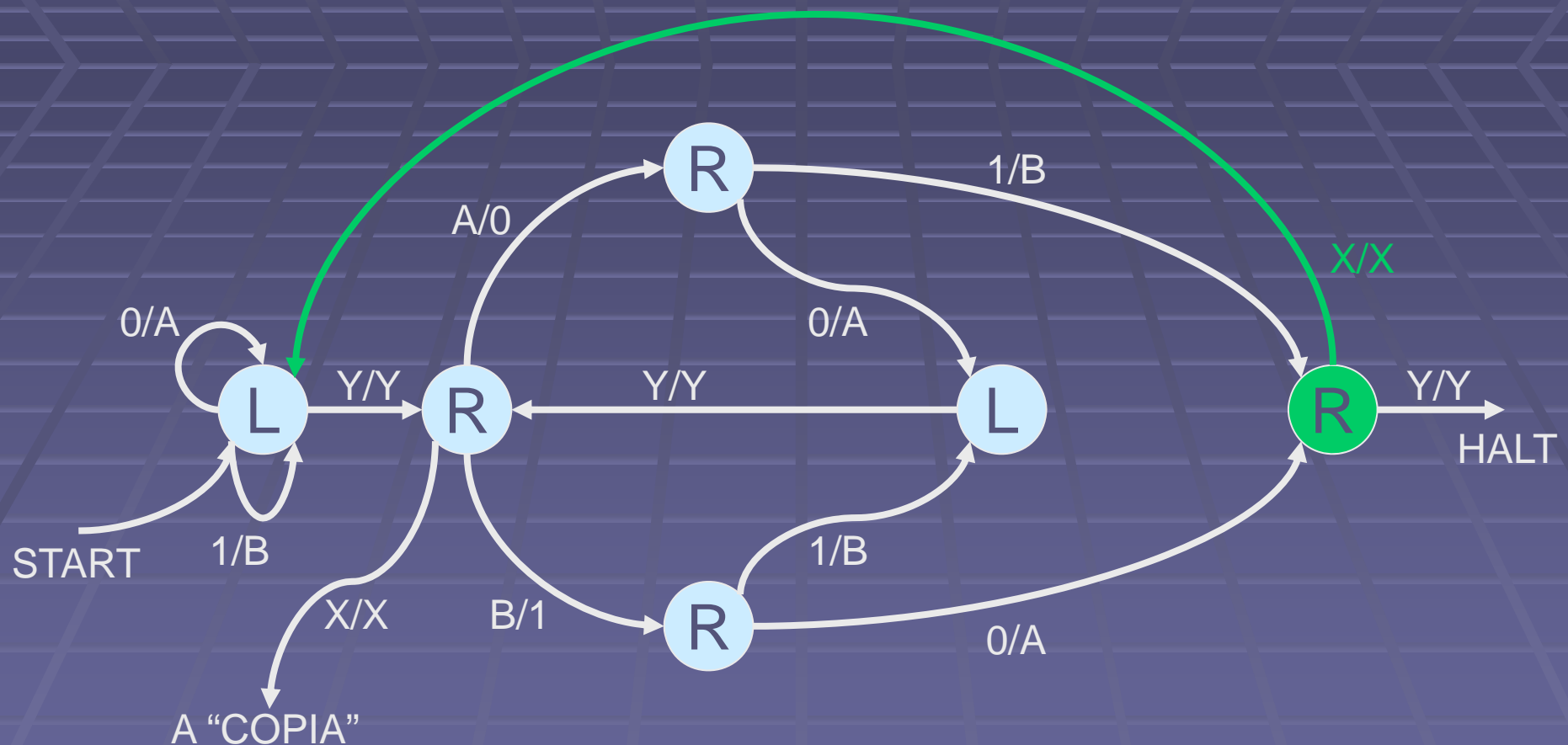
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Máquina Localizadora



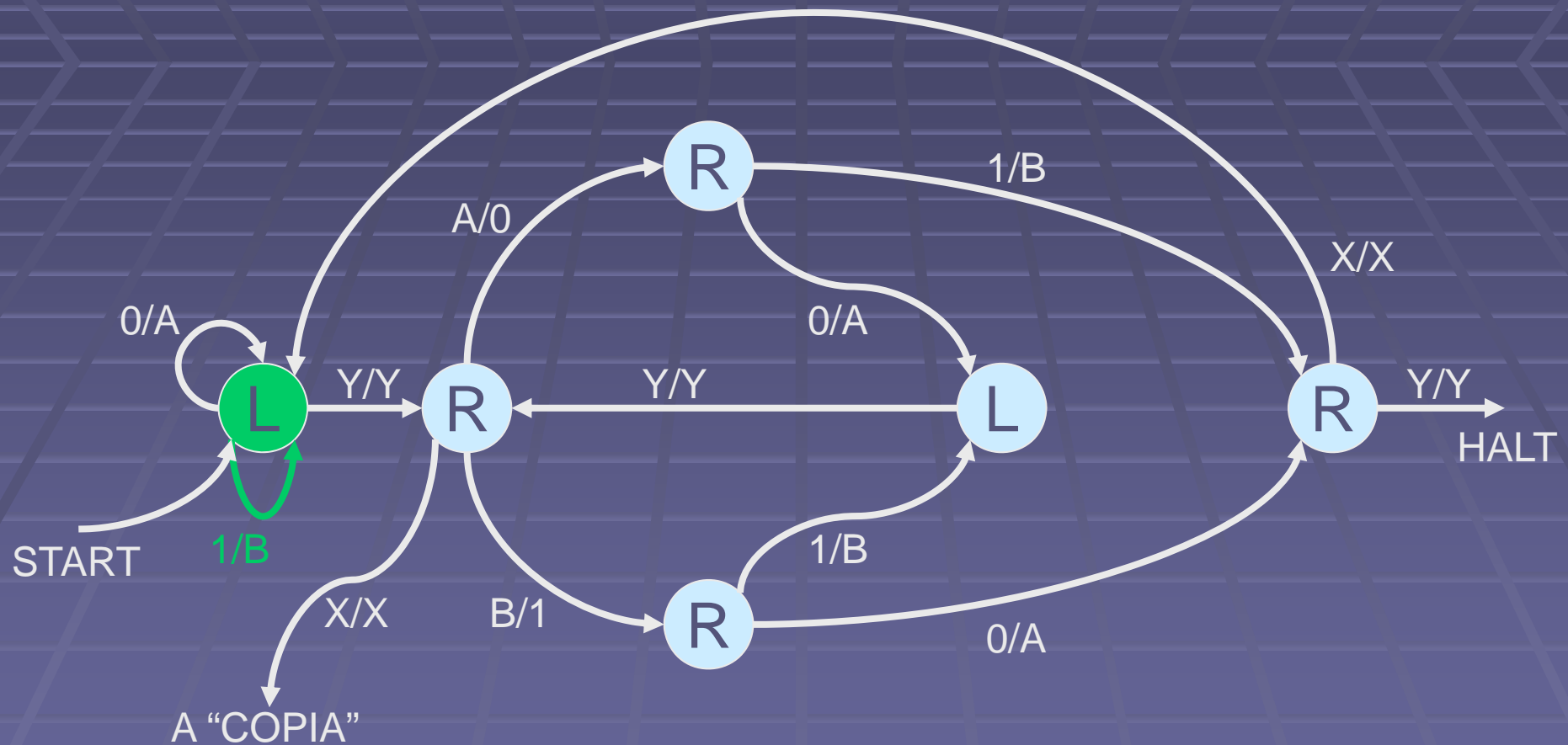
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Máquina Localizadora



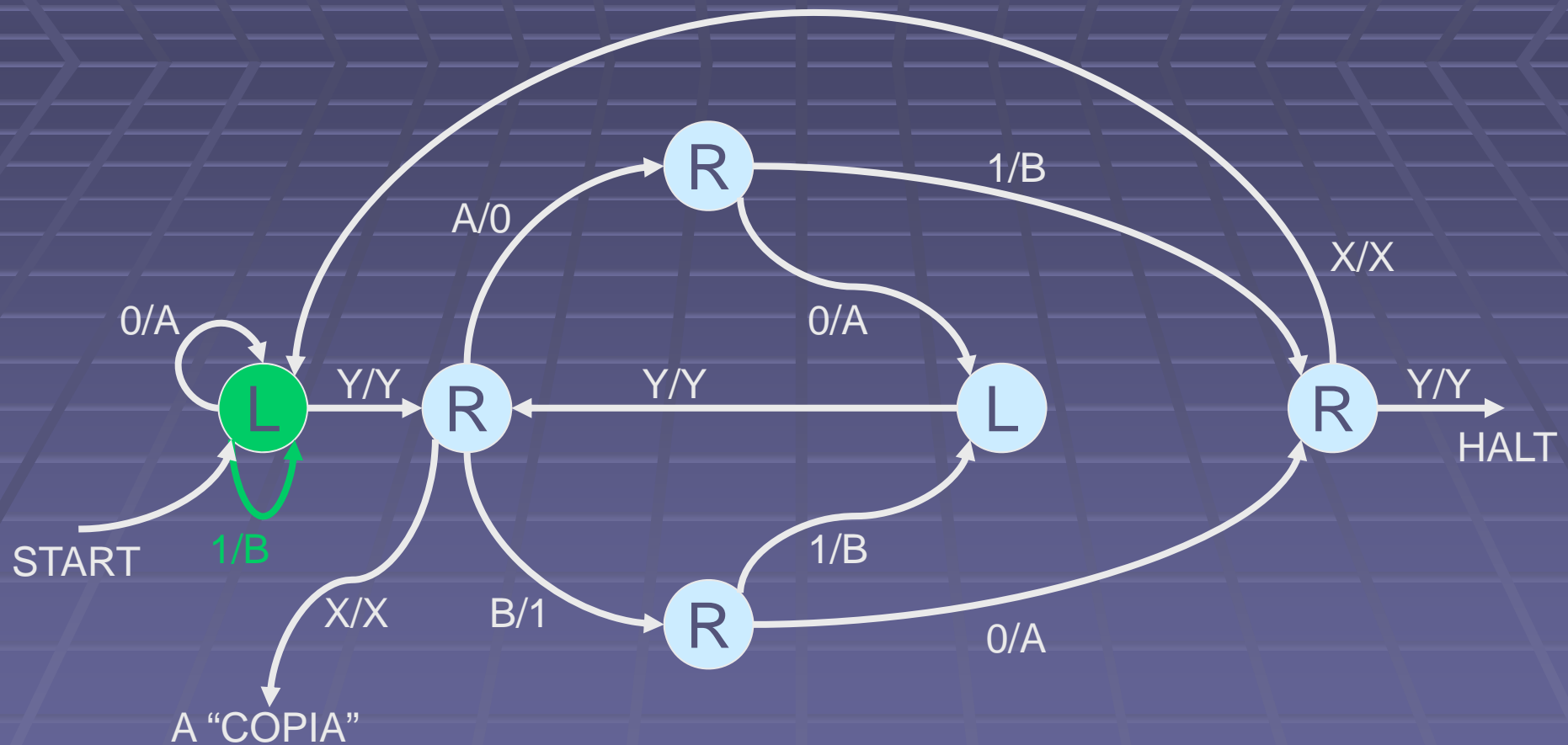
...0 0 0 Y 1AB X A01 011 X 101 110 X 111 000 Y 0 0 0 ...

Máquina Localizadora



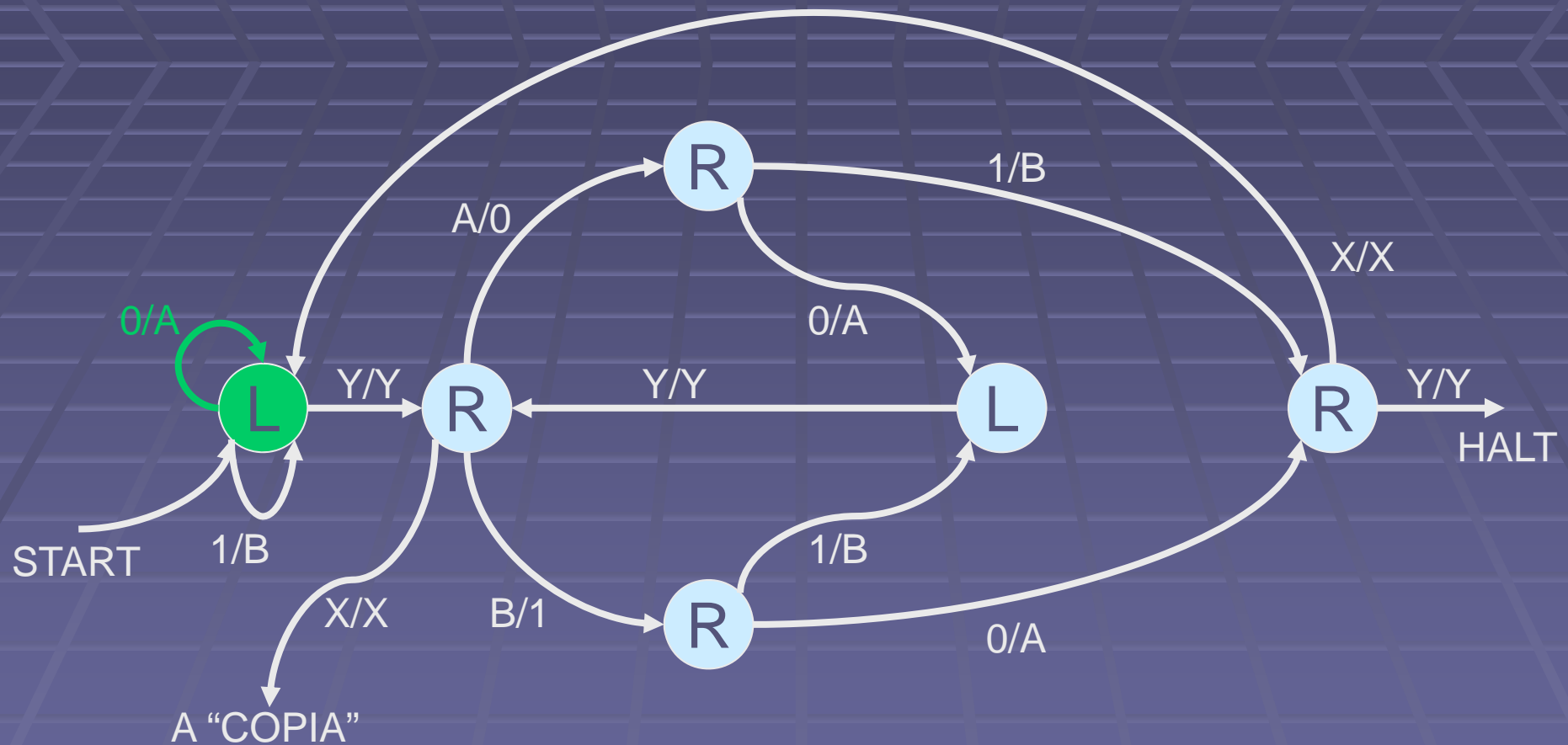
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Máquina Localizadora



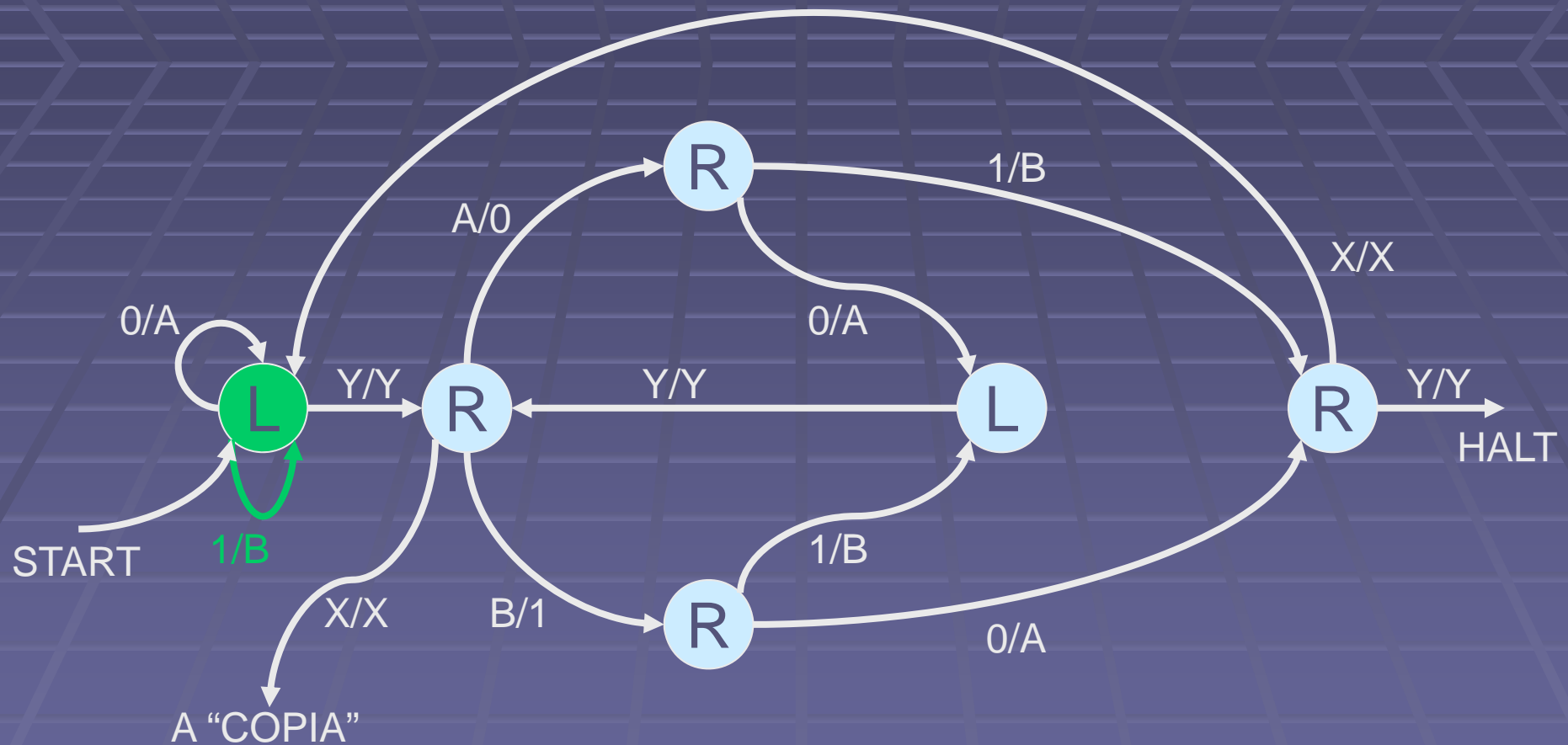
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Máquina Localizadora



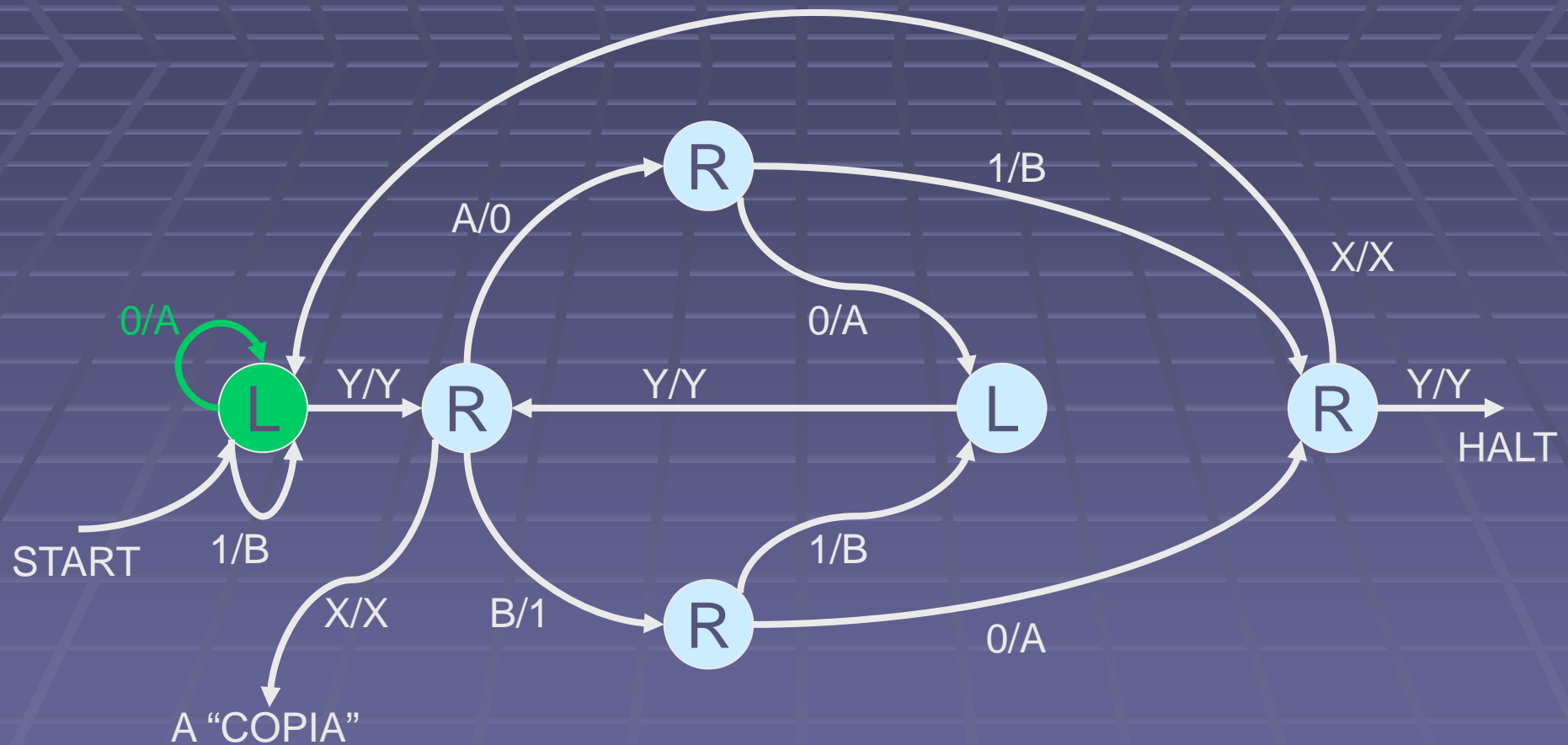
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Máquina Localizadora



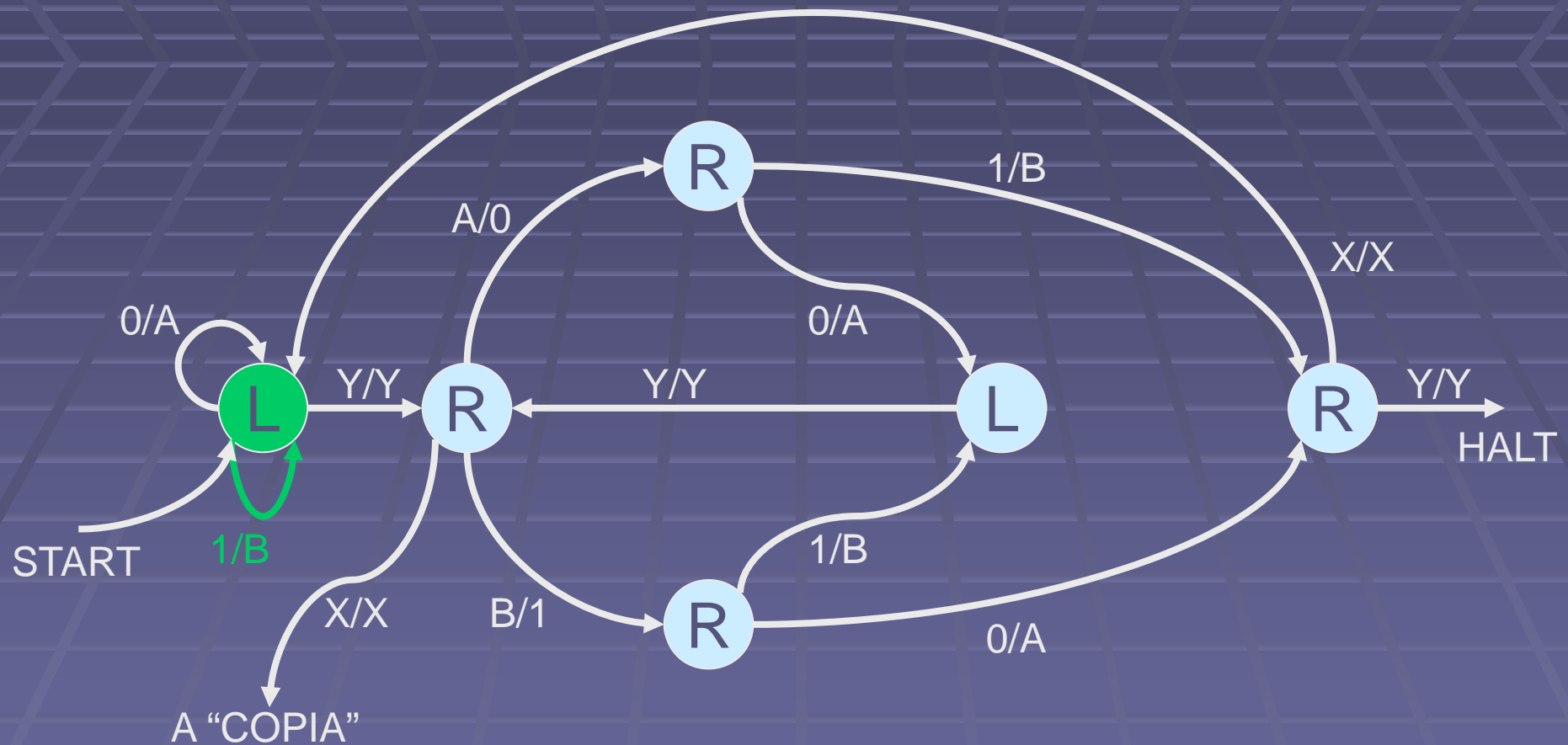
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Máquina Localizadora

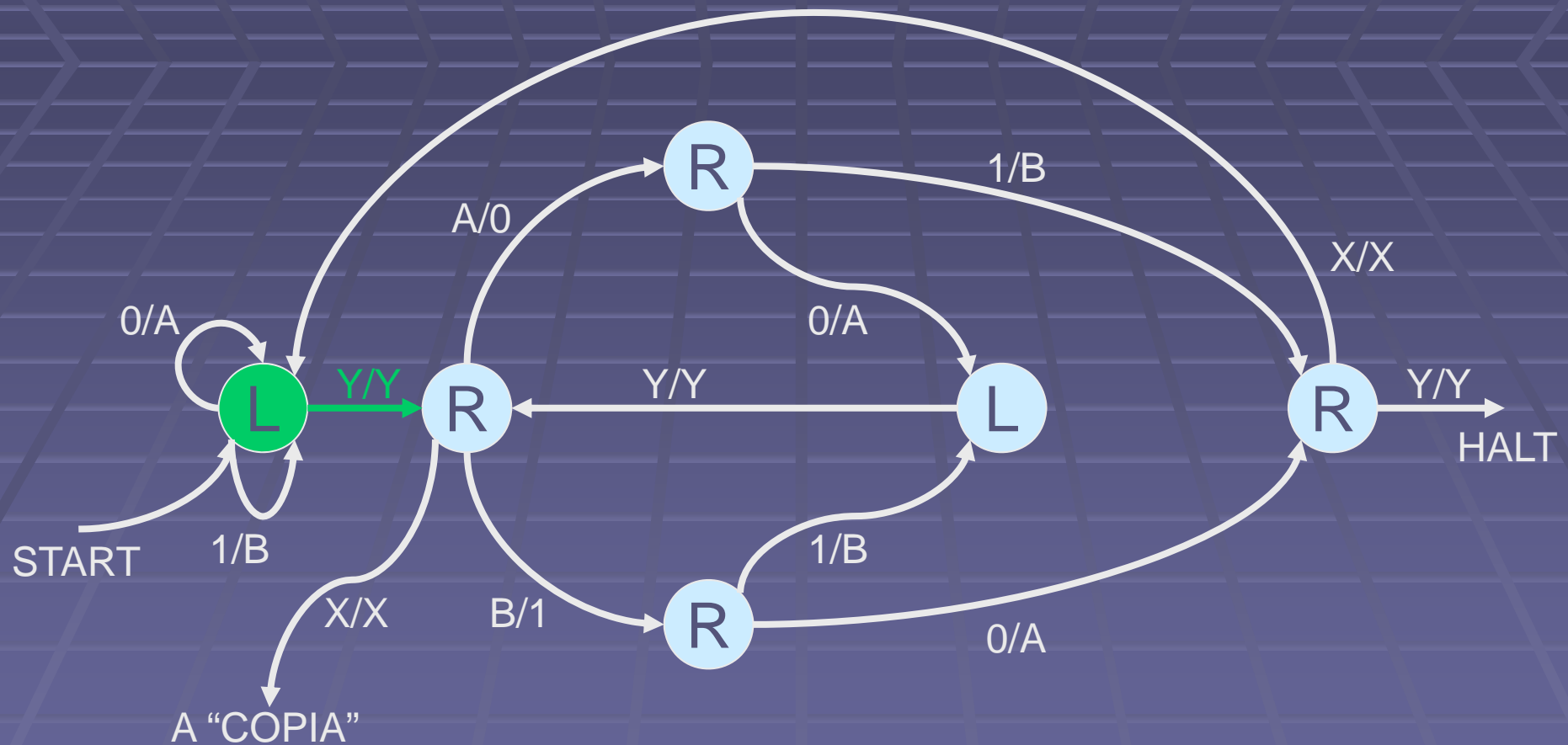


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Máquina Localizadora

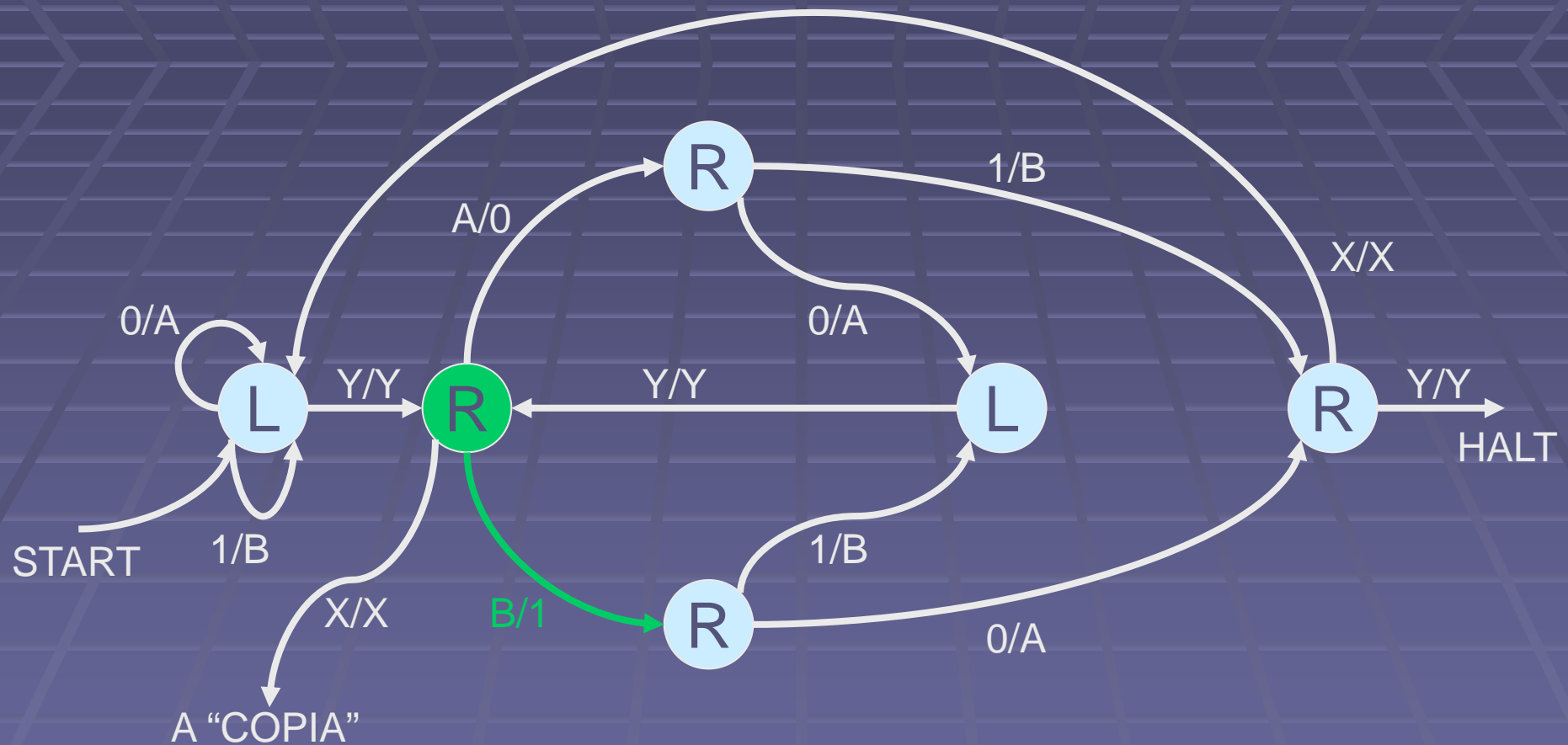


Máquina Localizadora



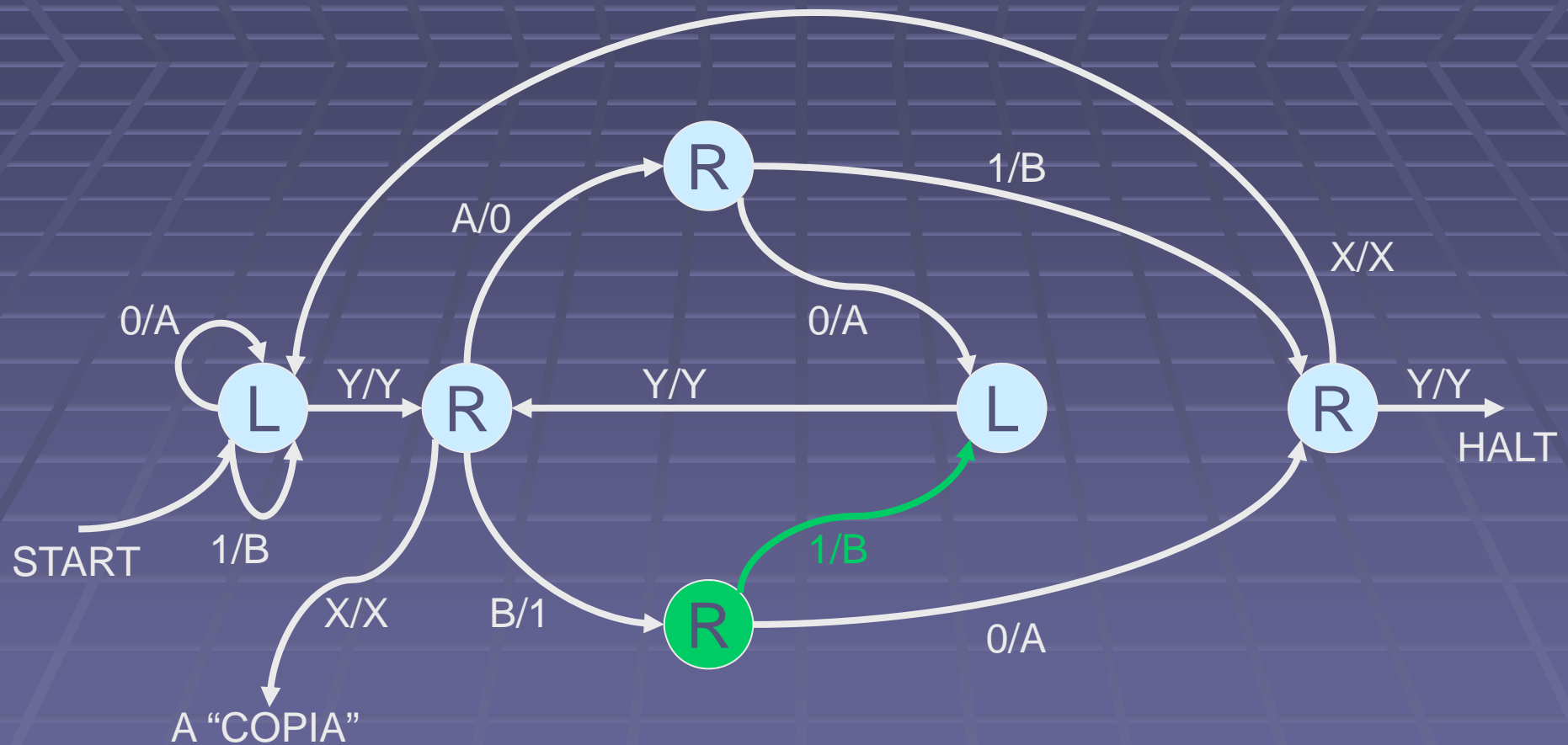
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Máquina Localizadora



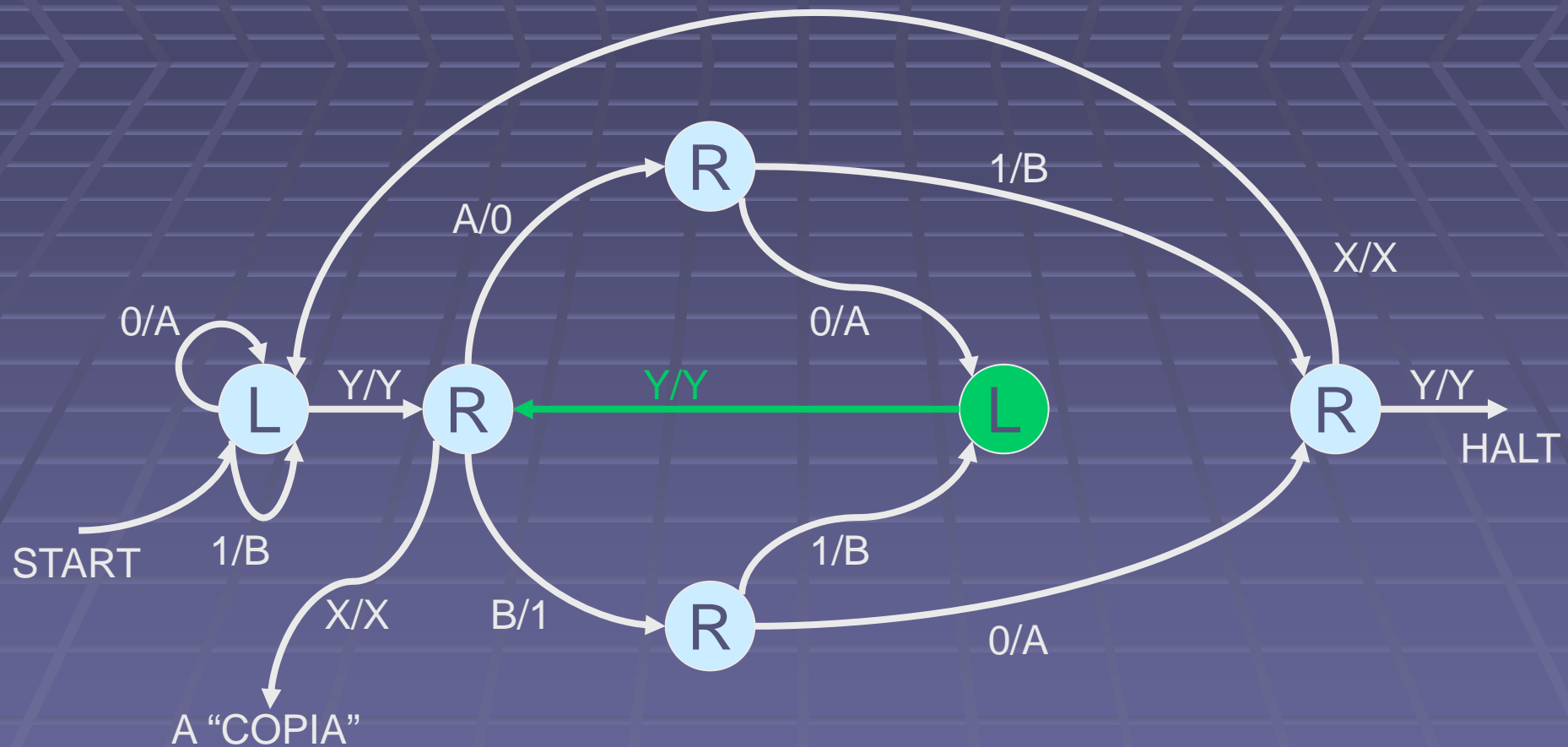
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Máquina Localizadora



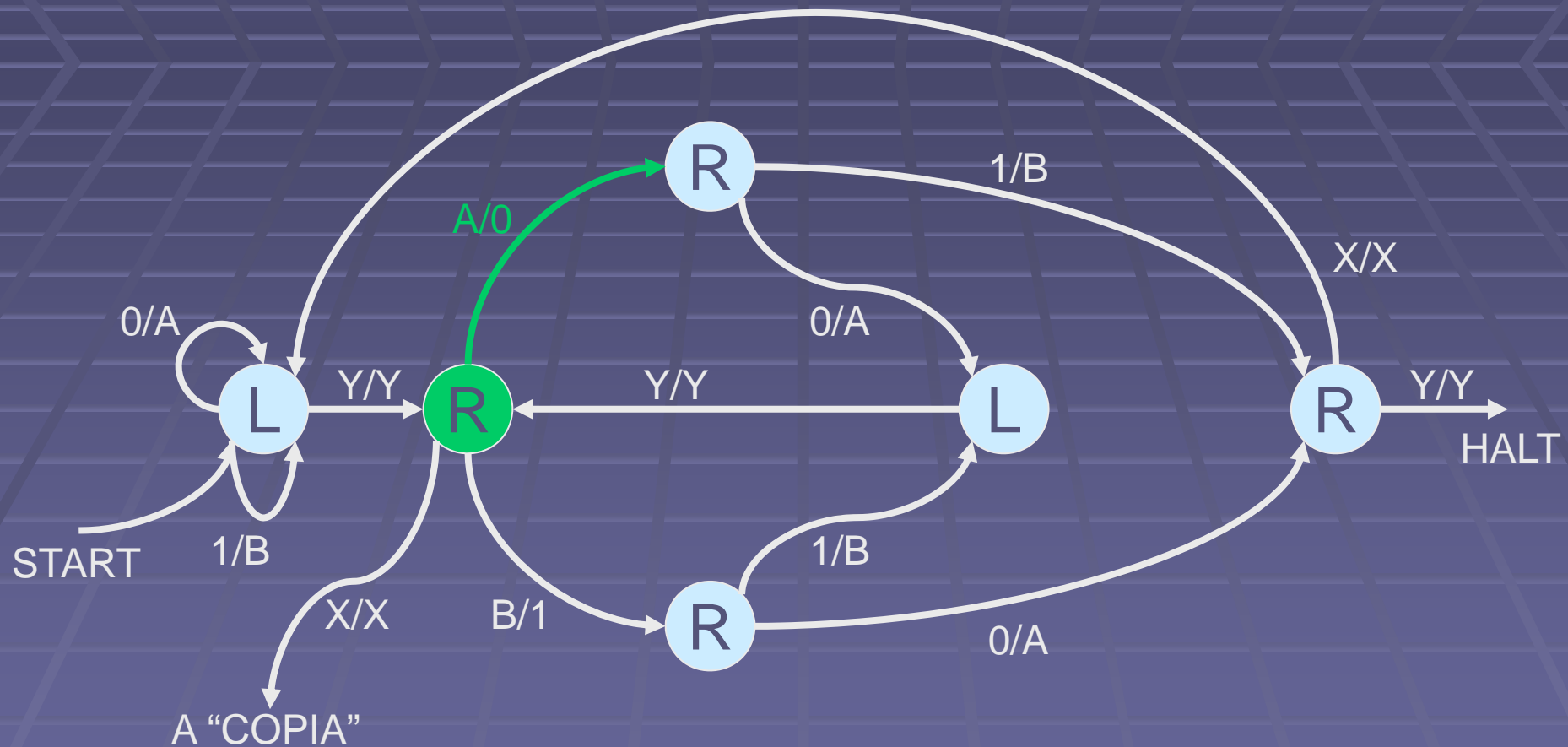
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Máquina Localizadora



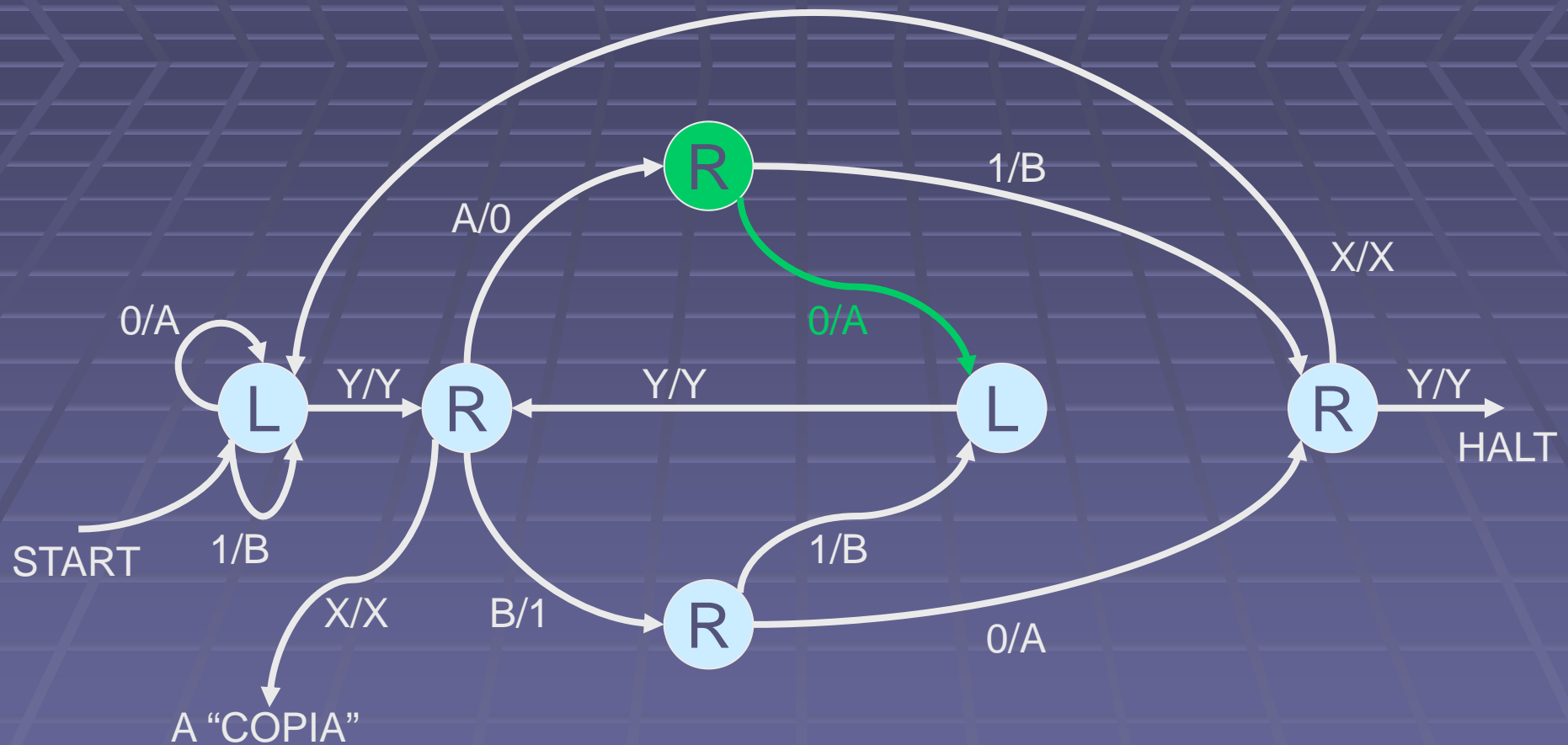
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Máquina Localizadora



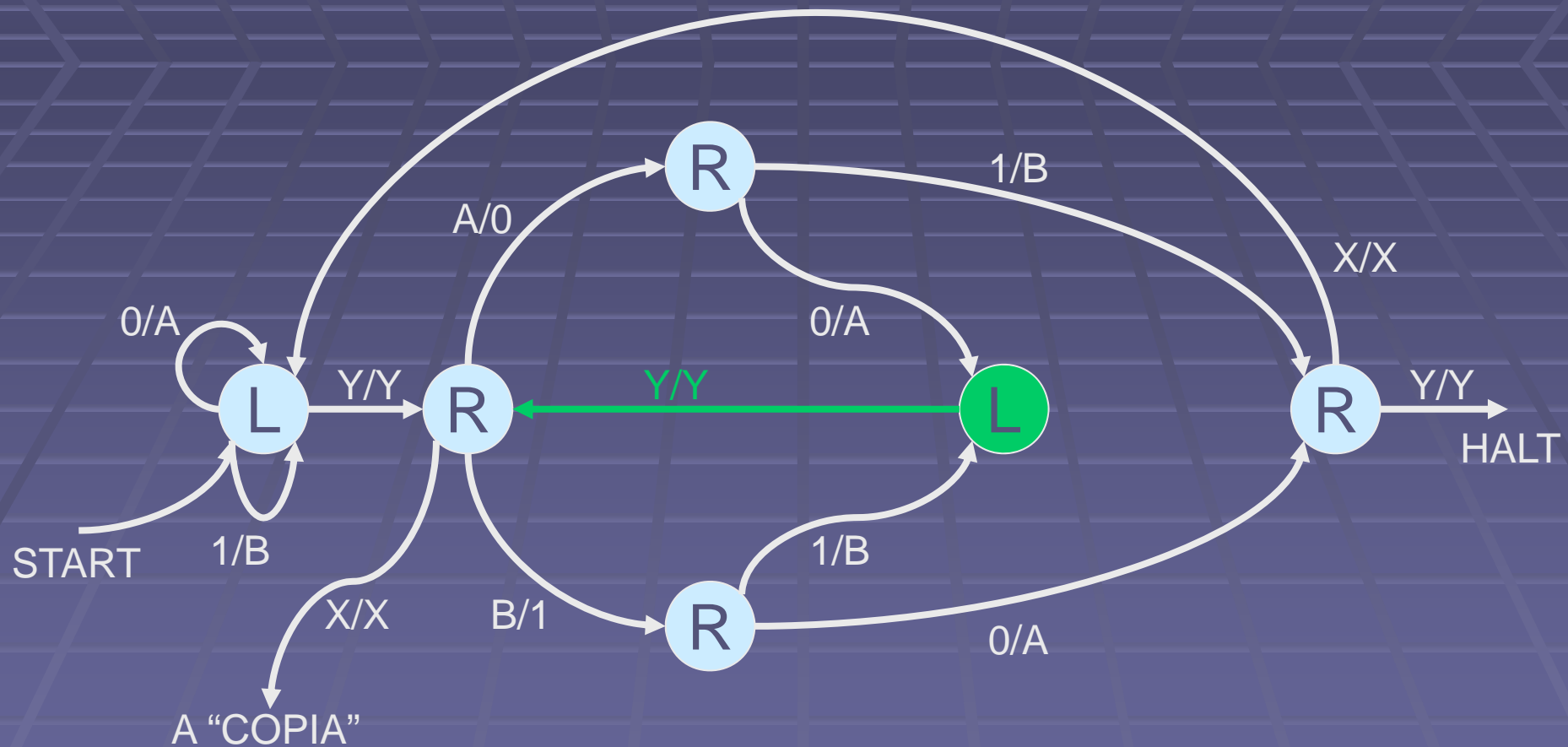
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Máquina Localizadora



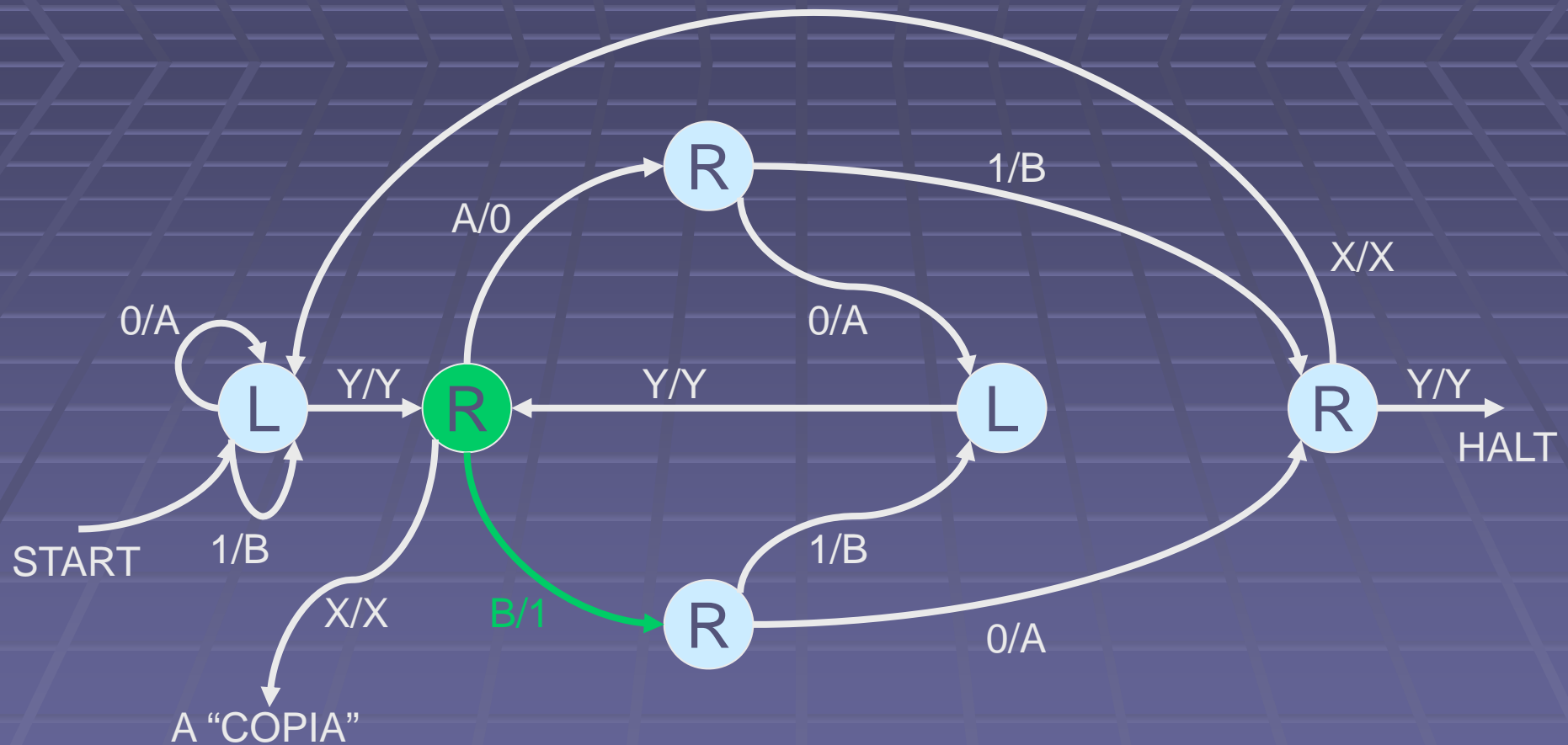
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Máquina Localizadora



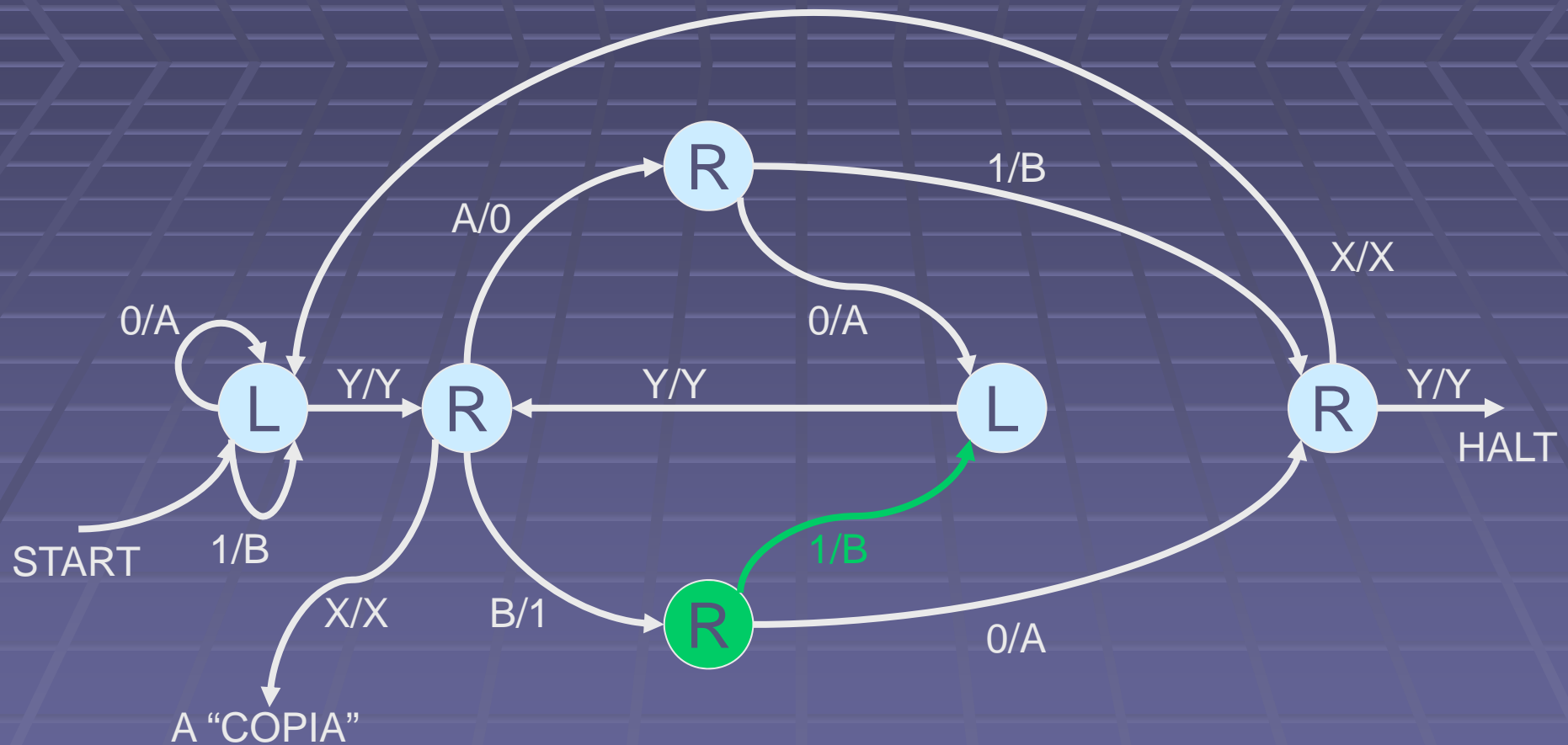
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Máquina Localizadora



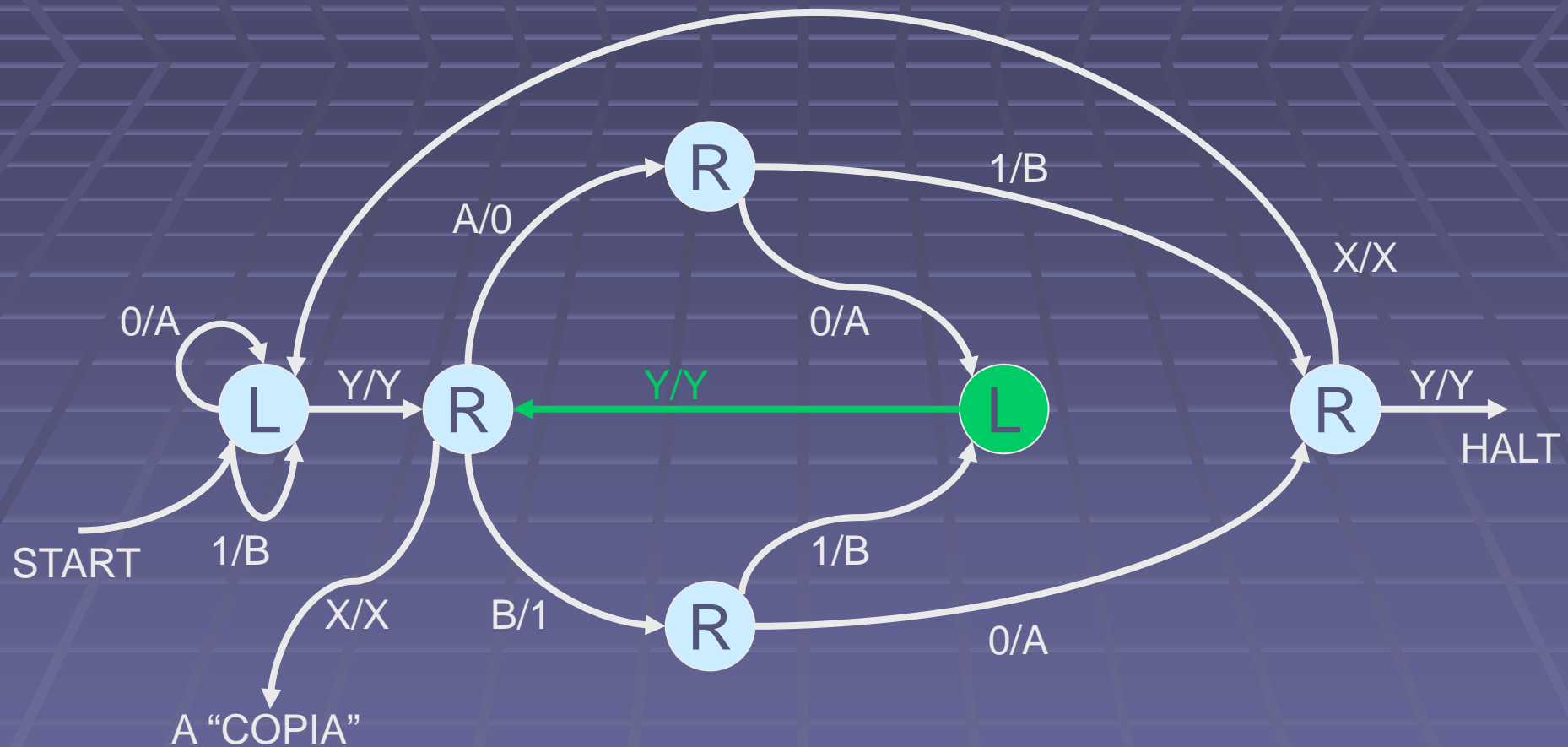
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Máquina Localizadora



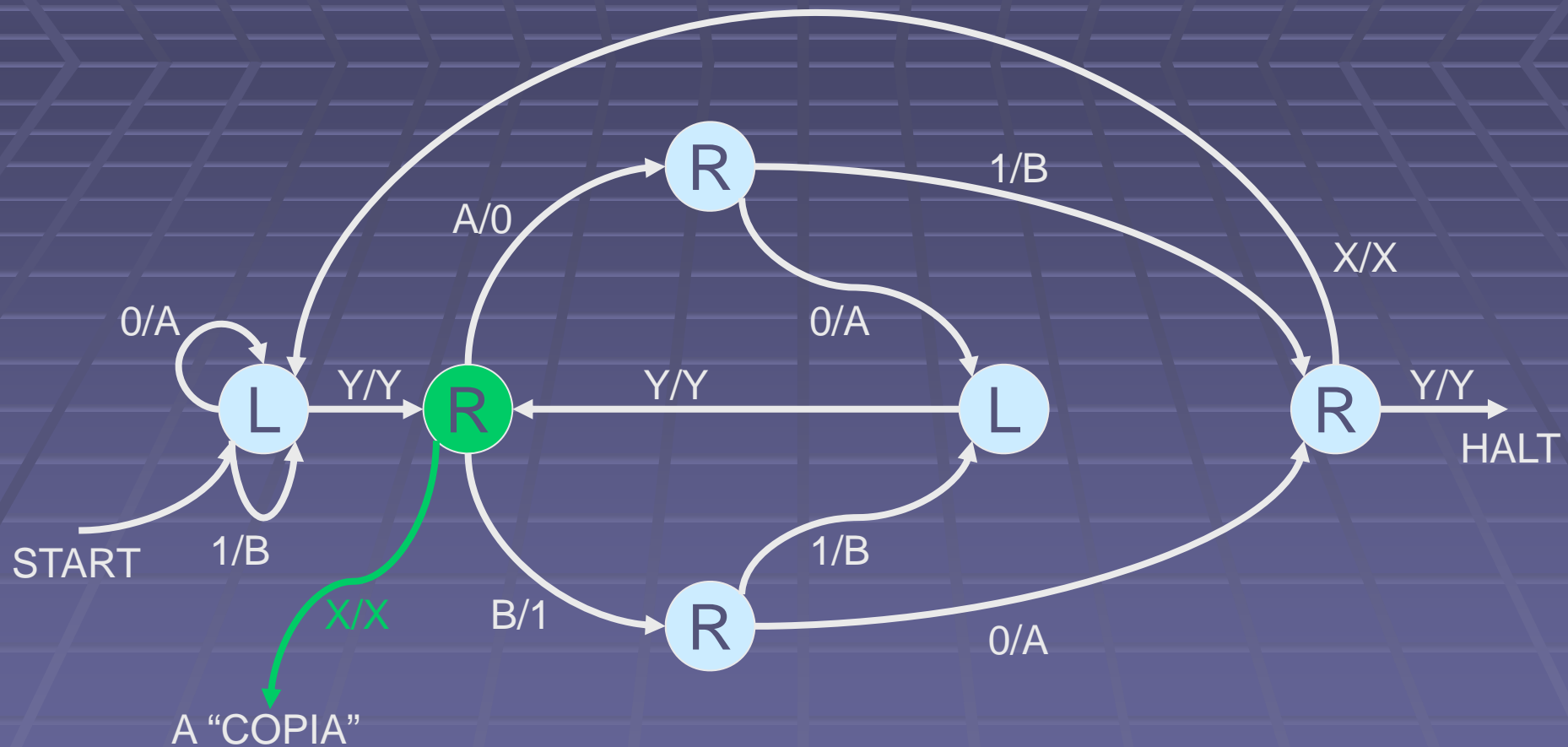
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Máquina Localizadora



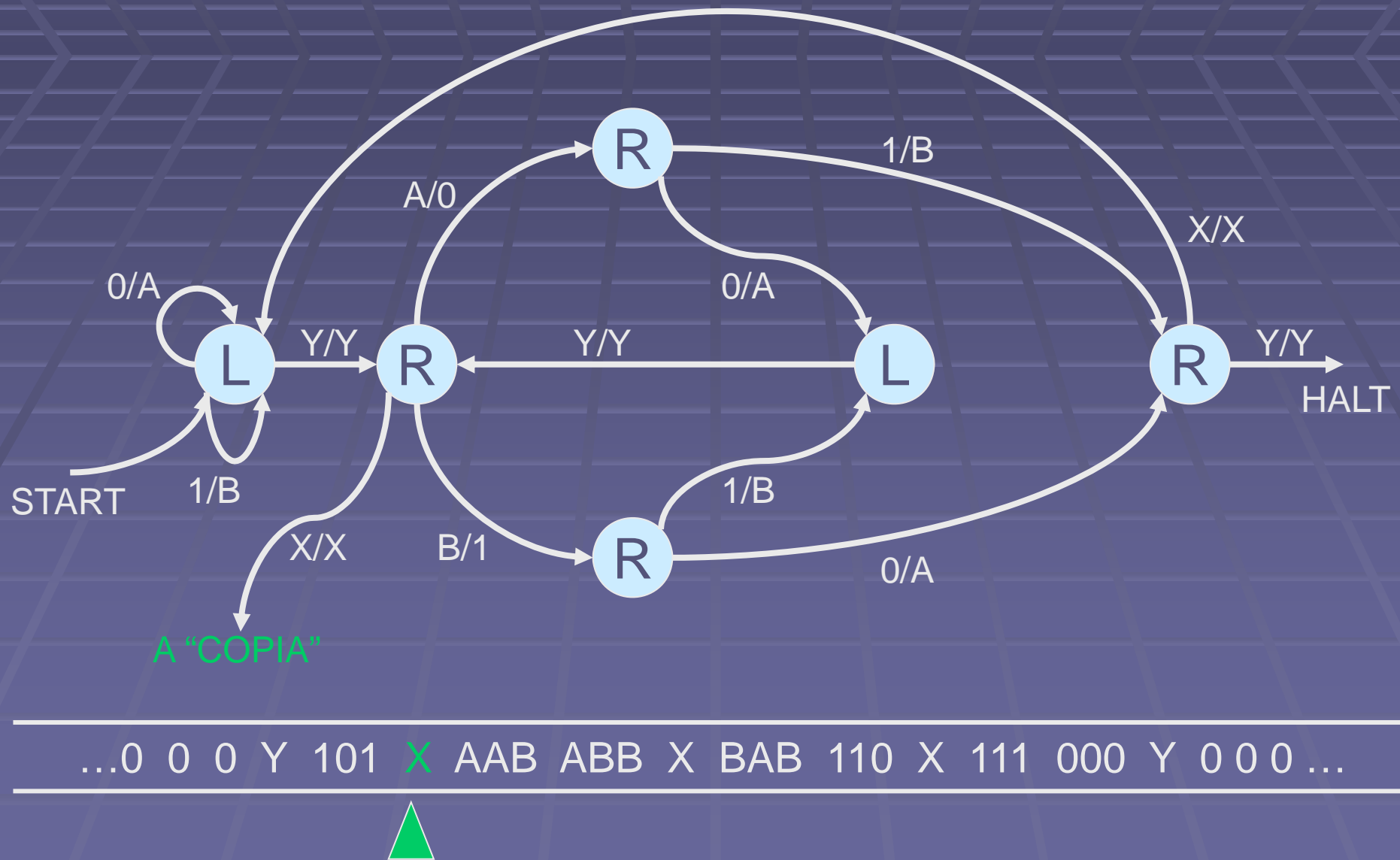
...0 0 0 **Y** 101 X AAB ABB X BAB 110 X 111 000 Y 0 0 0 ...

Máquina Localizadora

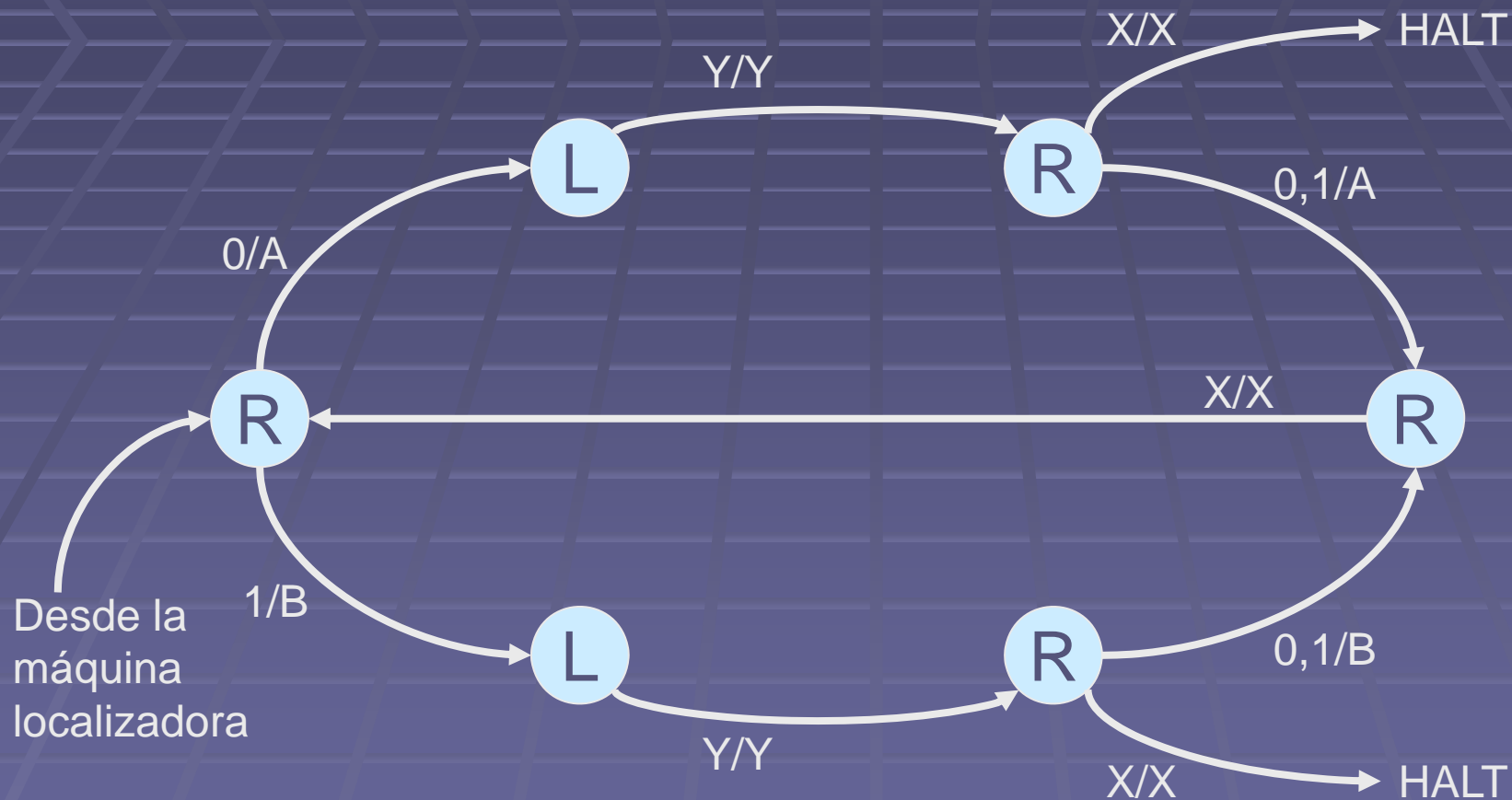


...0 0 0 Y 101 X AAB ABB X BAB 110 X 111 000 Y 0 0 0 ...

Máquina Localizadora



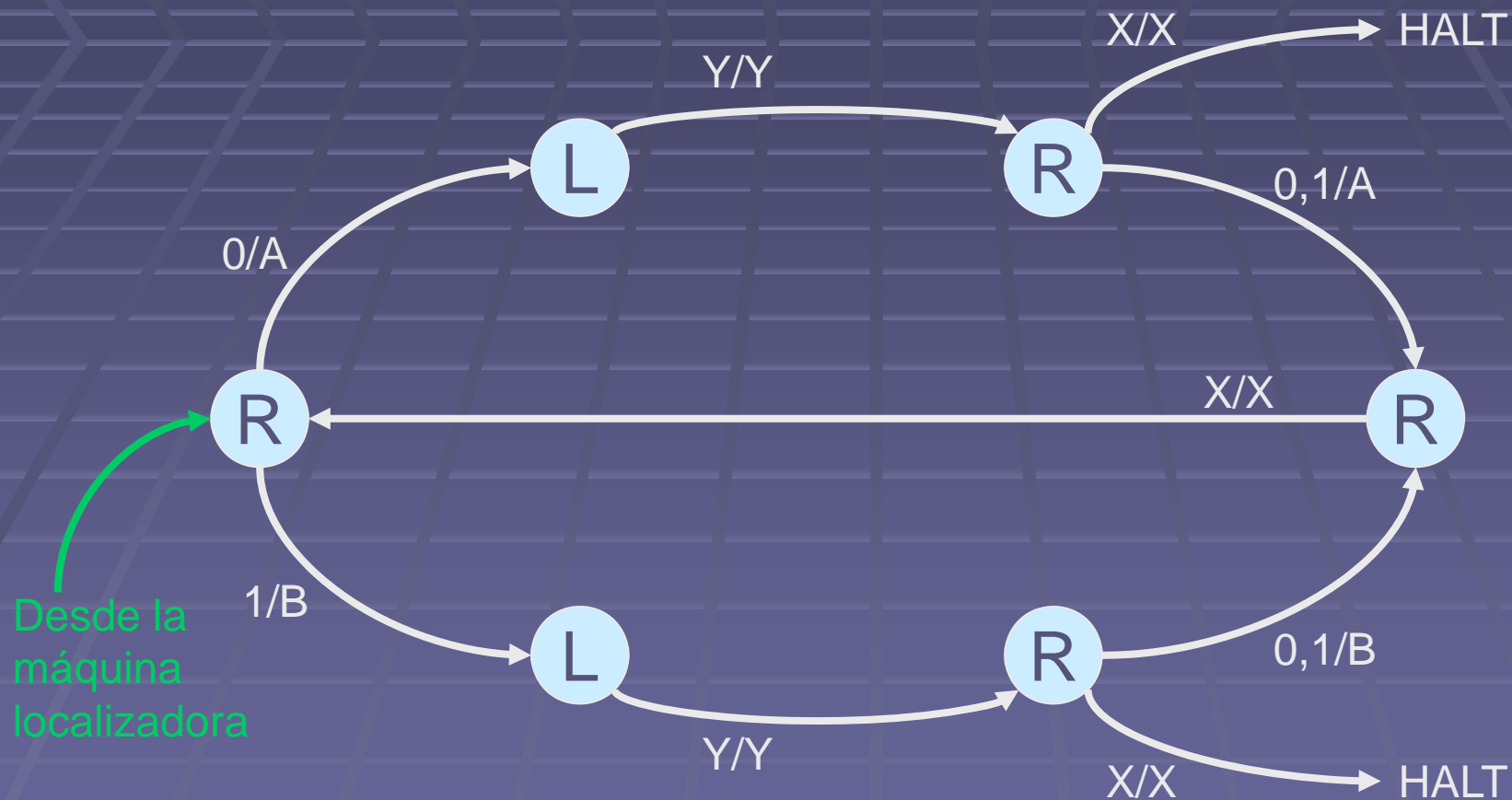
Máquina Copiadora



...0 0 0 Y 101 X AAB ABB X BAB 110 X 111 000 Y 0 0 0 ...

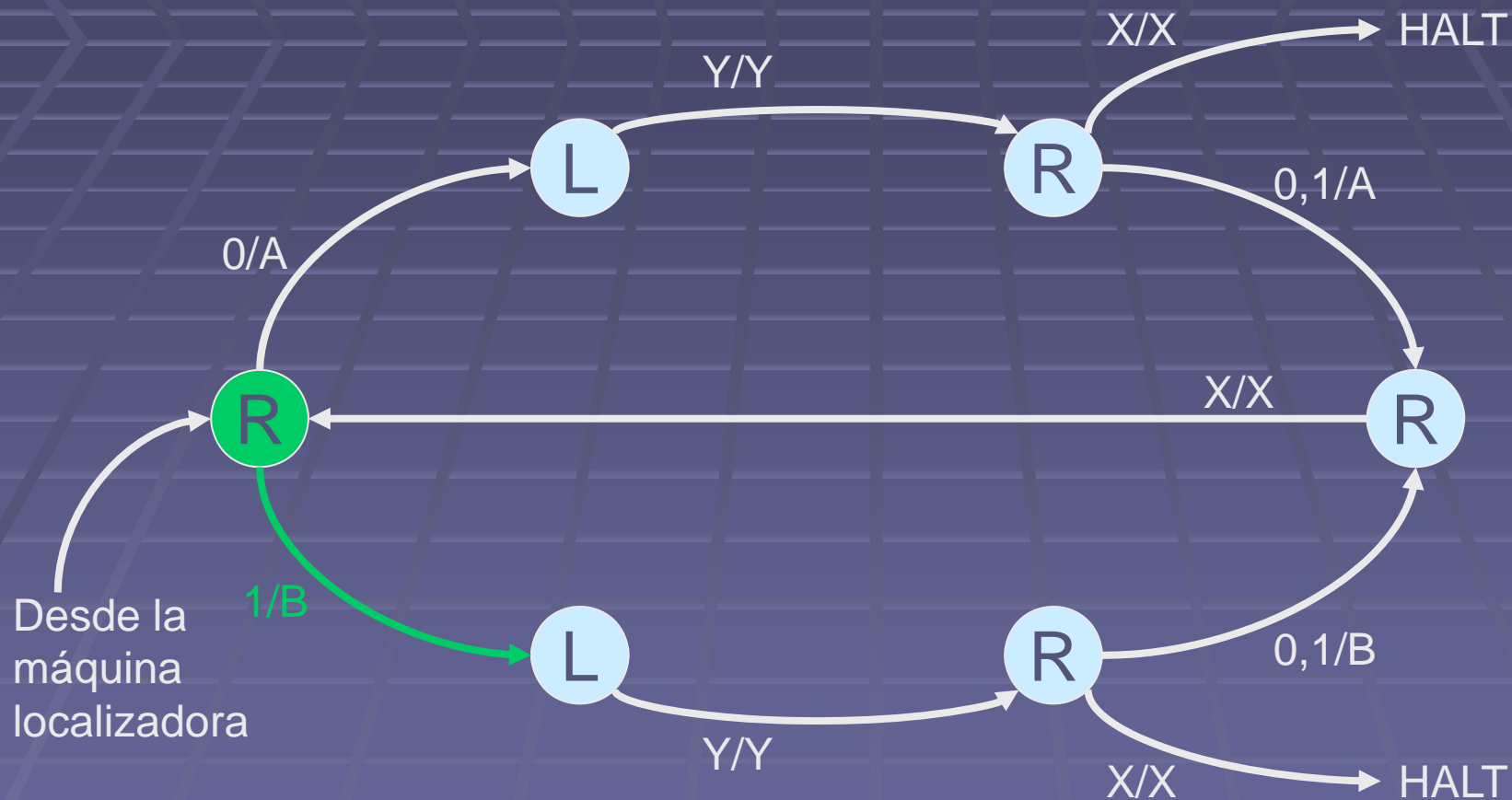


Máquina Copiadora



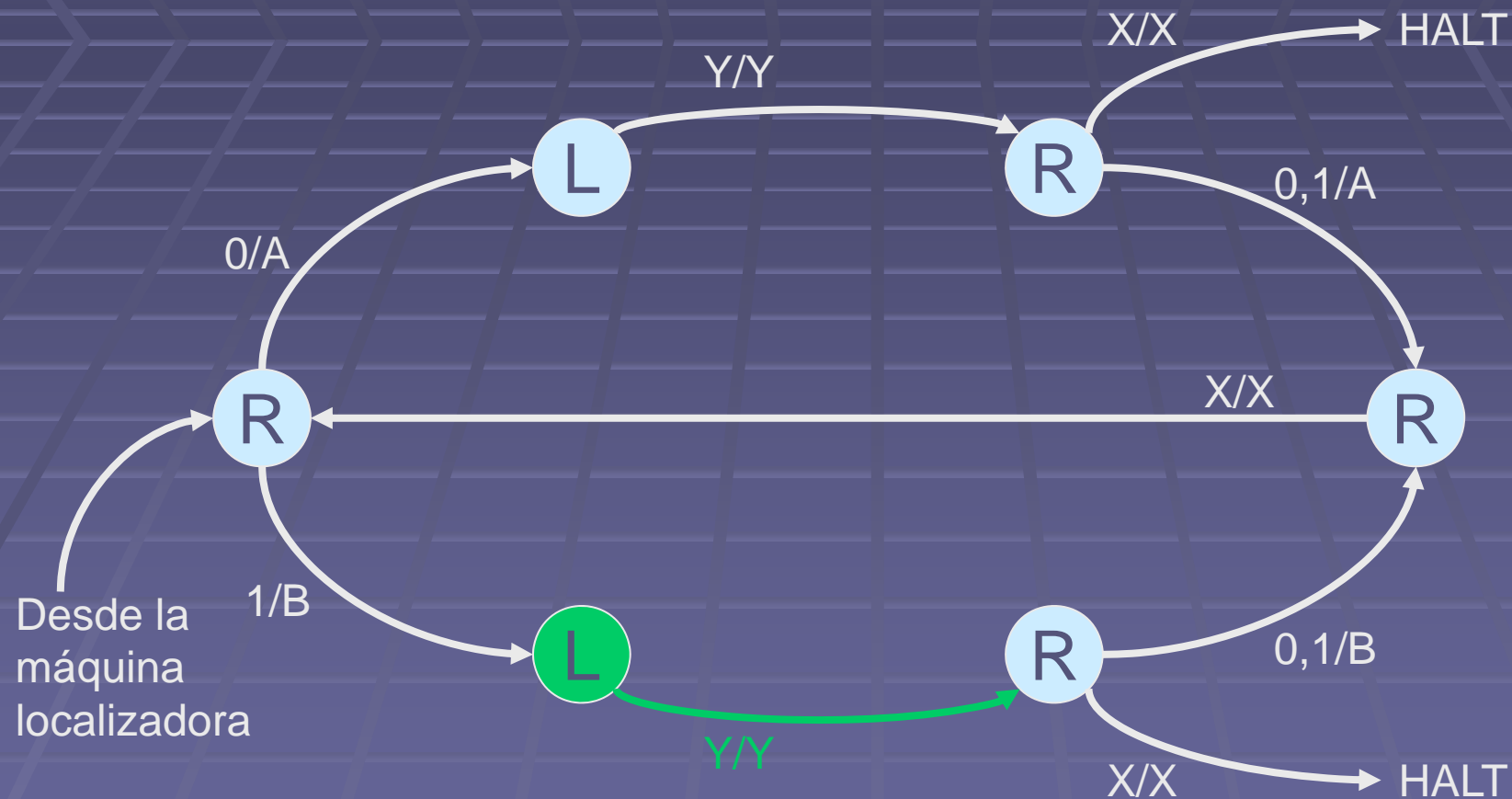
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Máquina Copiadora



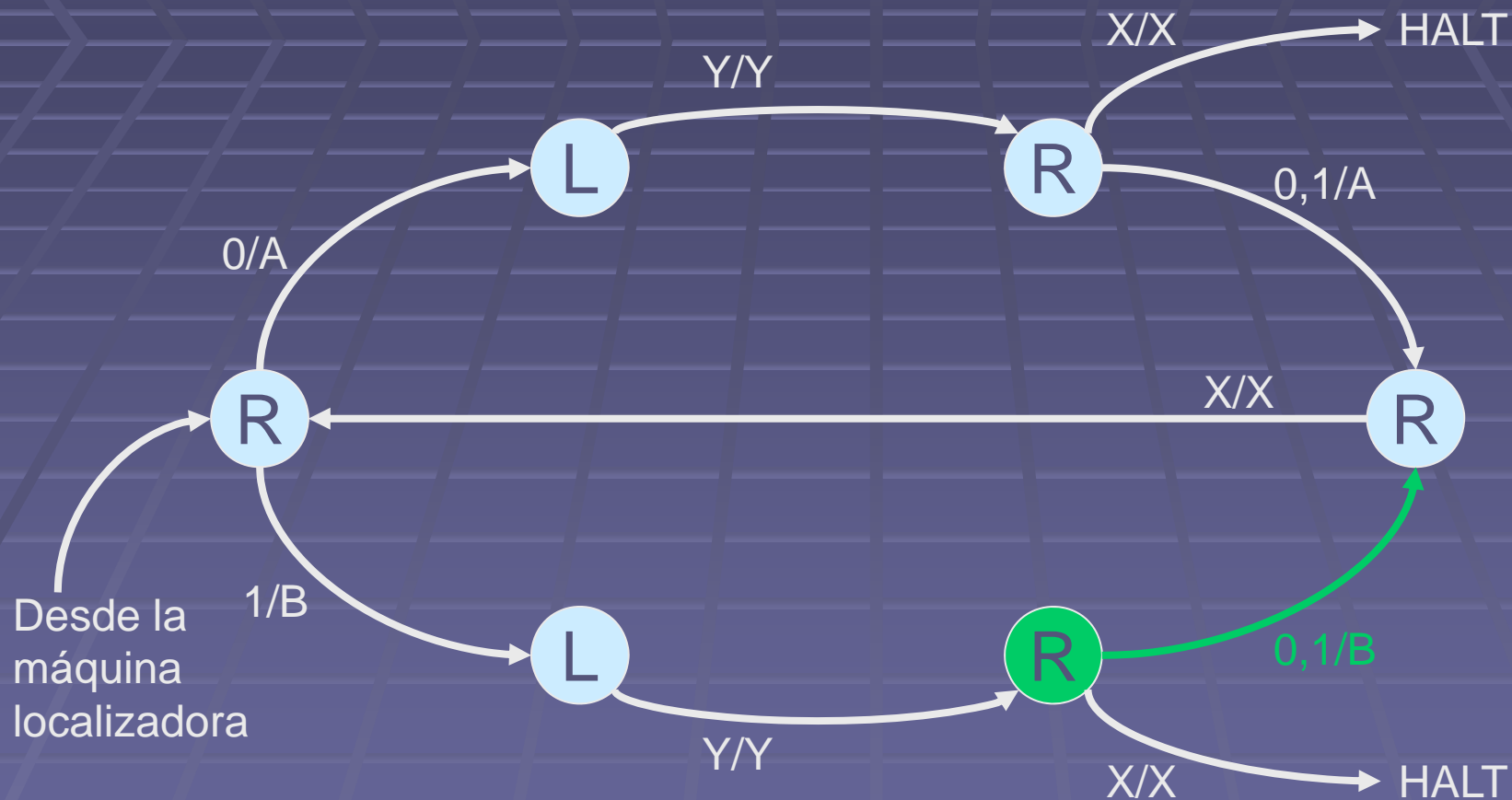
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Máquina Copiadora



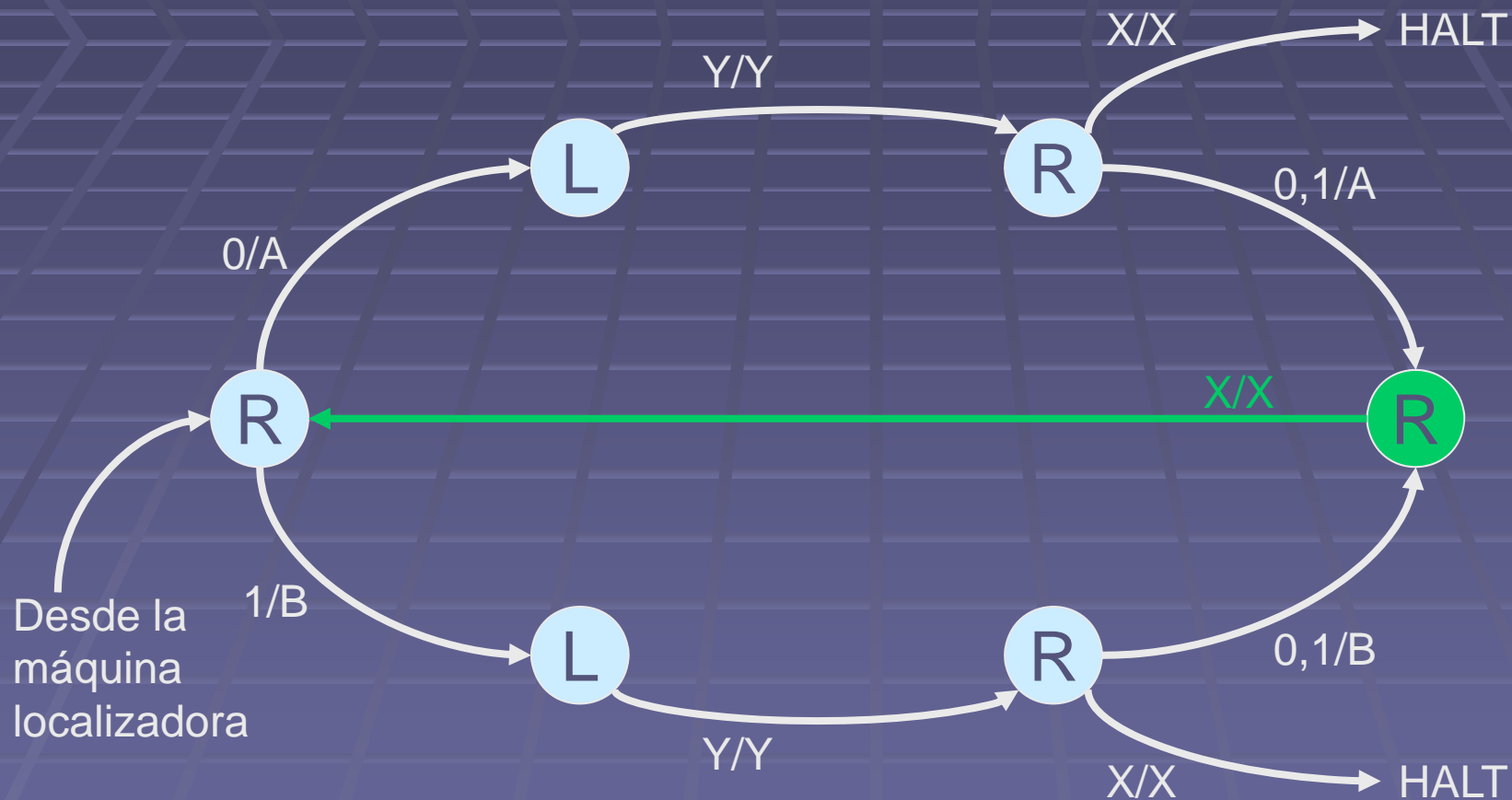
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Máquina Copiadora



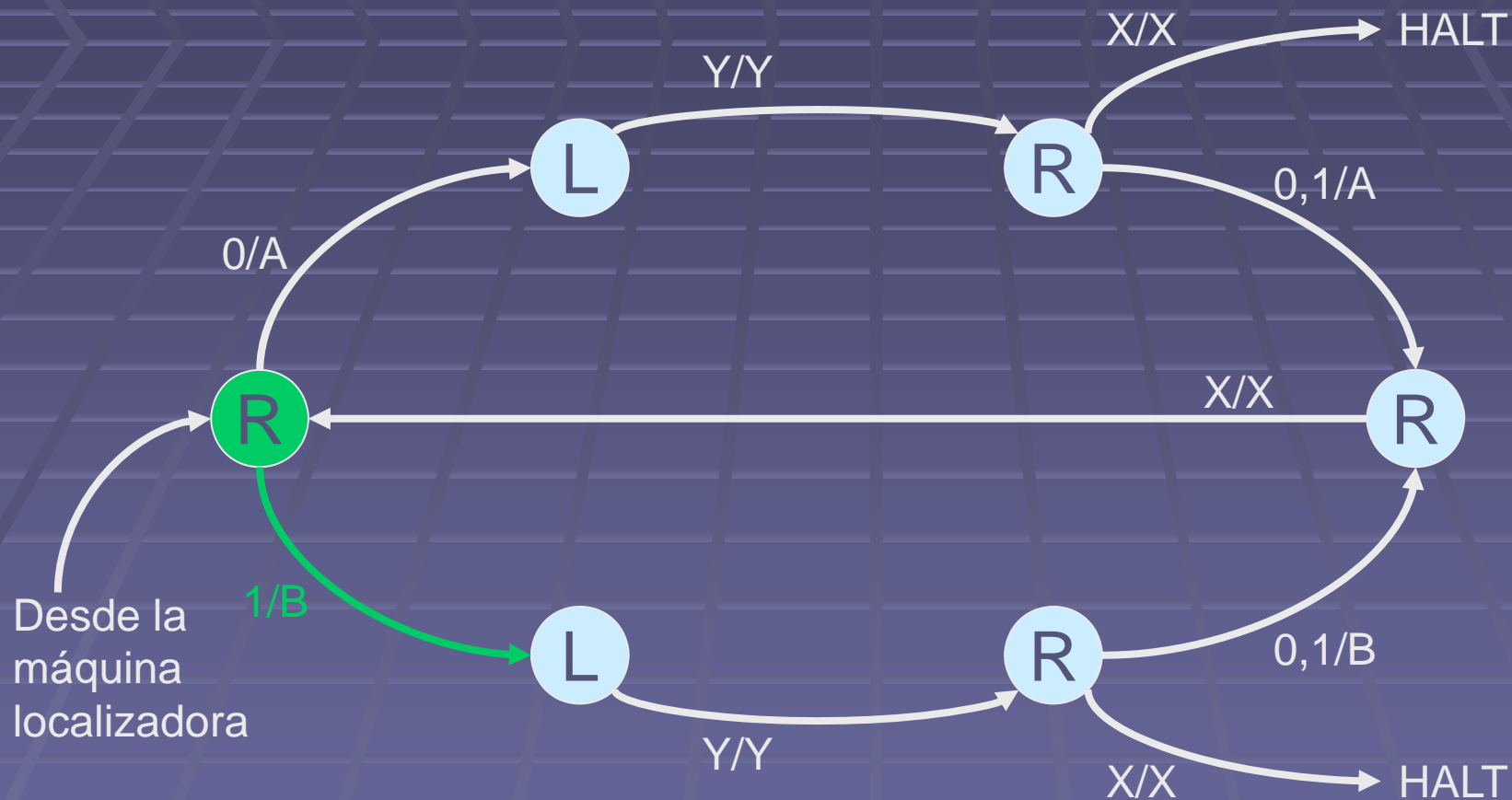
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Máquina Copiadora



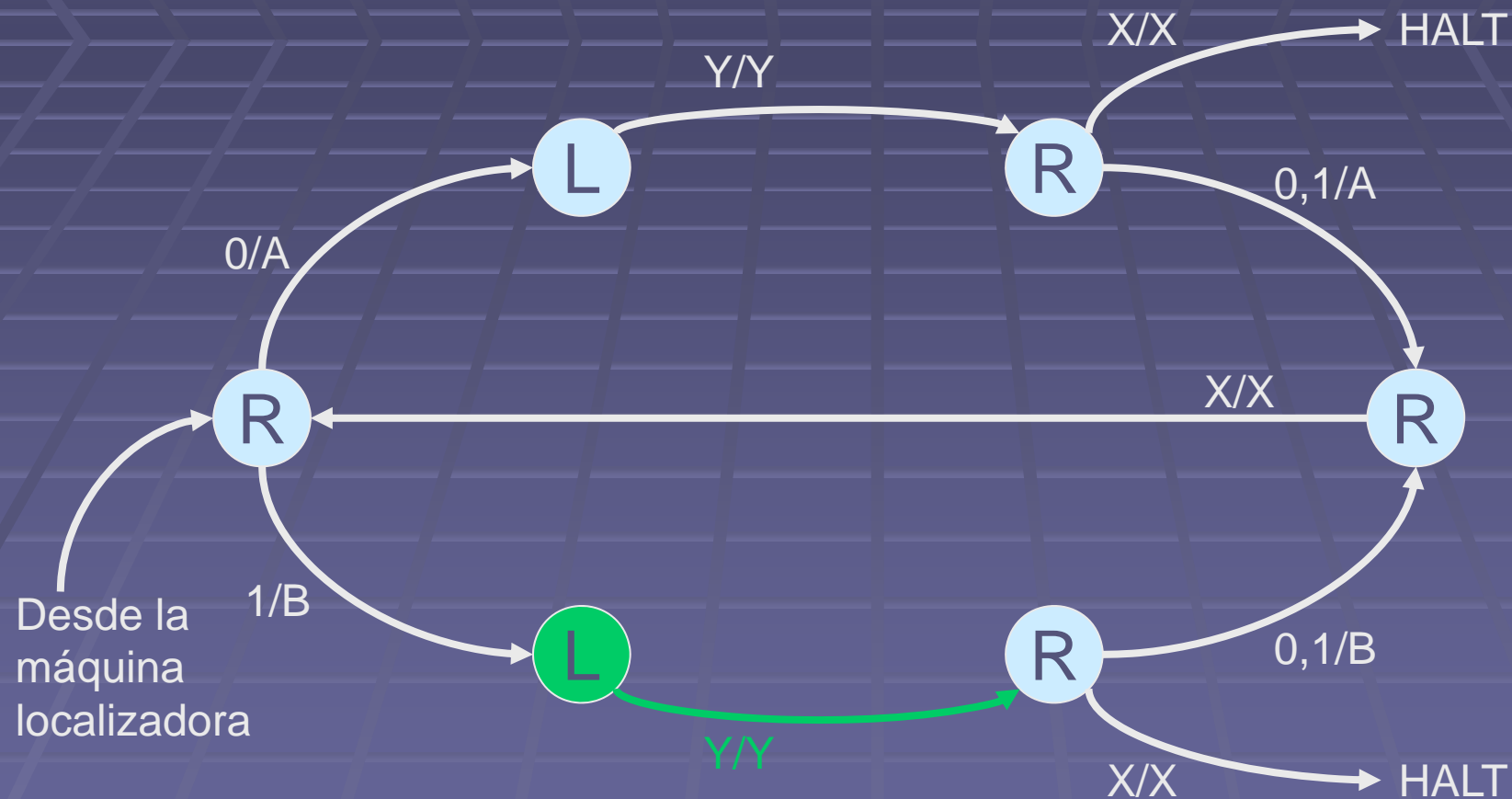
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Máquina Copiadora



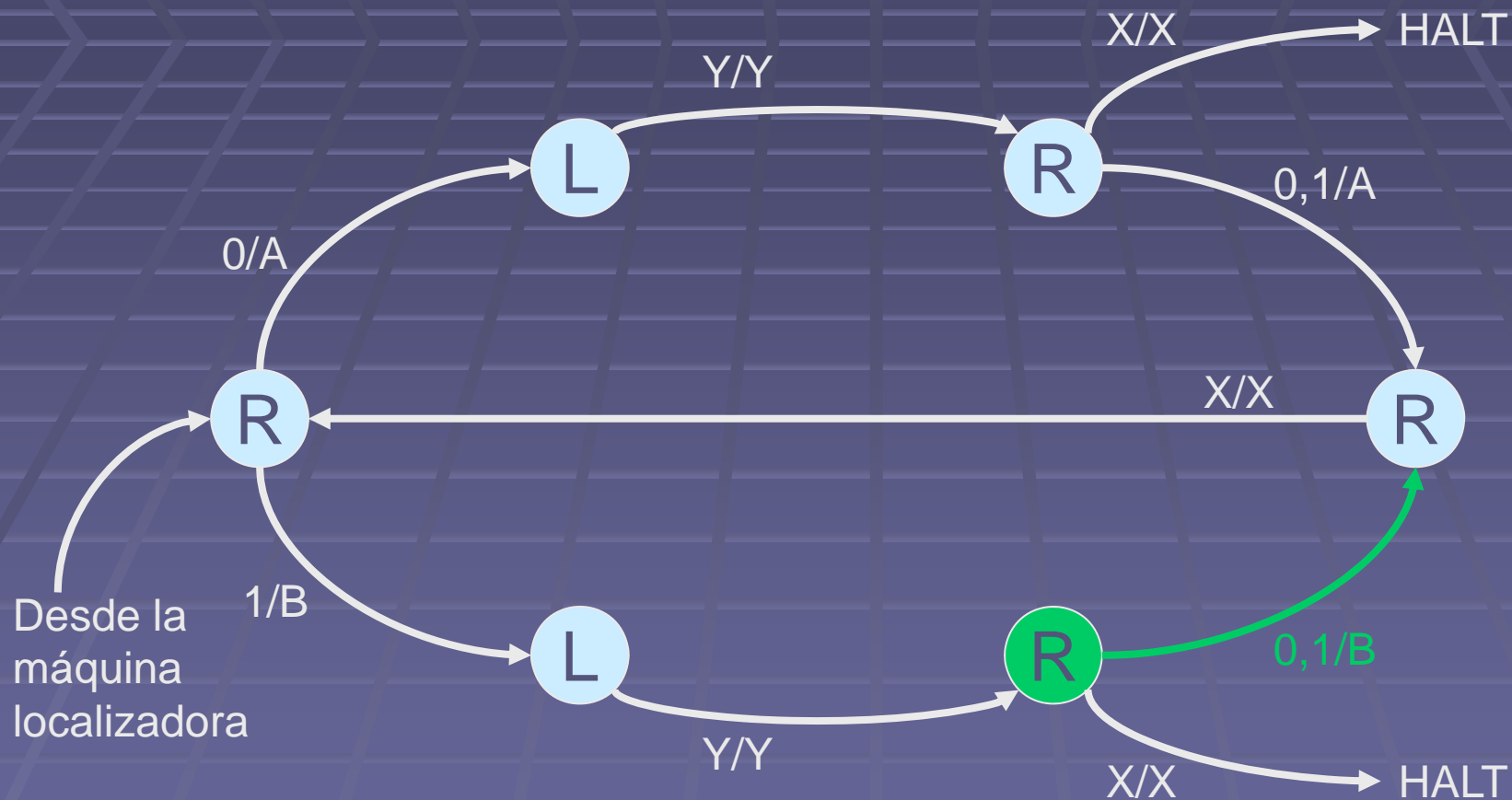
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Máquina Copiadora



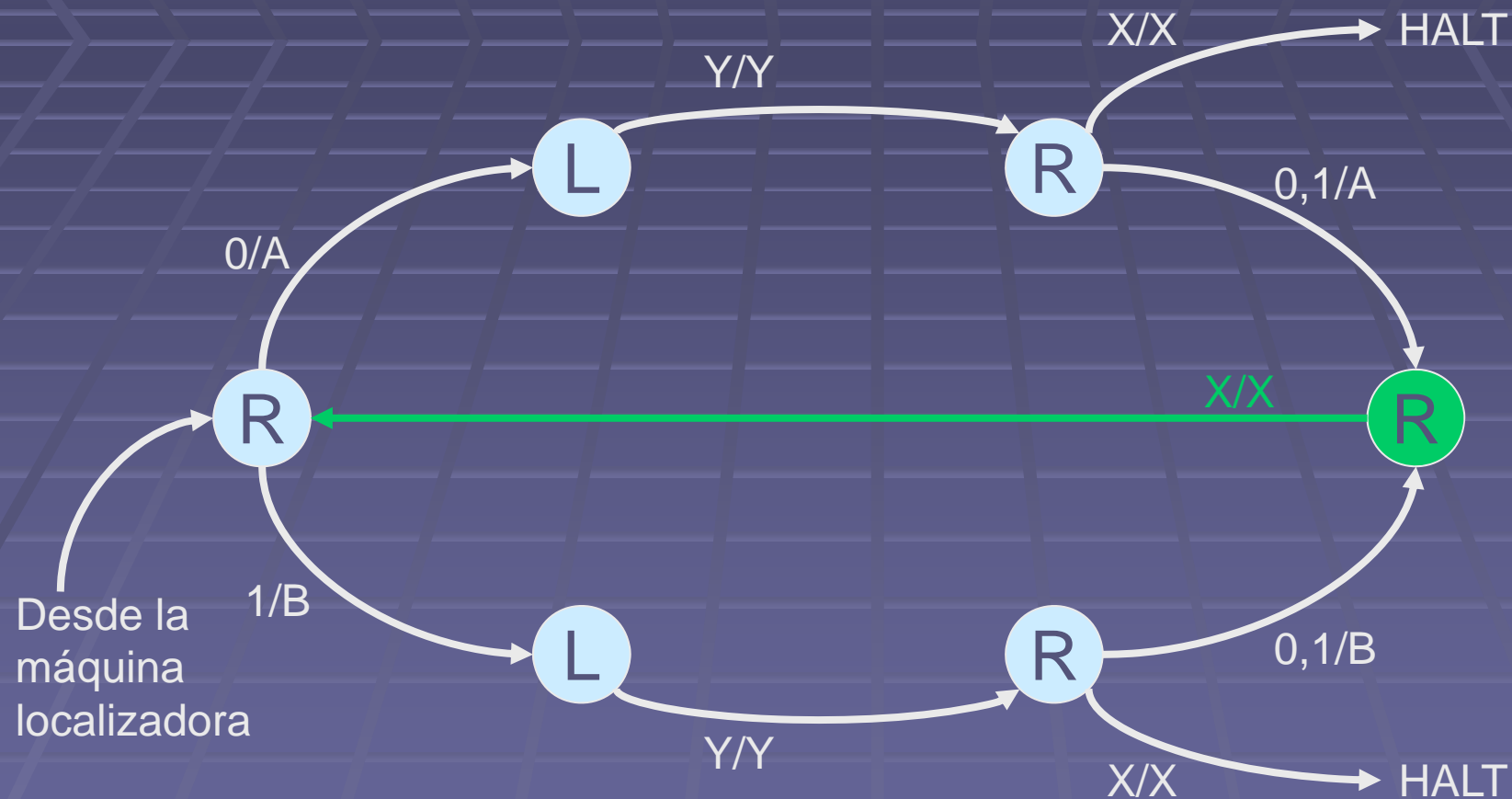
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Máquina Copiadora



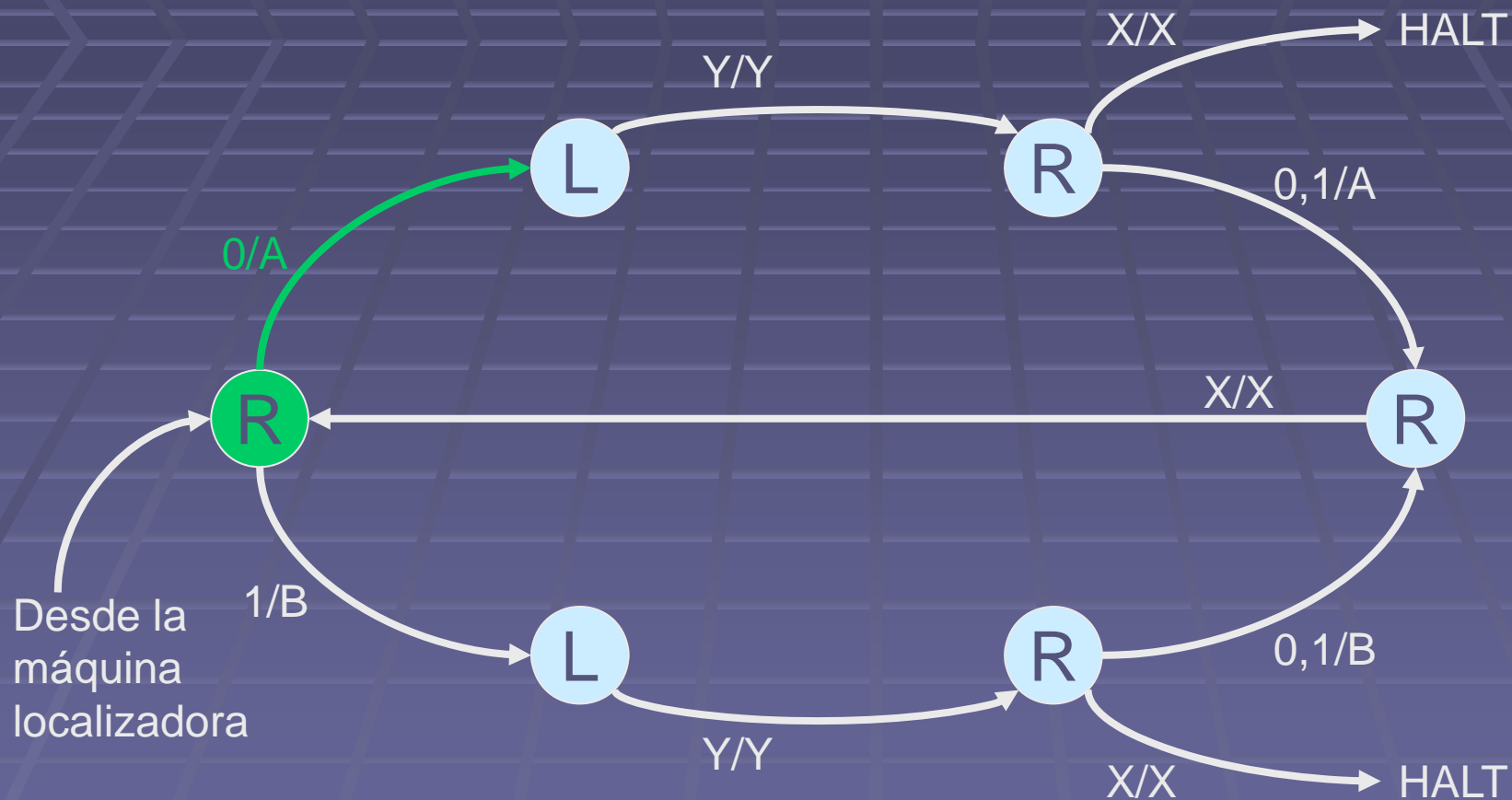
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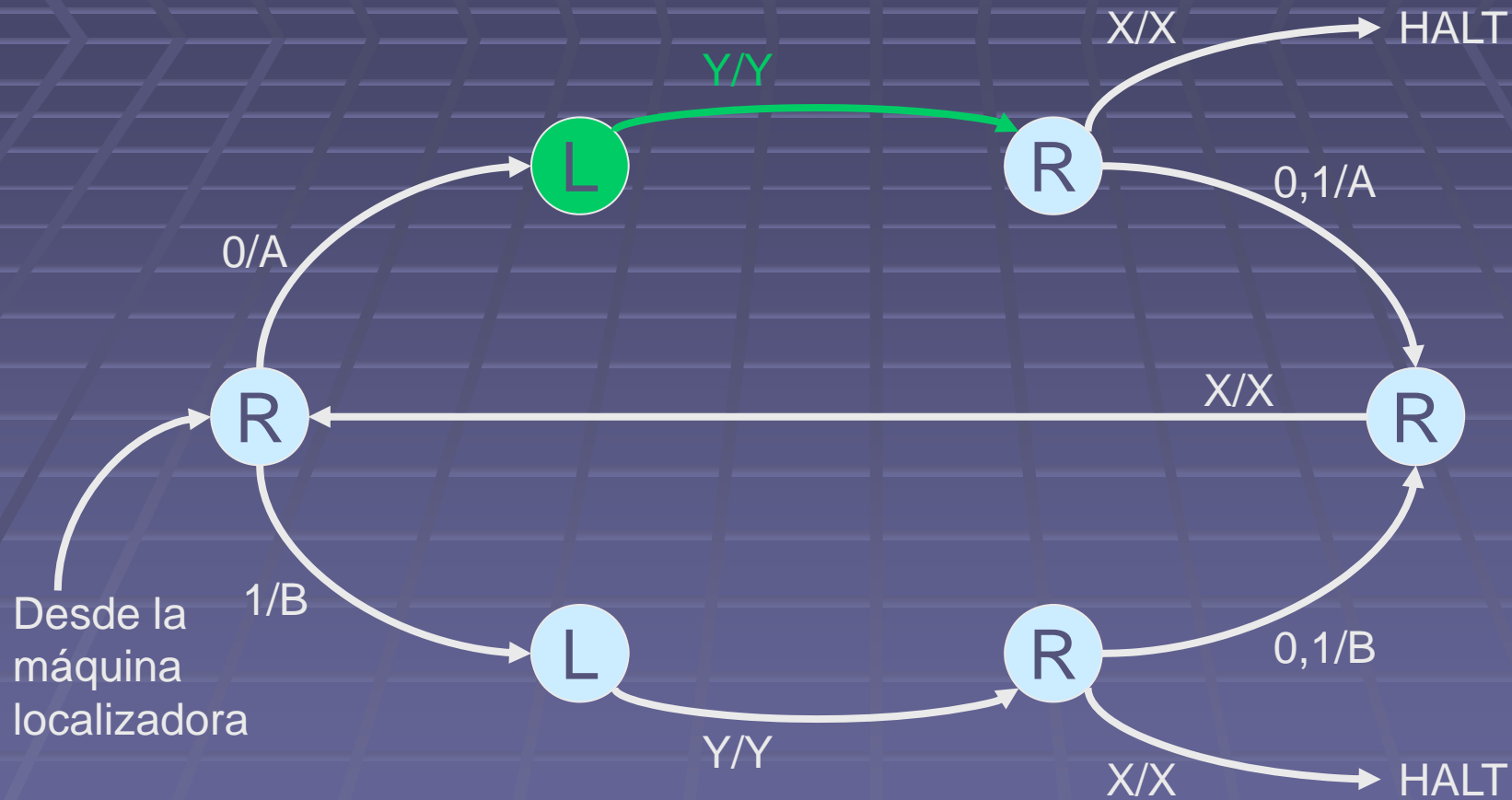
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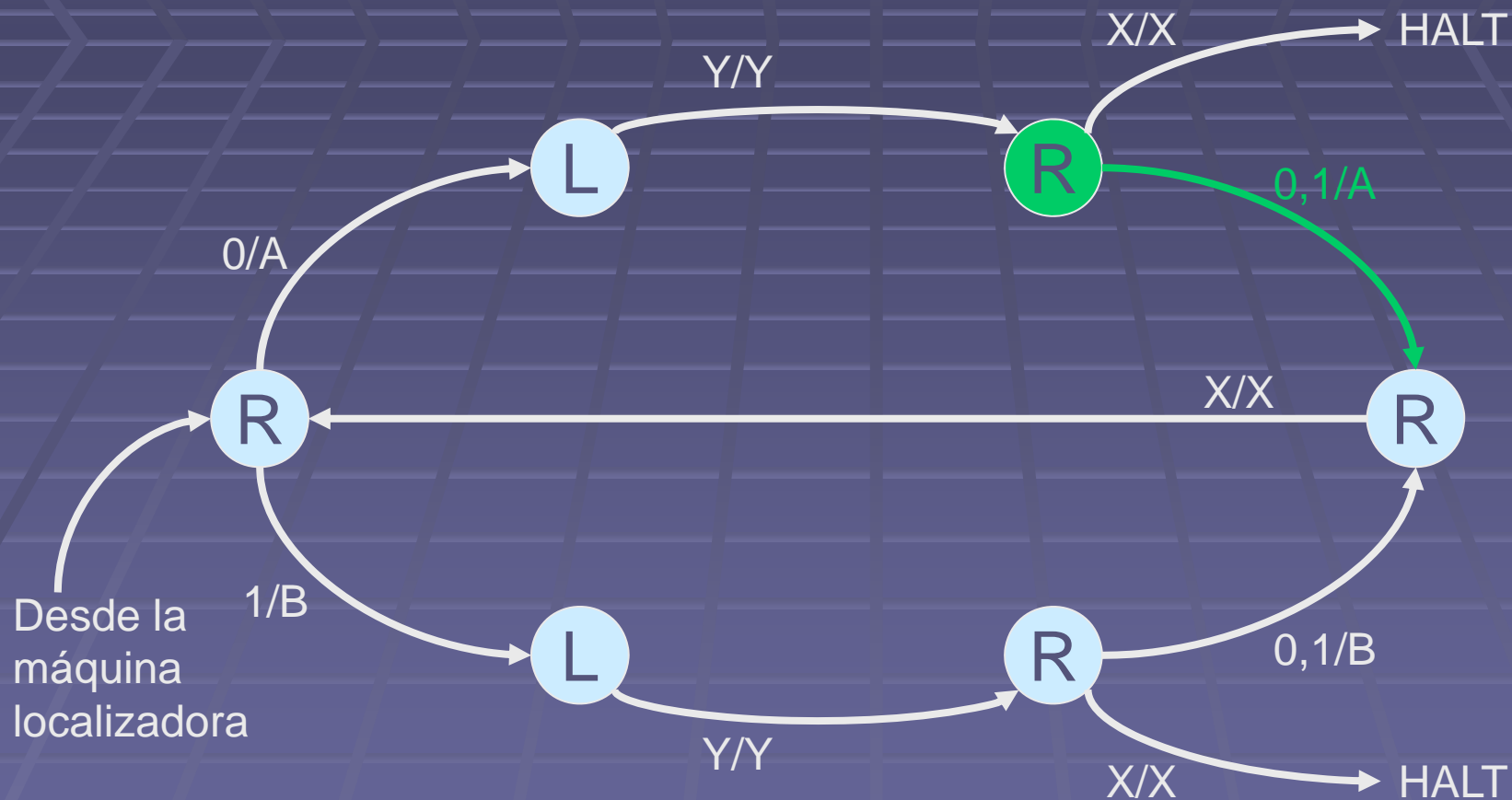
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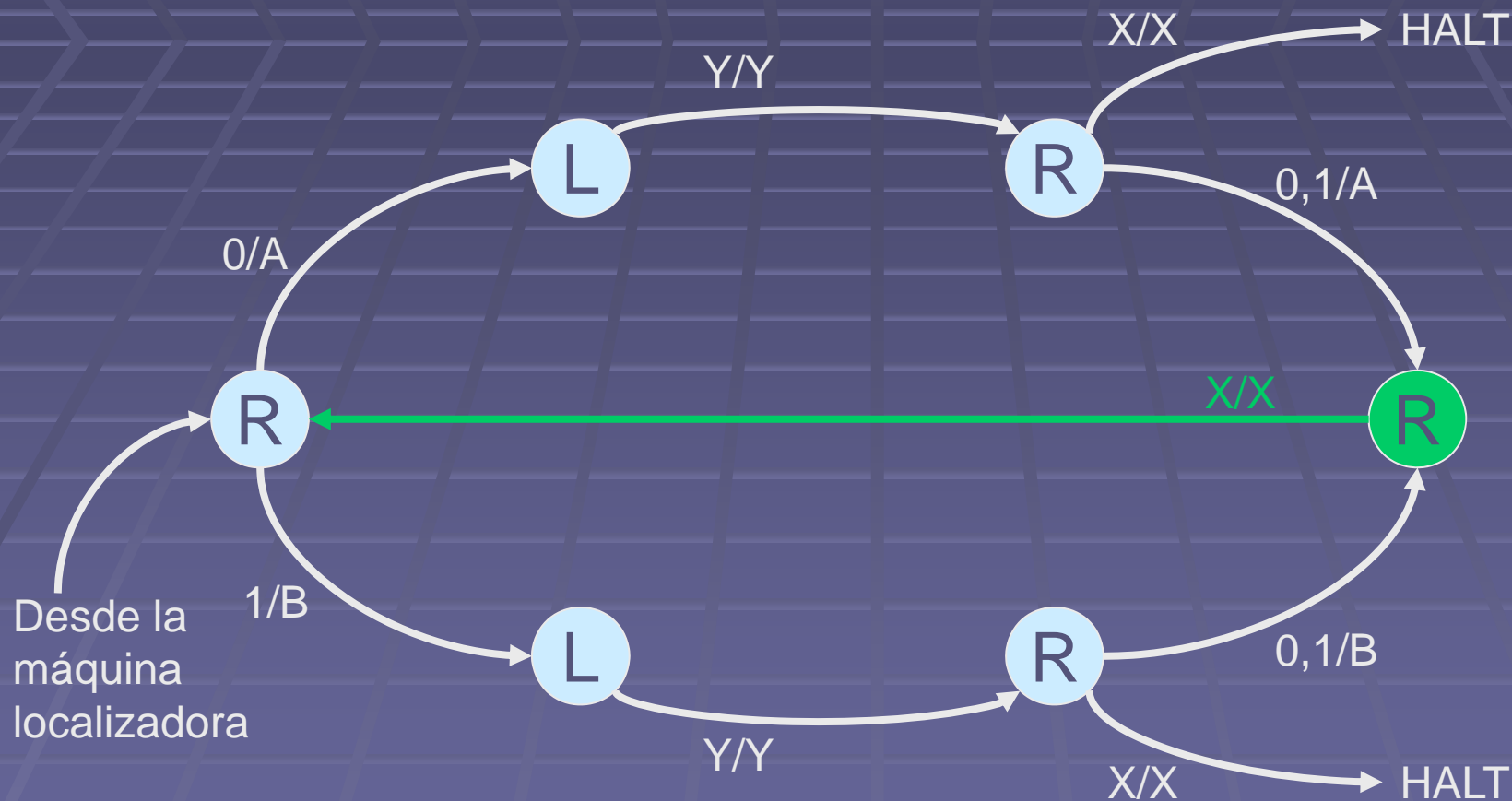
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Máquina Copiadora



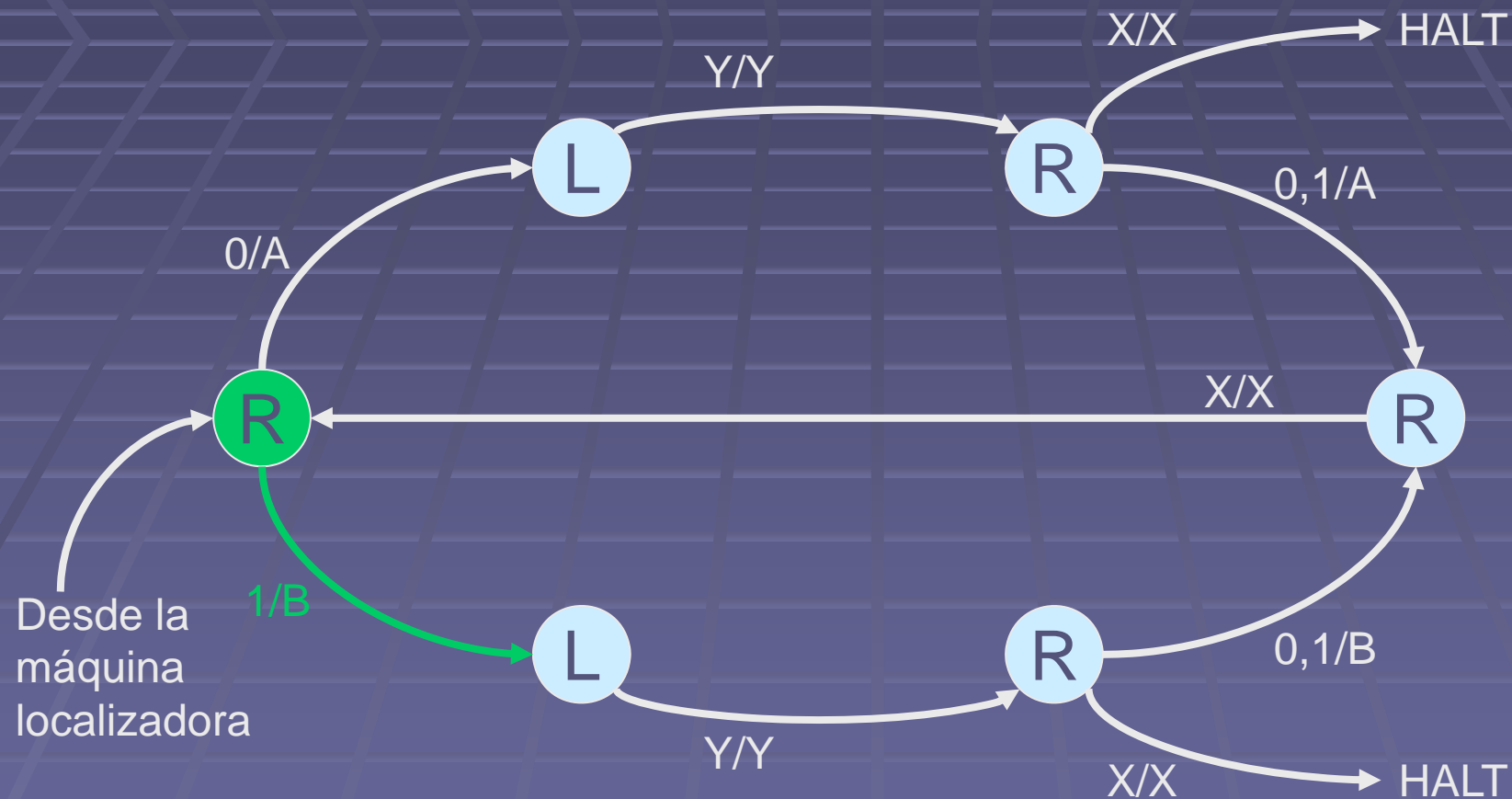
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Máquina Copiadora



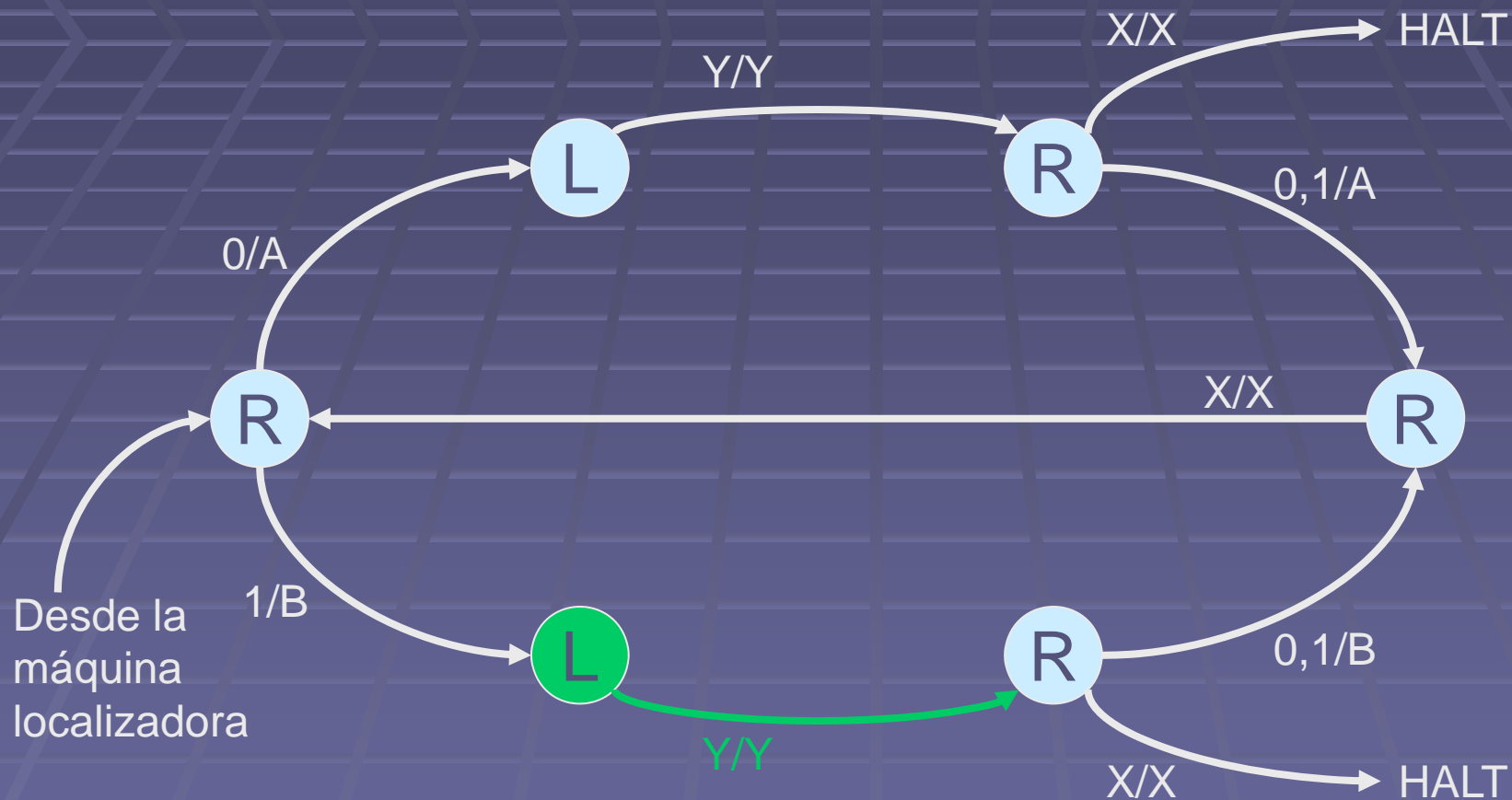
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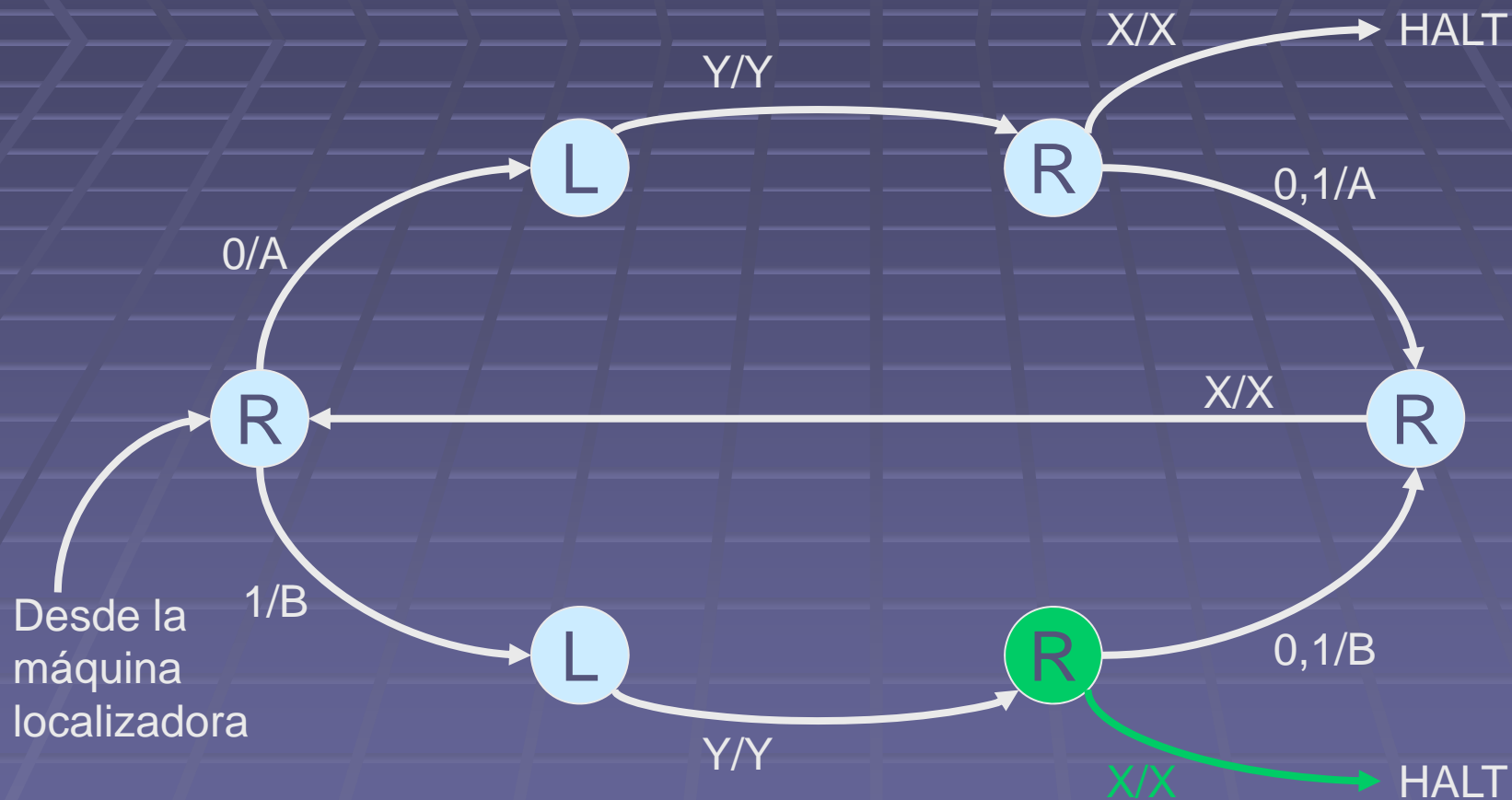
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Máquina Copiadora



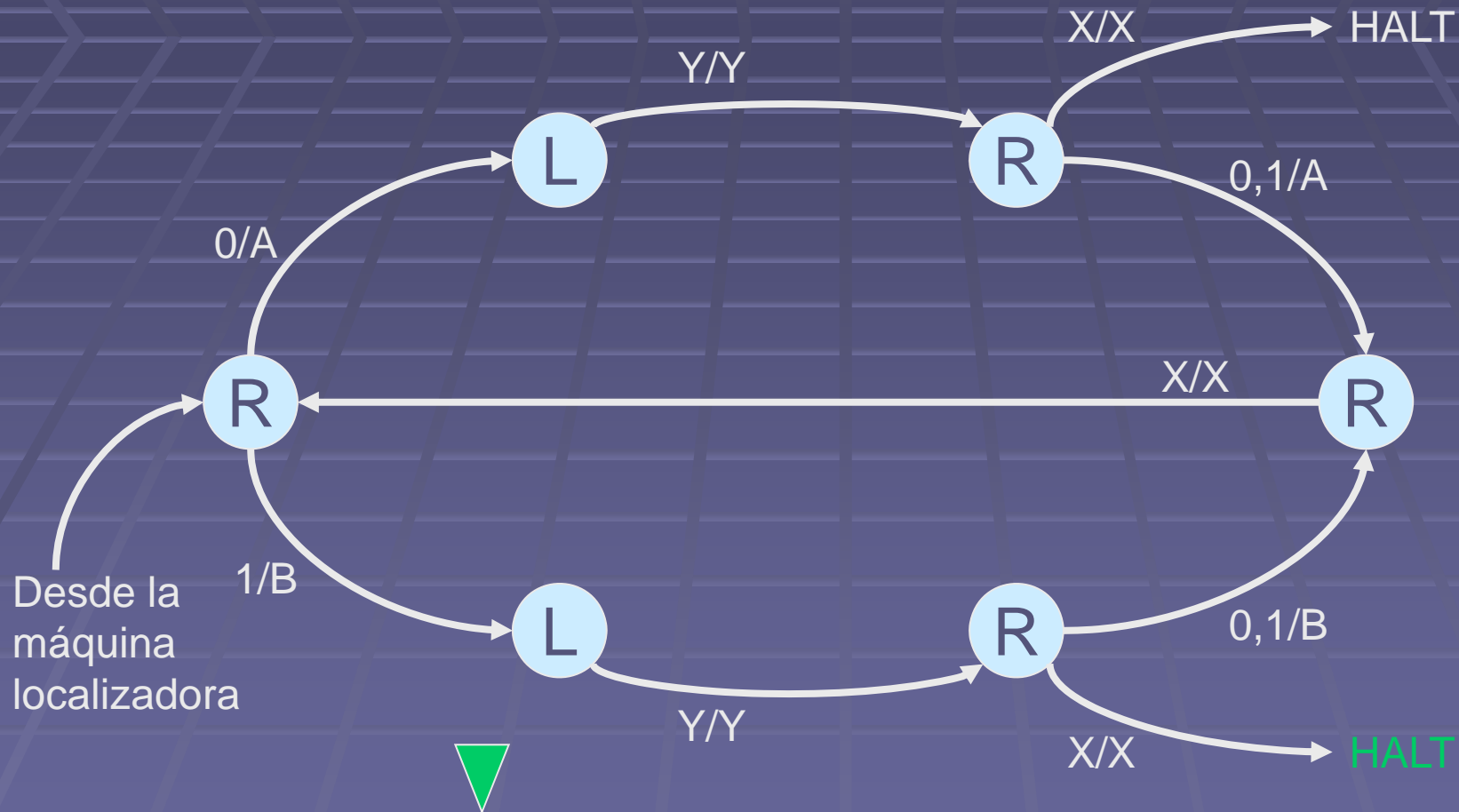
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Máquina Copiadora



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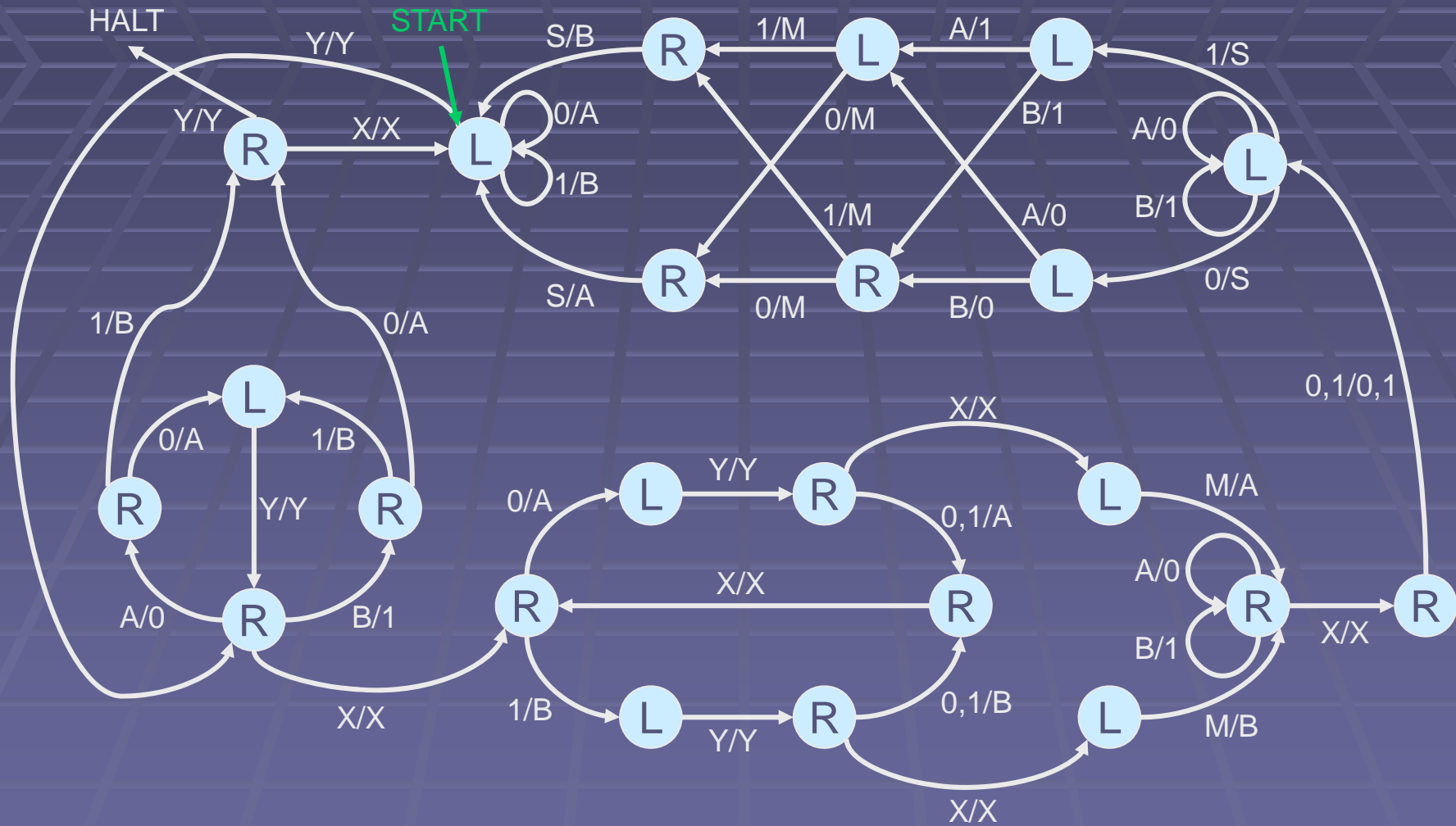
Máquina Copiadora



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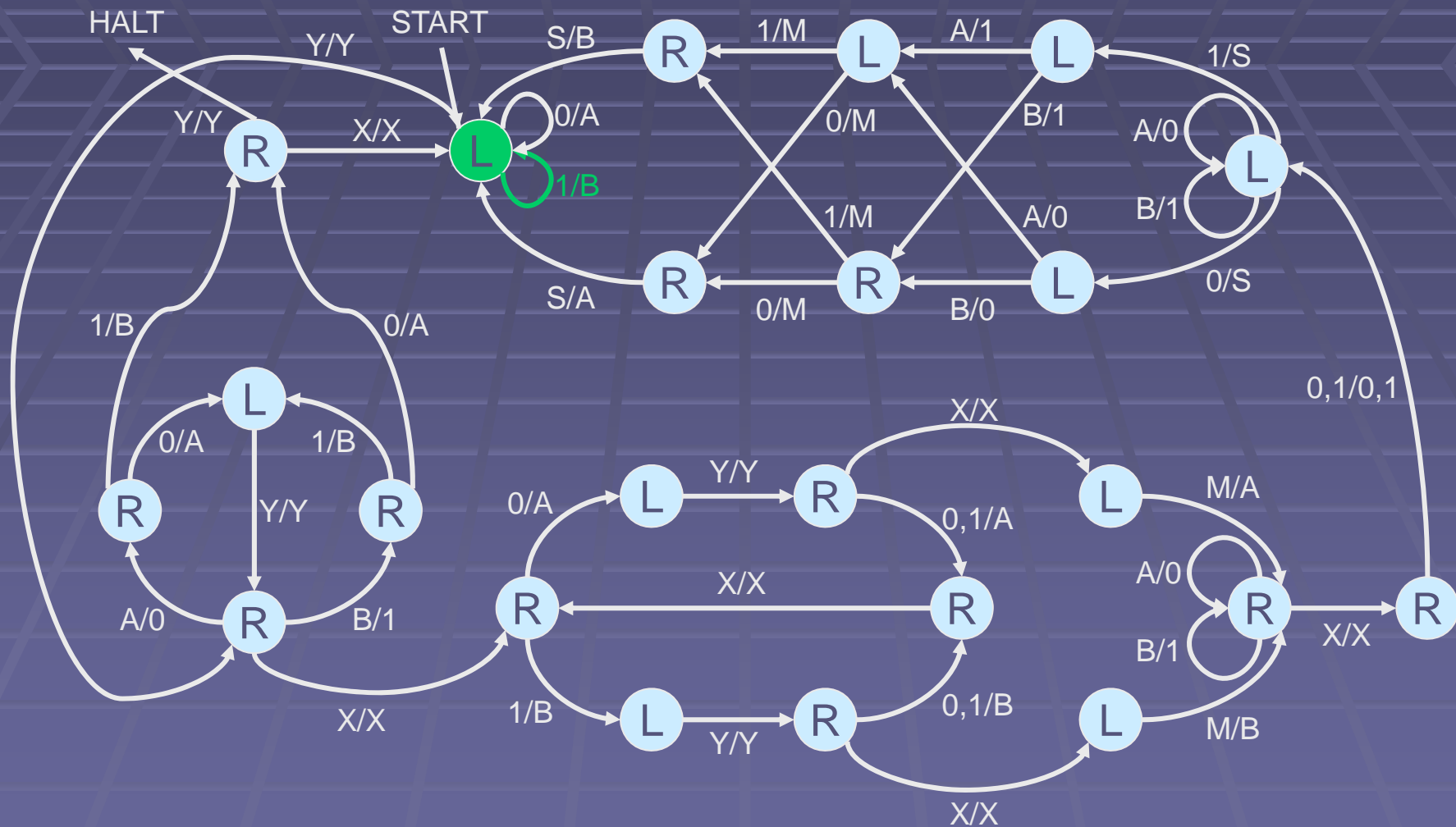
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Máquina de Turing Universal



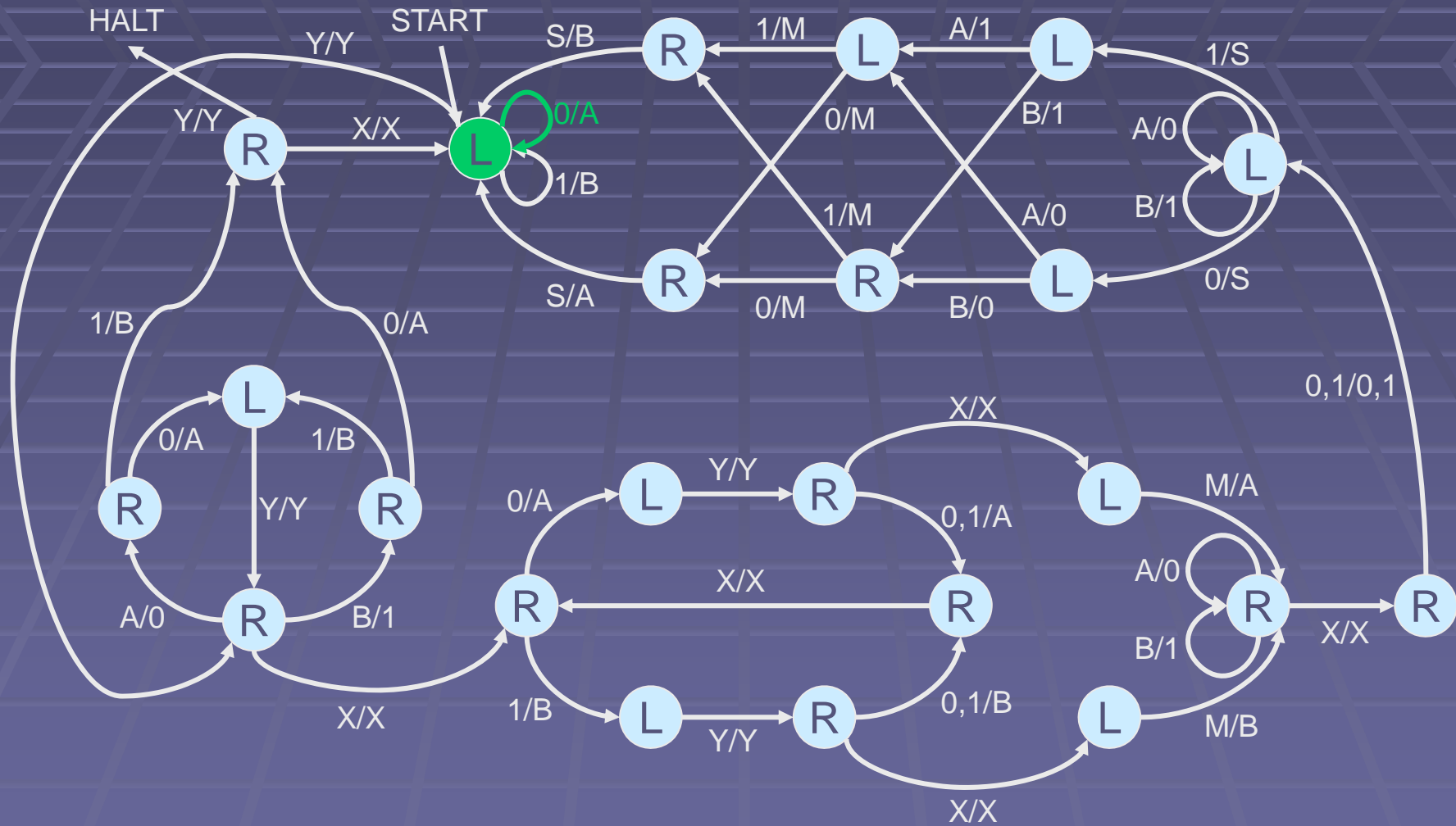
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Máquina de Turing Universal



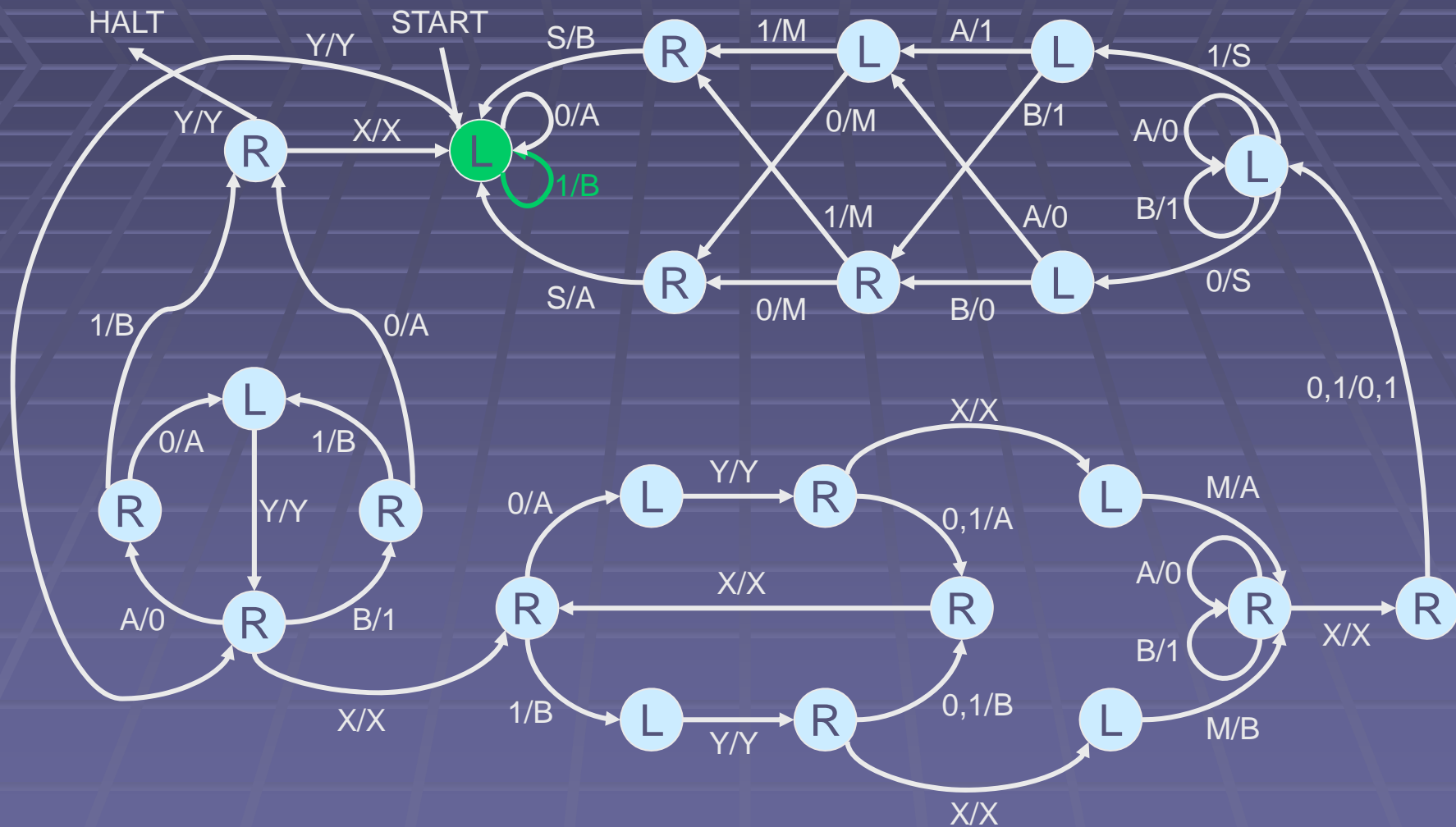
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Máquina de Turing Universal



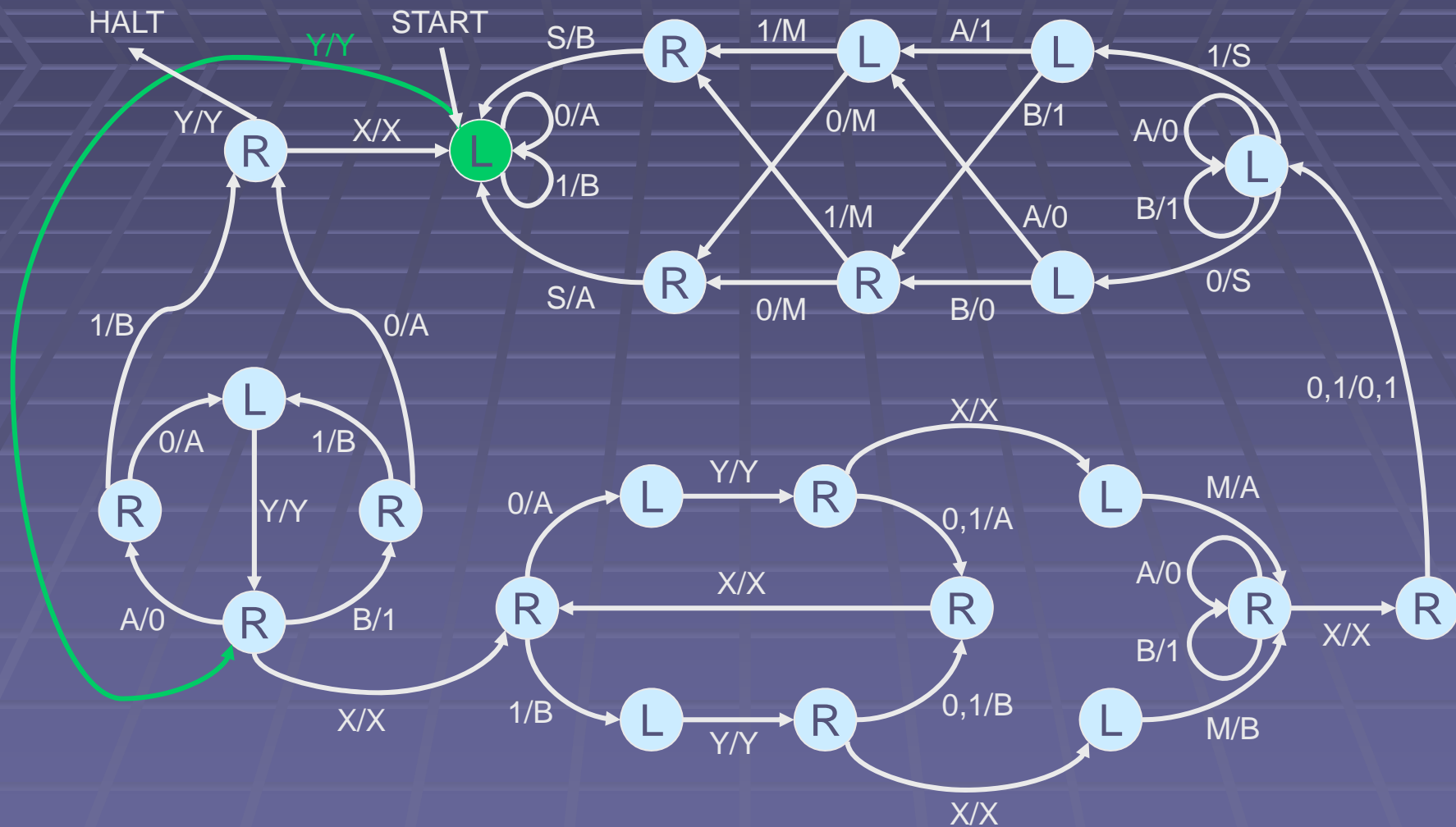
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Máquina de Turing Universal



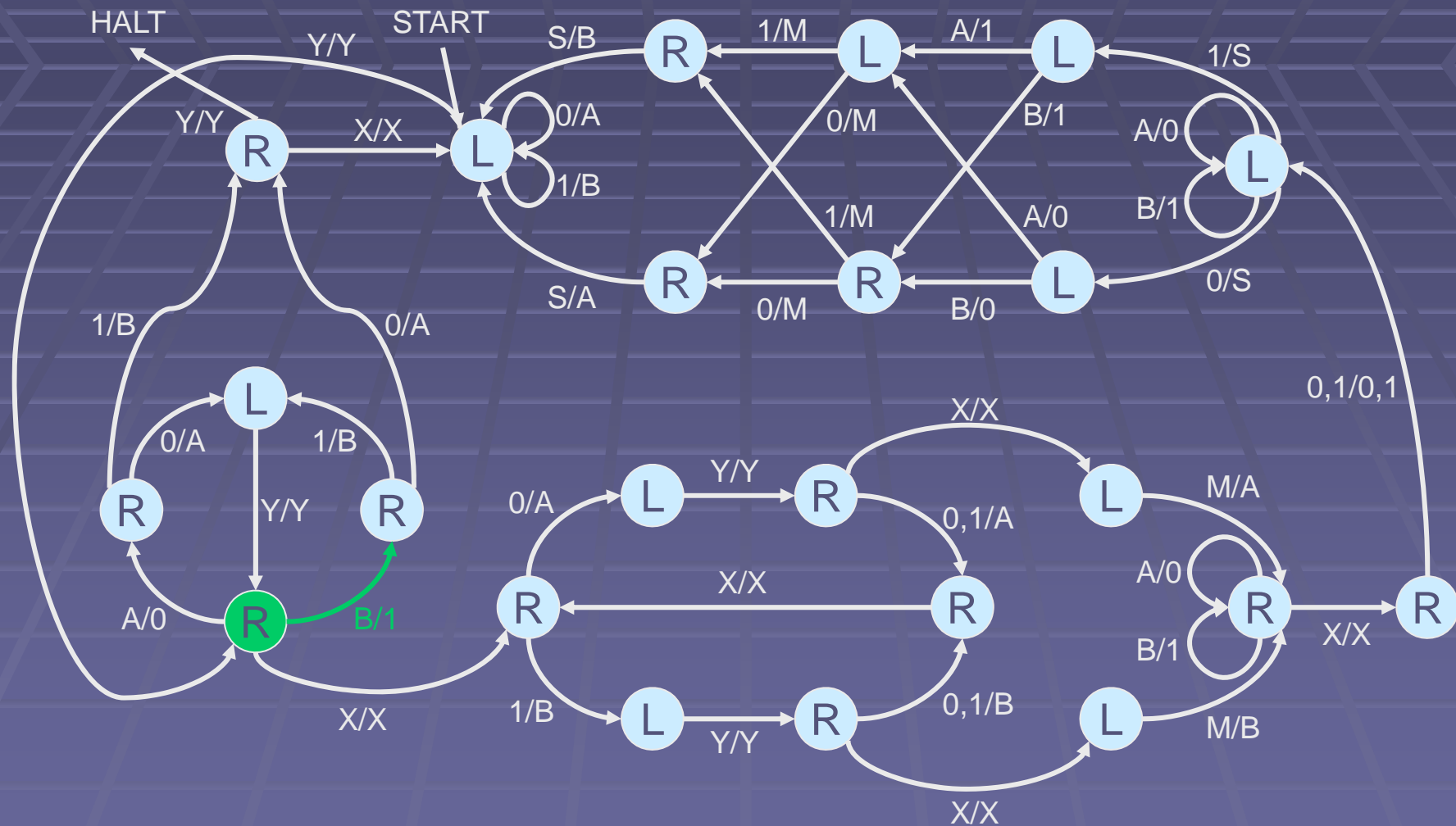
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Máquina de Turing Universal



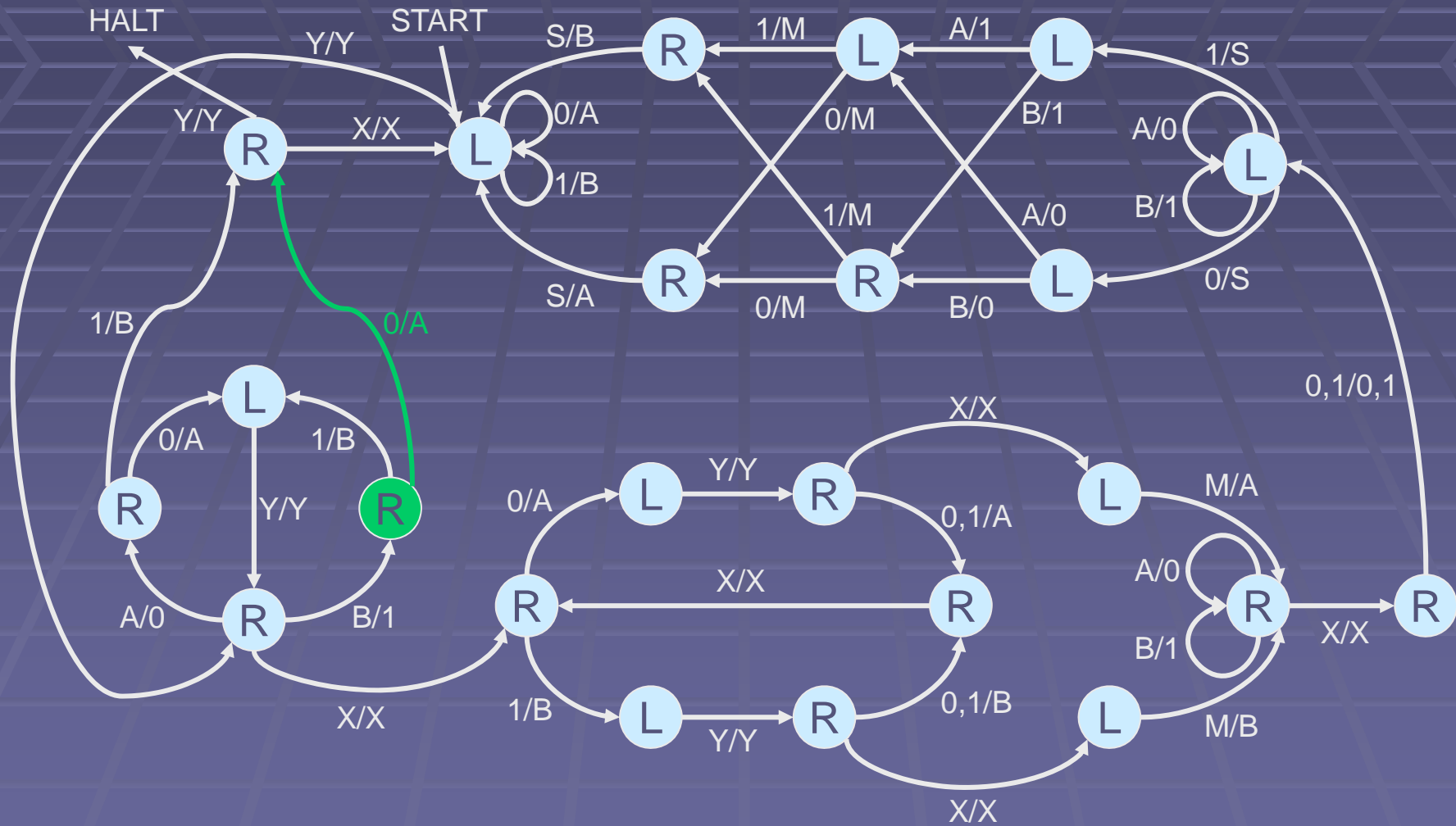
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Máquina de Turing Universal



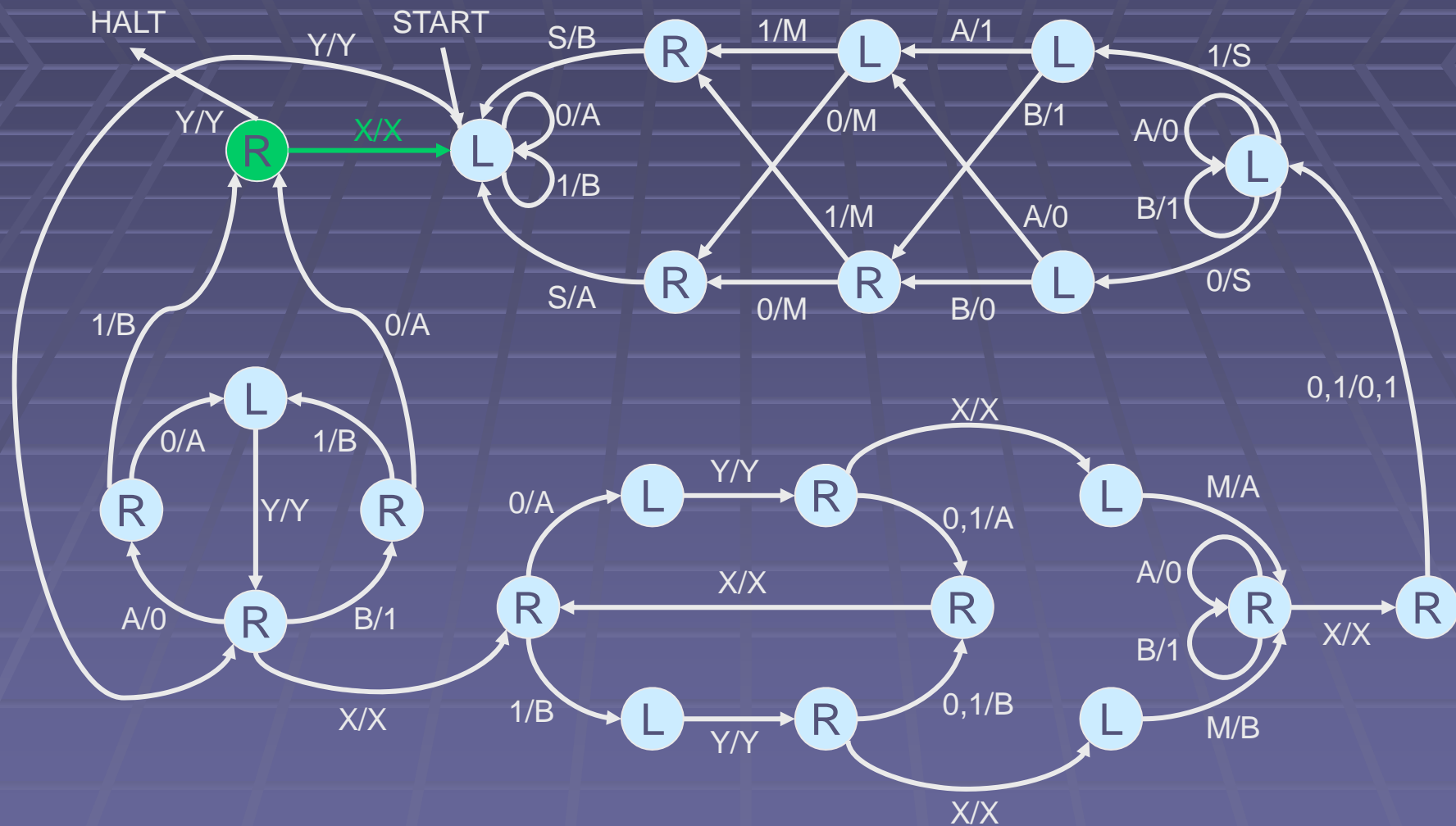
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Máquina de Turing Universal



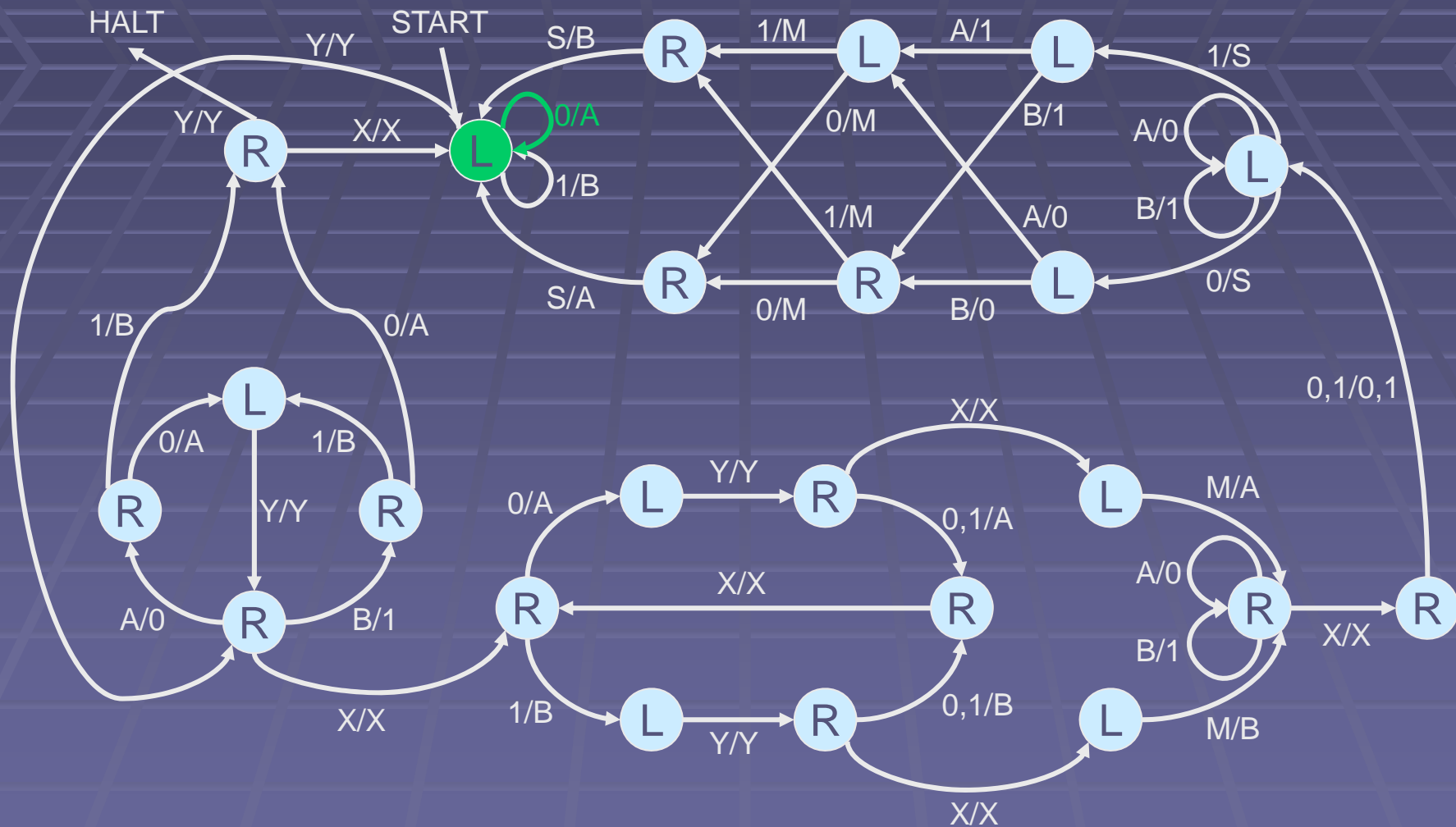
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Máquina de Turing Universal



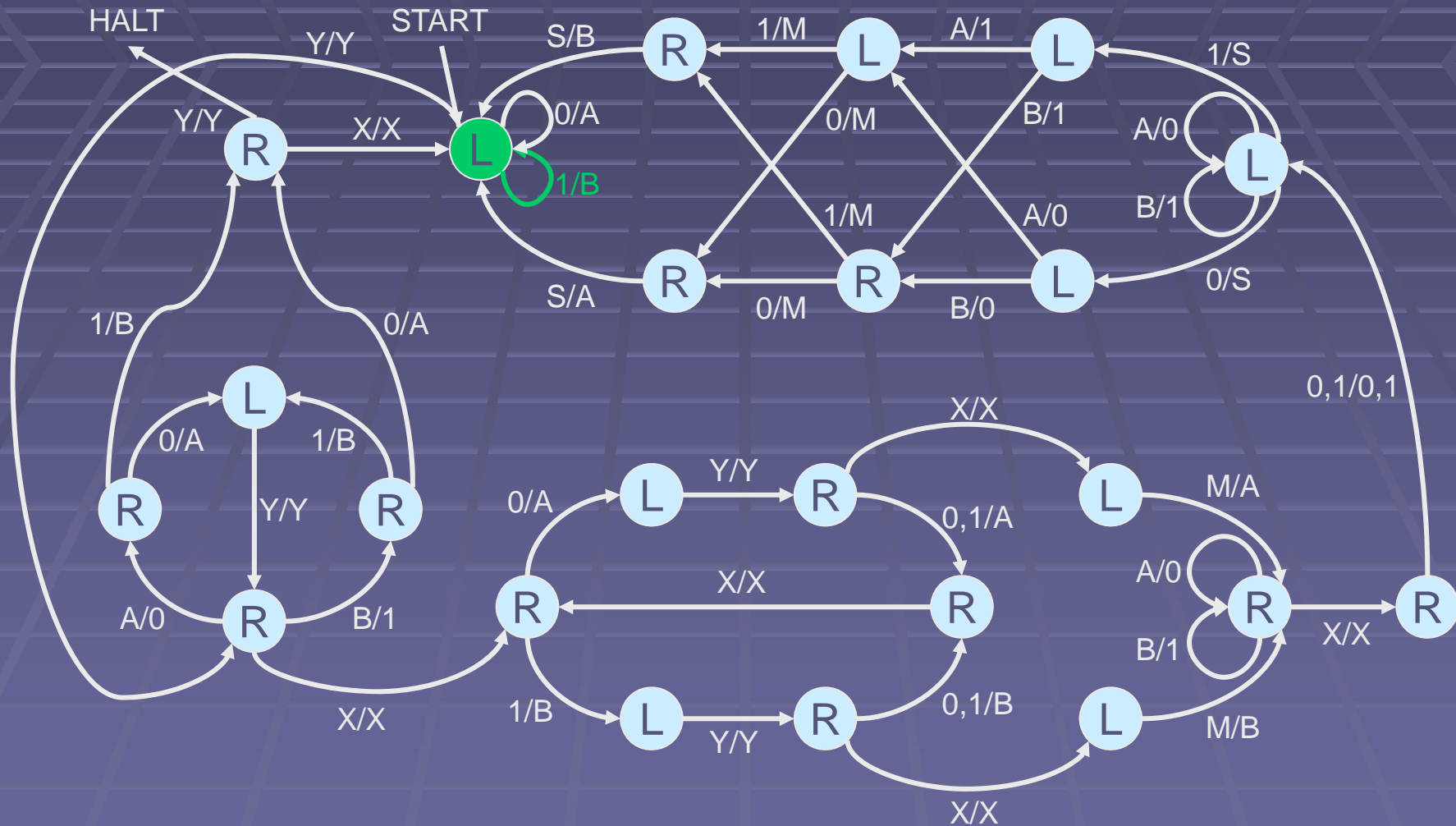
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Máquina de Turing Universal



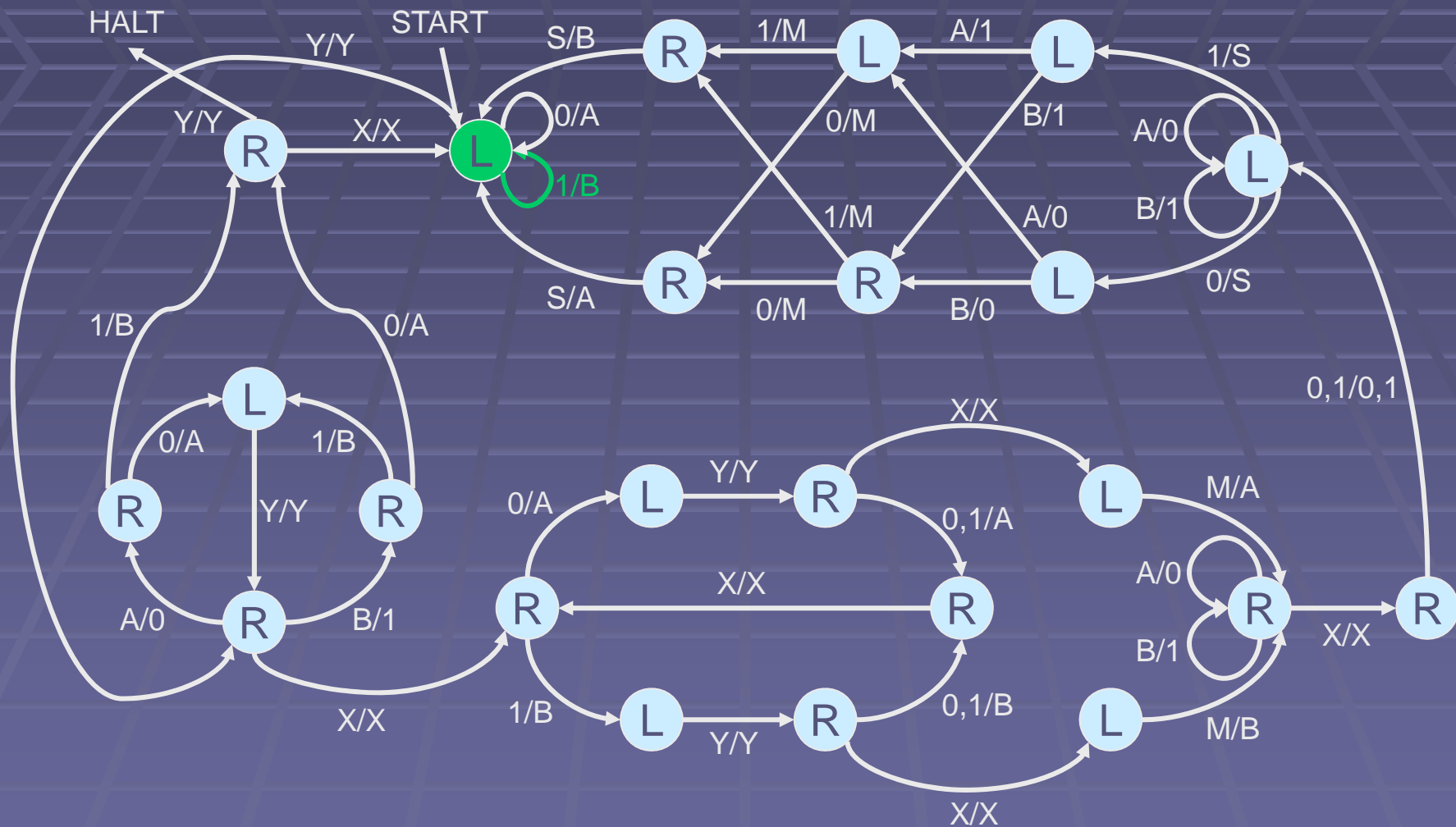
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Máquina de Turing Universal



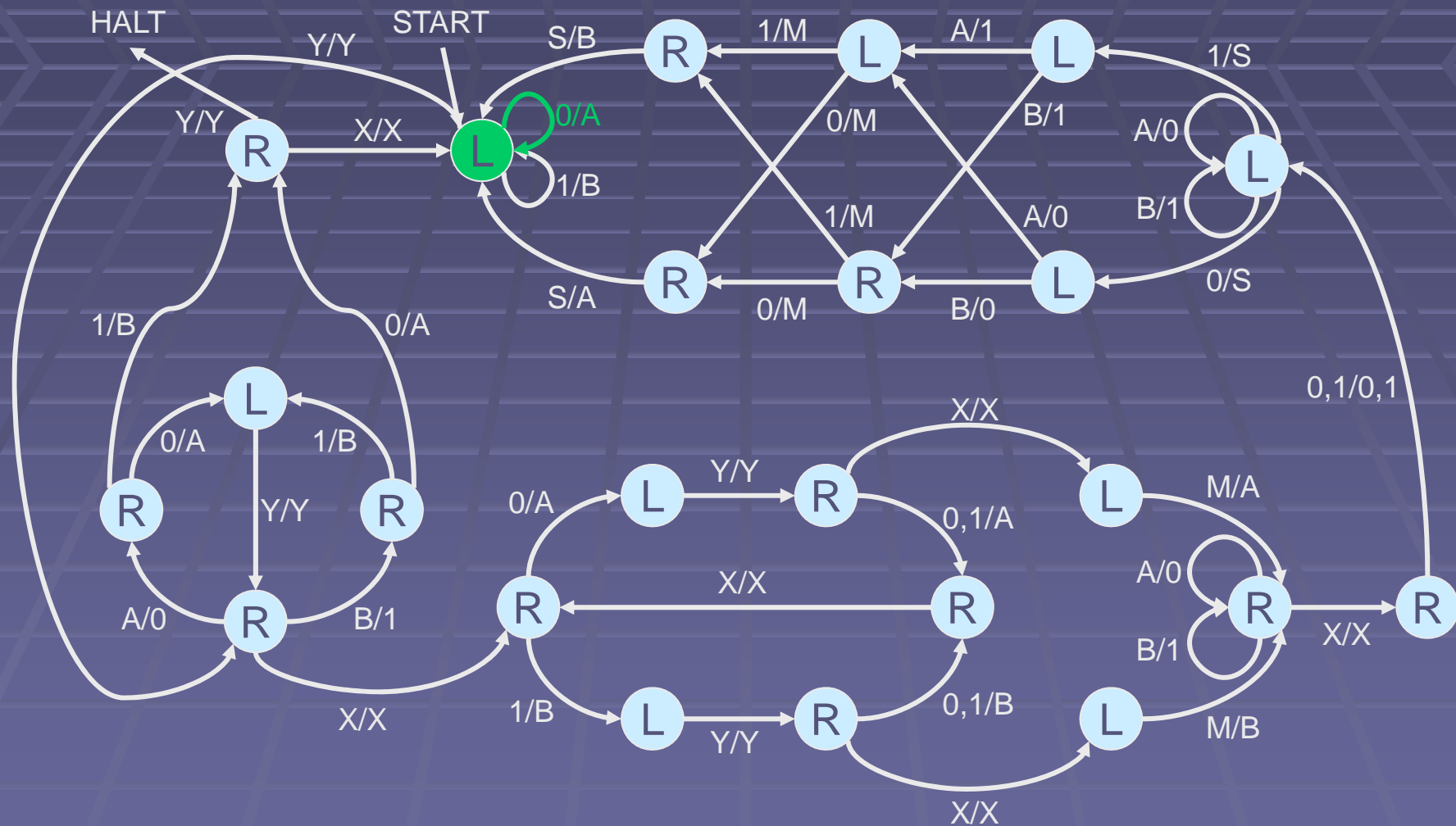
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Máquina de Turing Universal



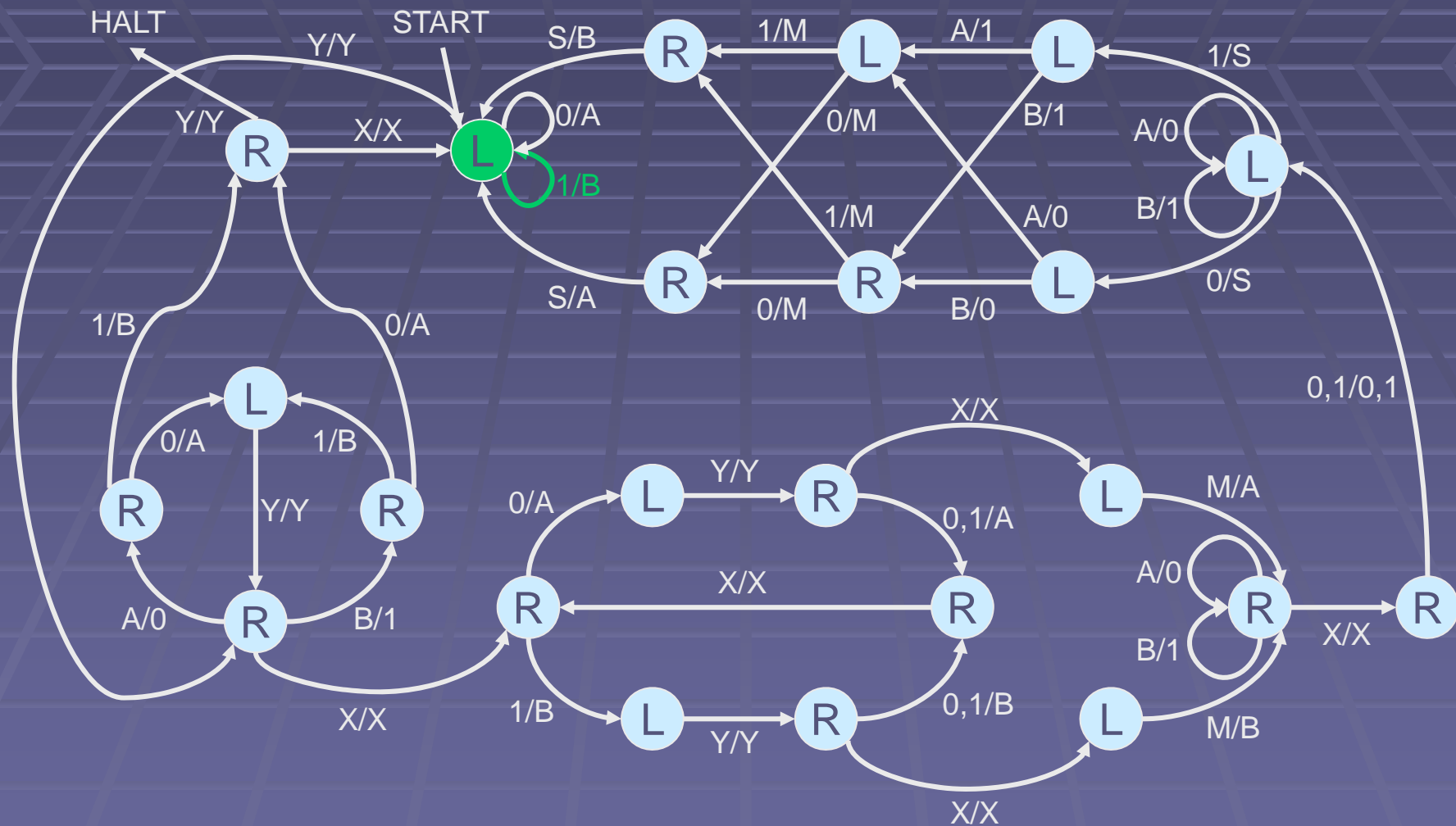
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Máquina de Turing Universal



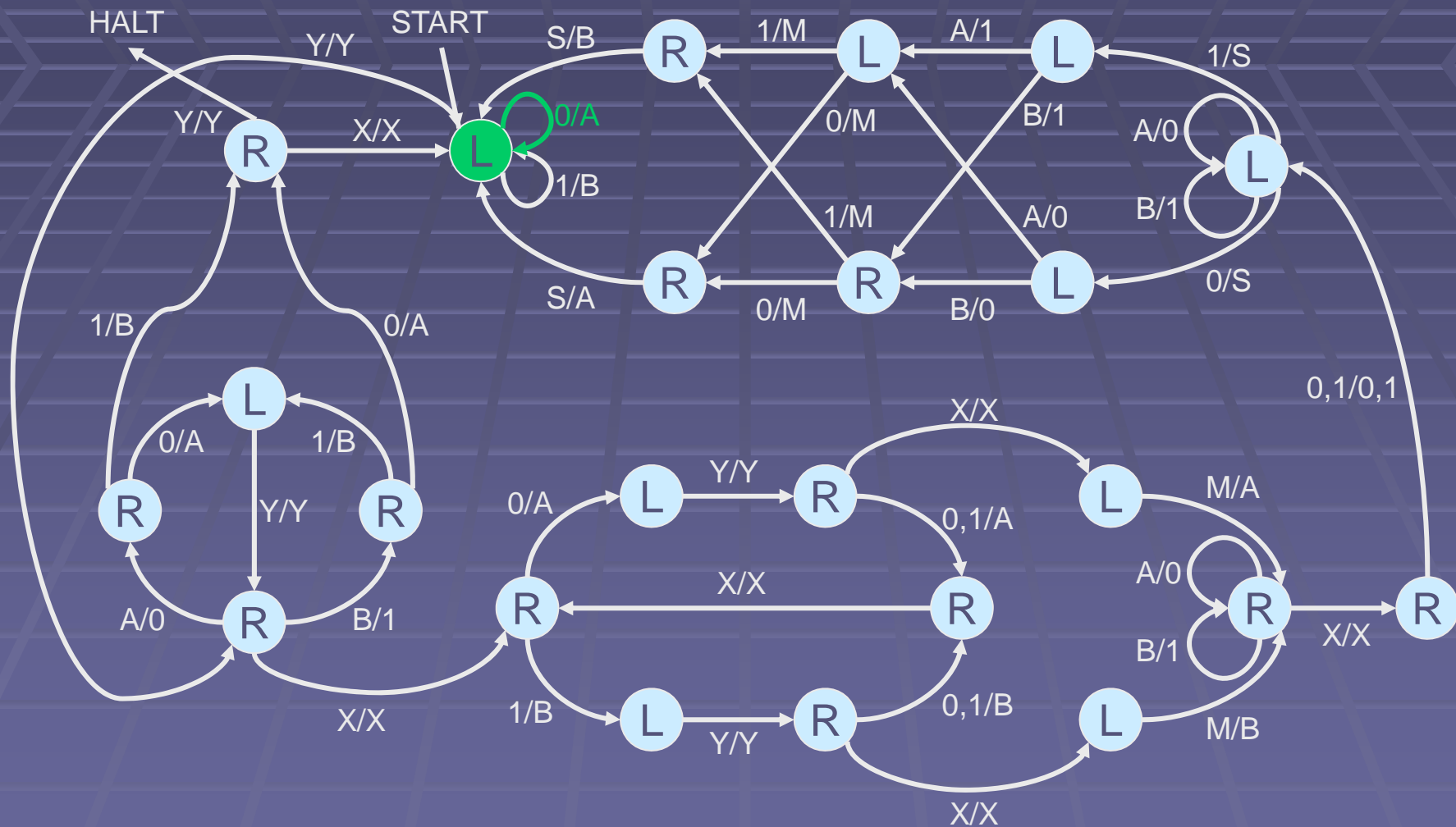
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Máquina de Turing Universal



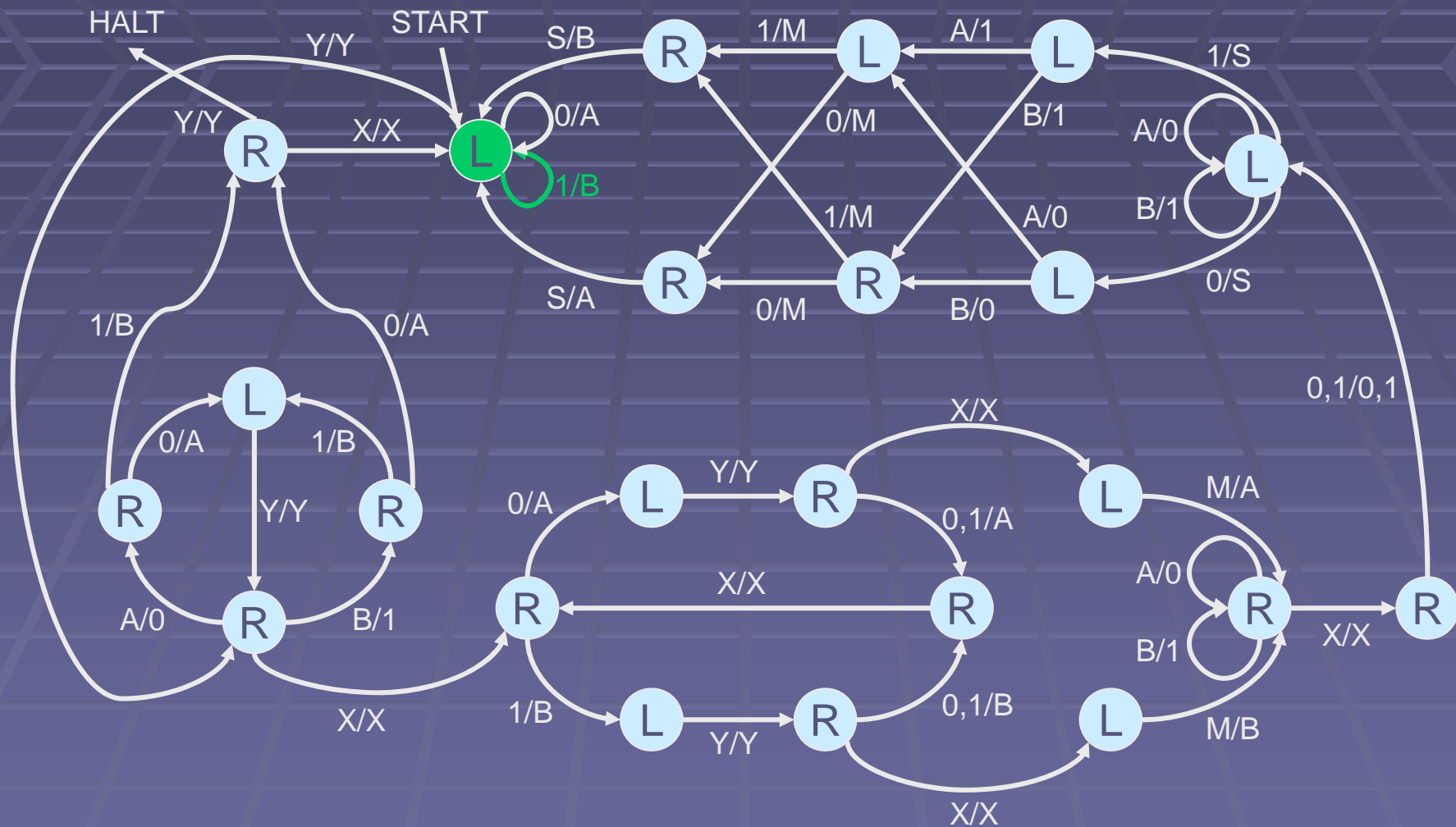
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Máquina de Turing Universal



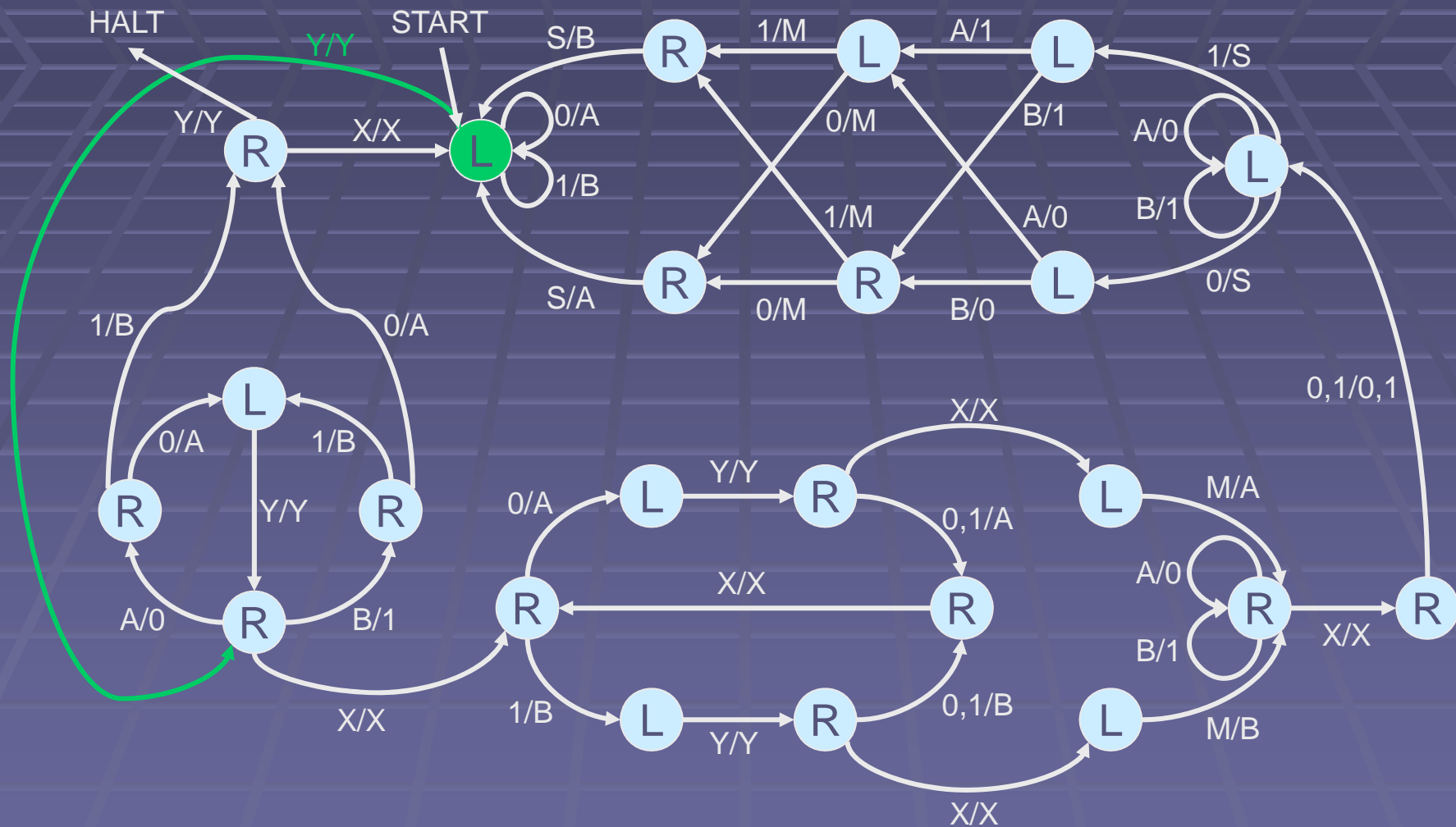
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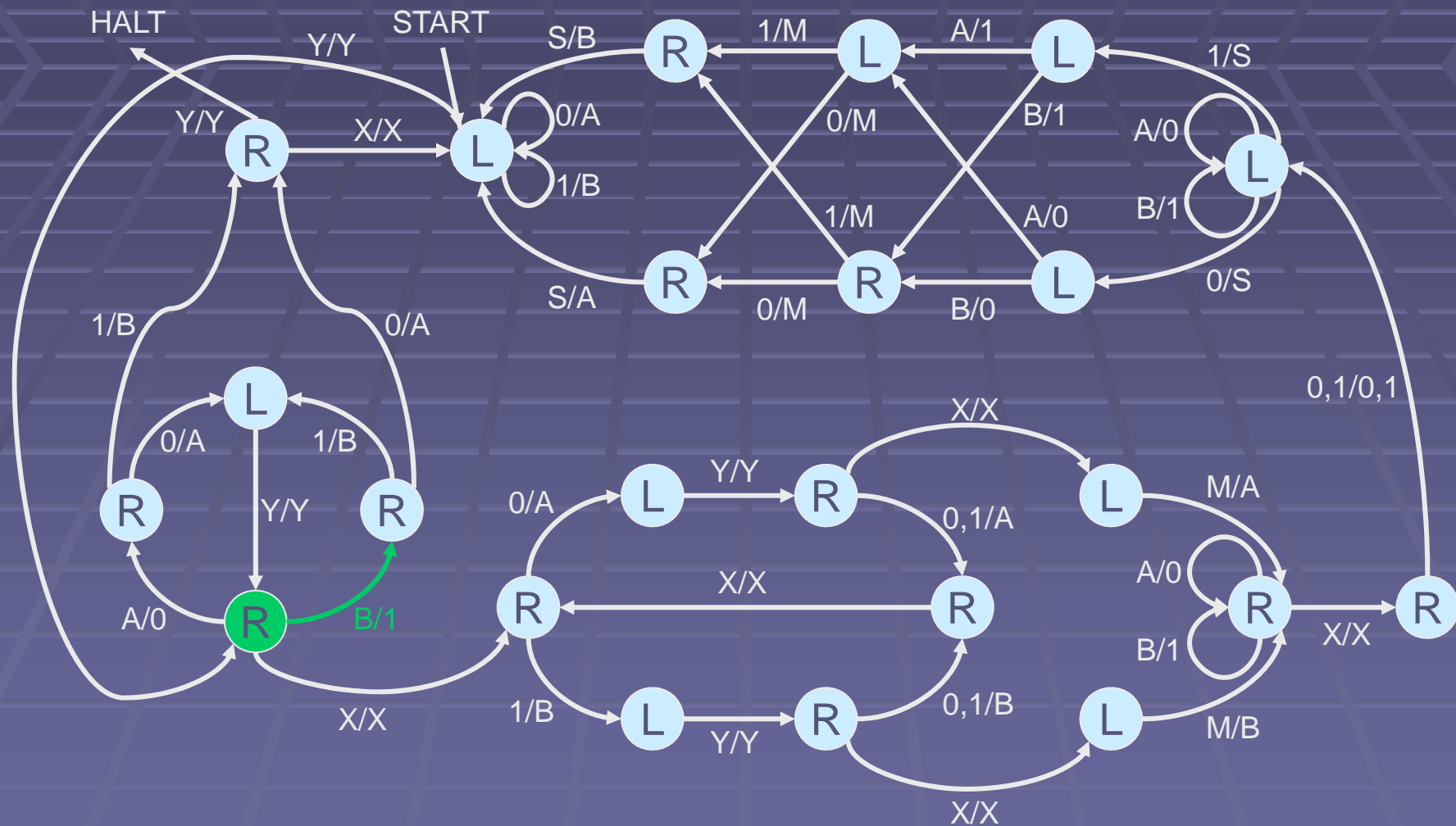
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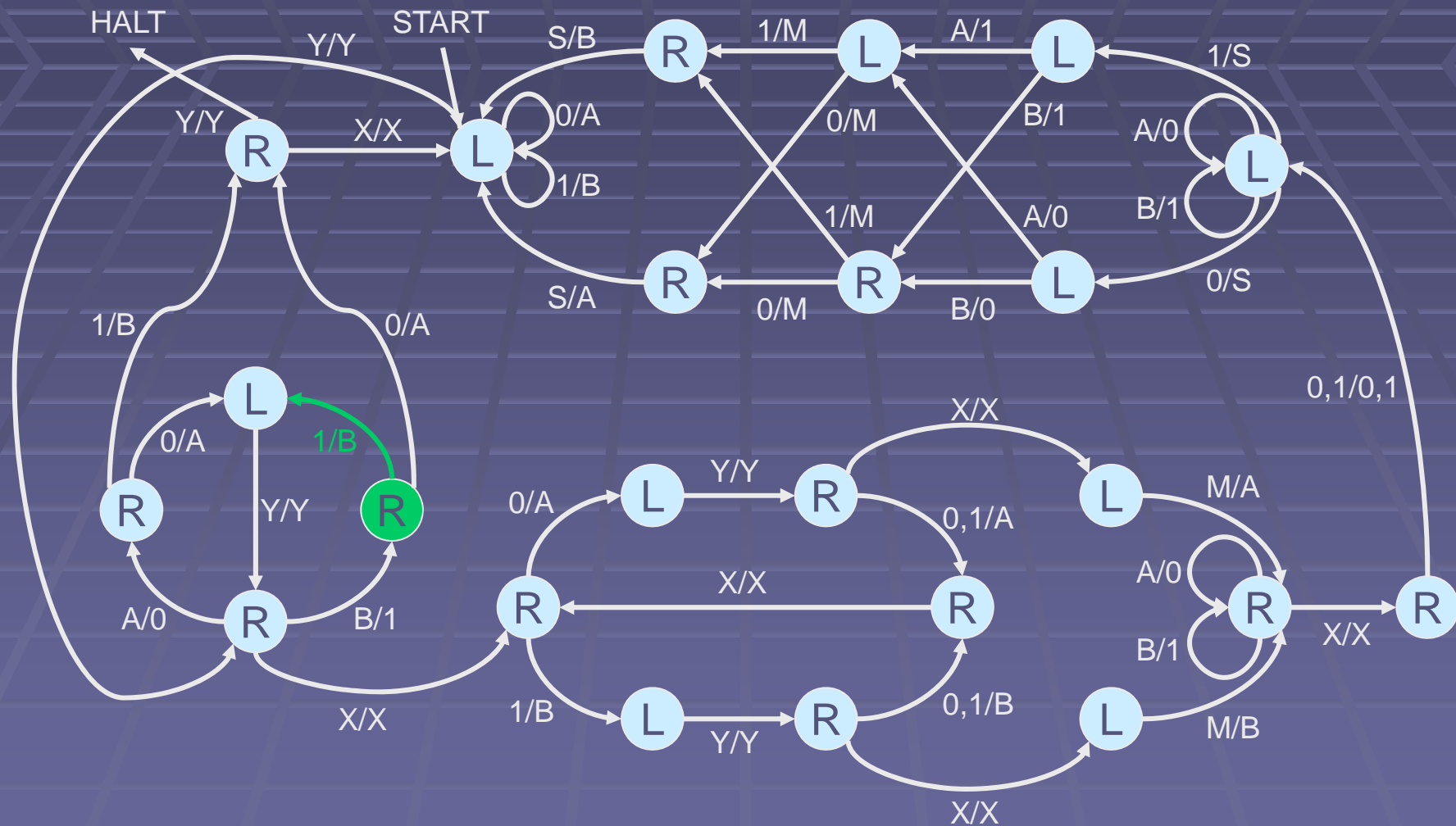
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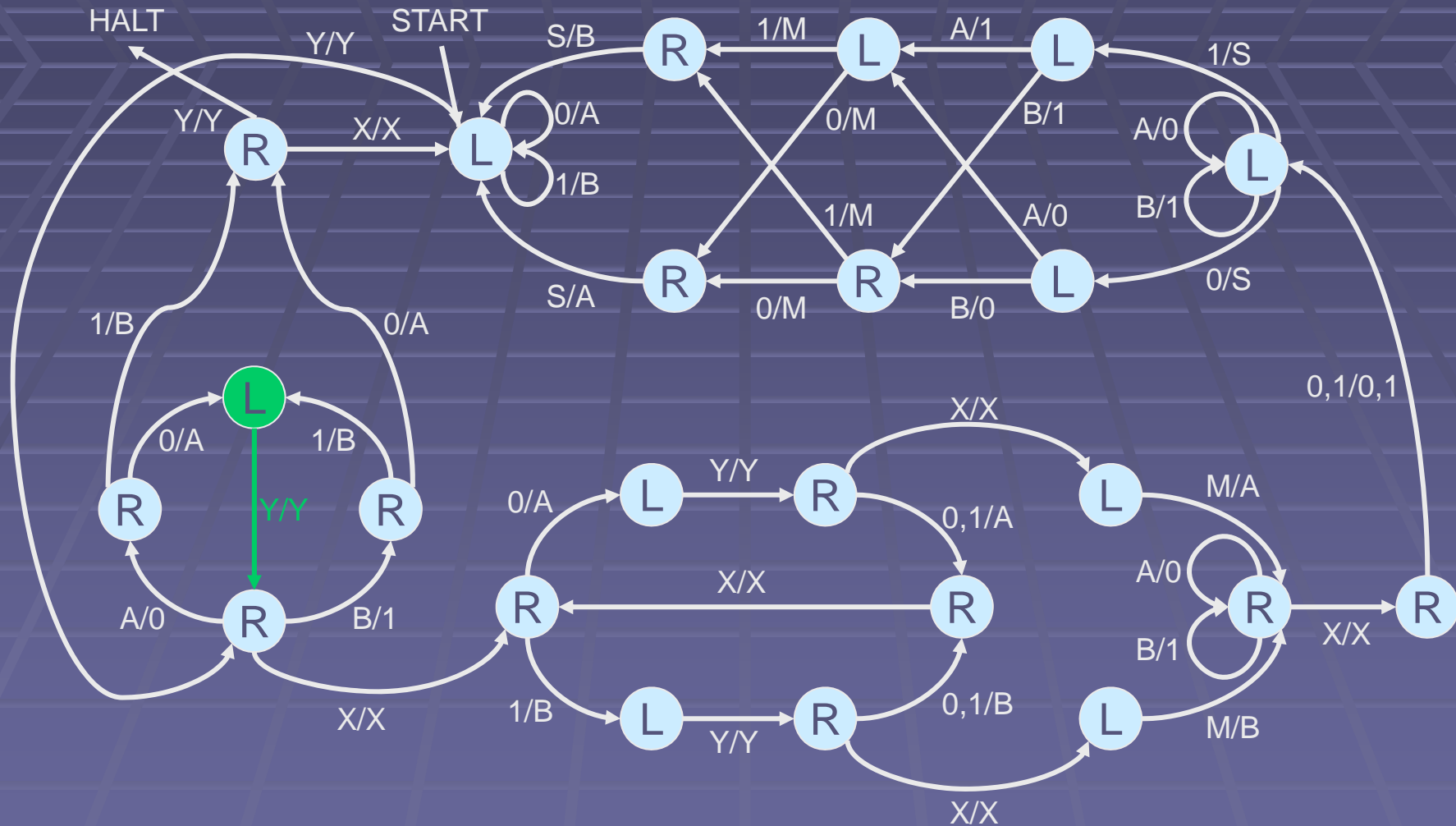
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Máquina de Turing Universal



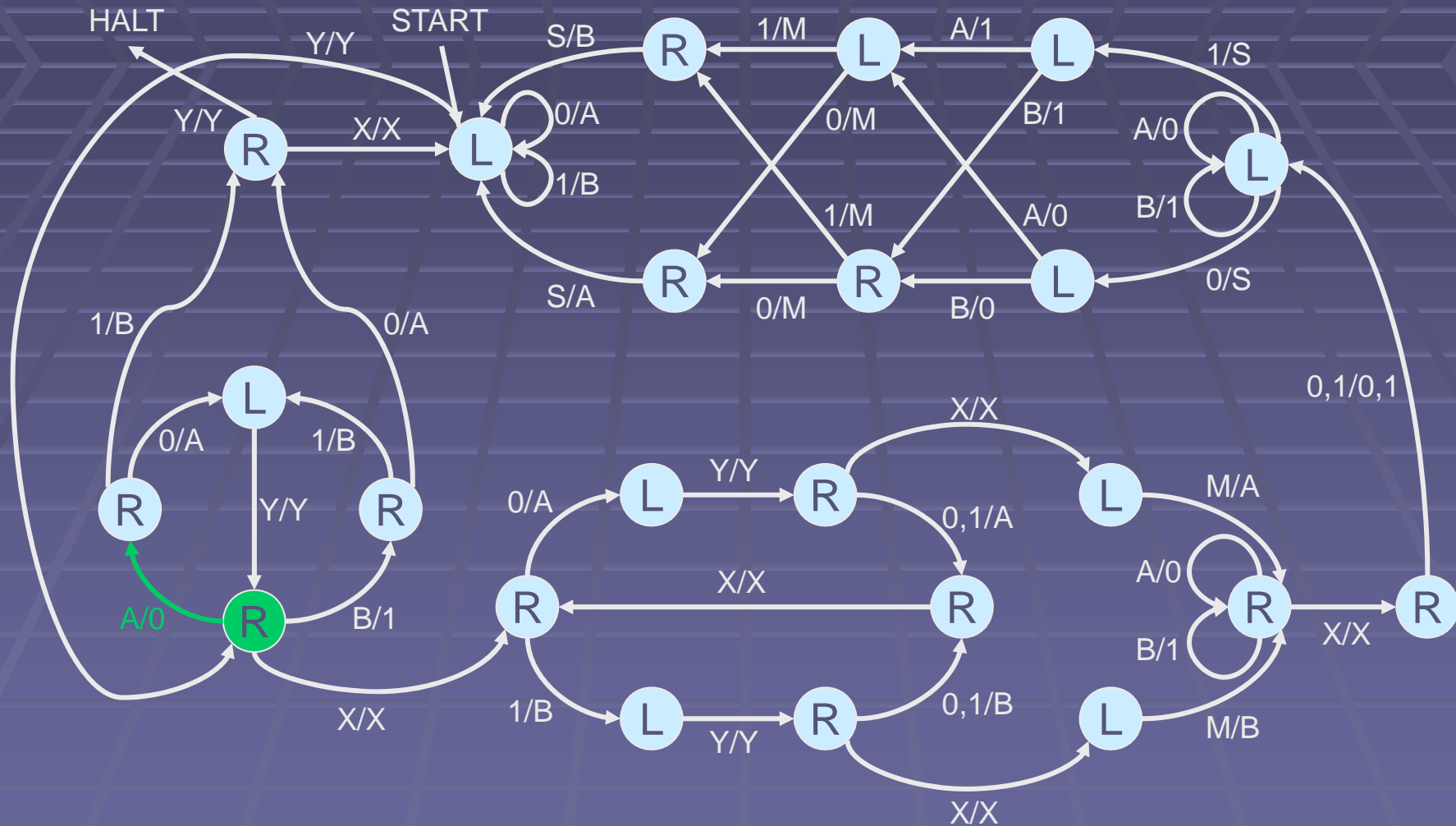
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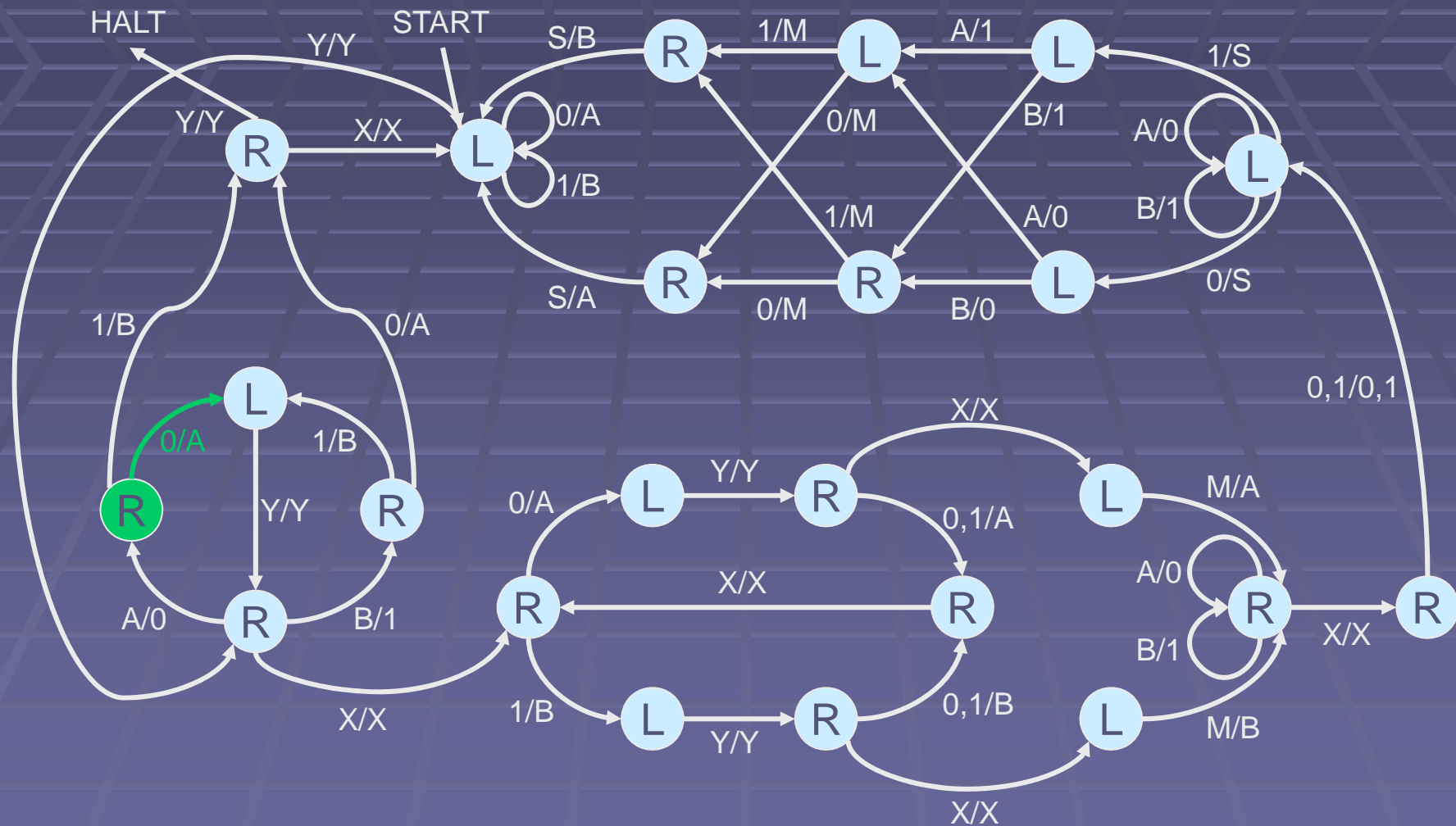
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Máquina de Turing Universal



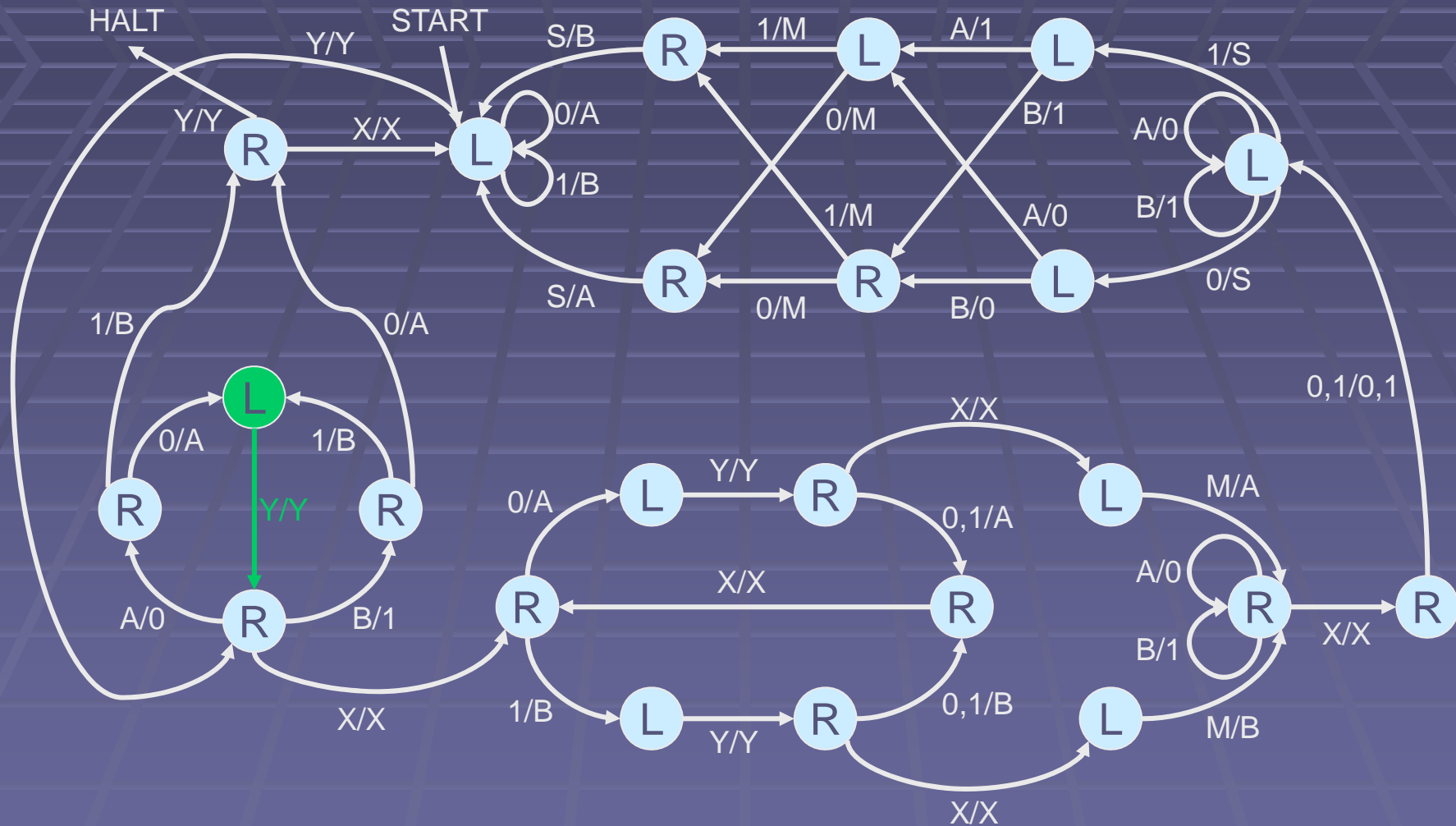
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Máquina de Turing Universal



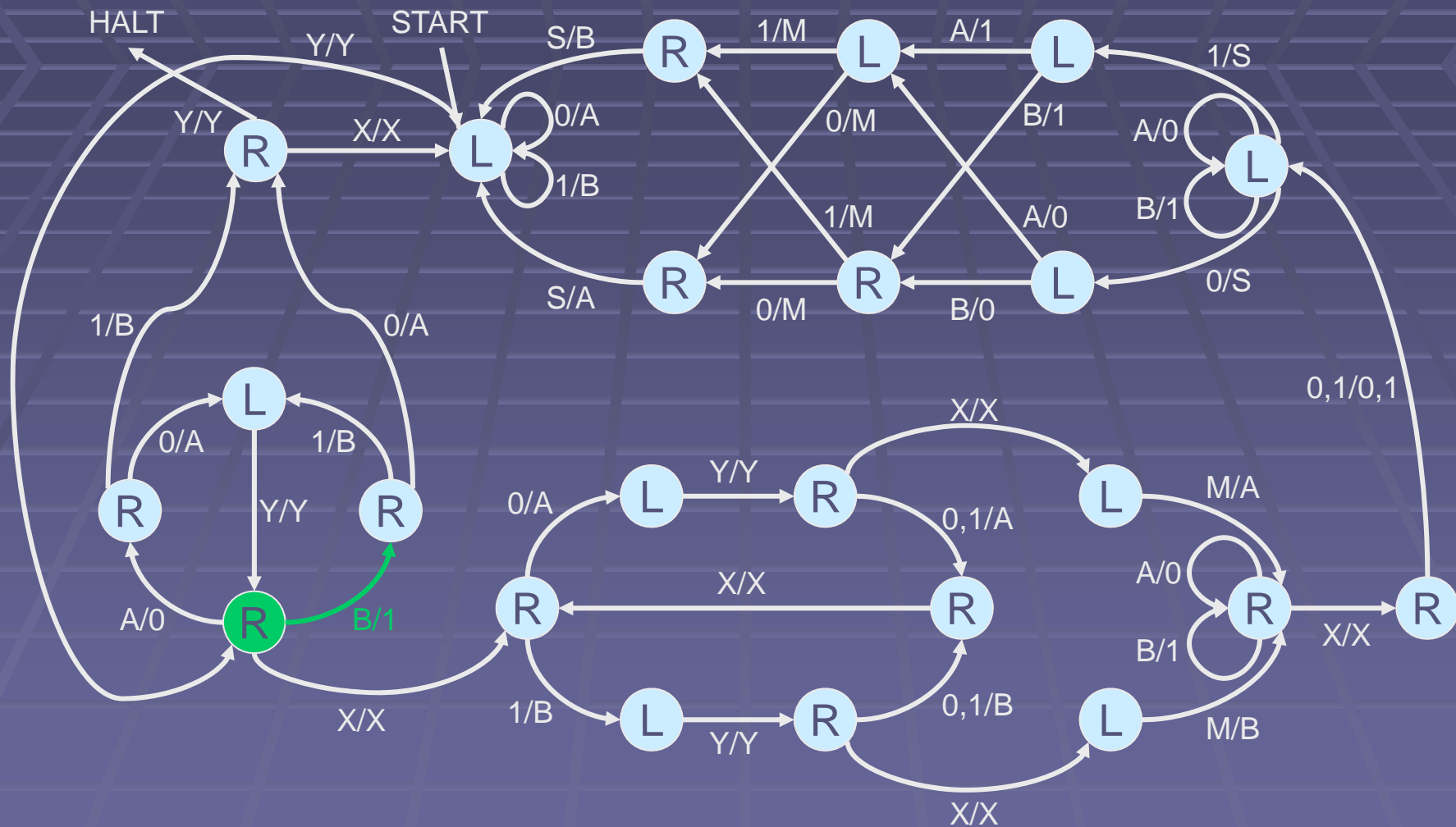
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Máquina de Turing Universal



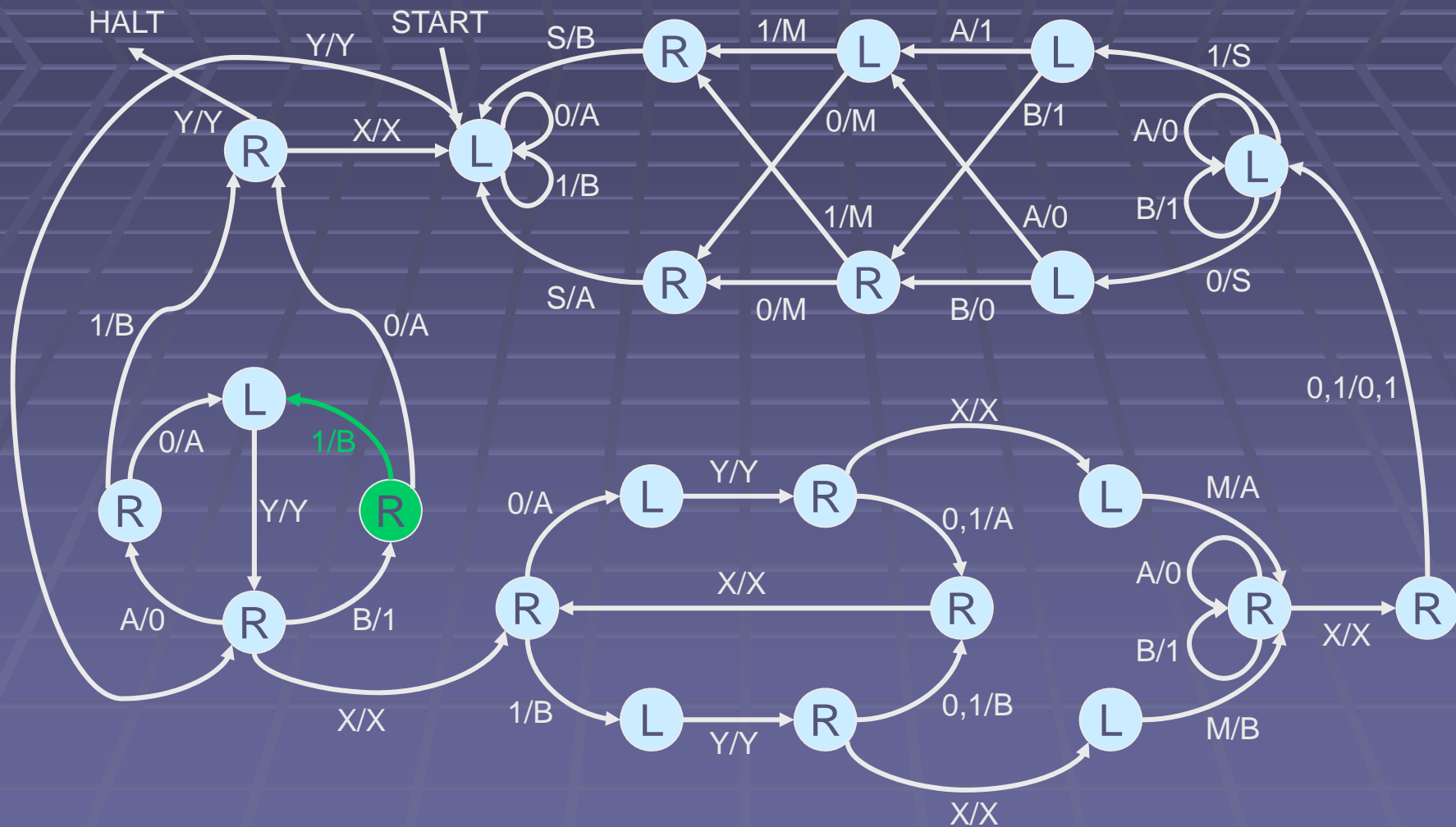
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Máquina de Turing Universal



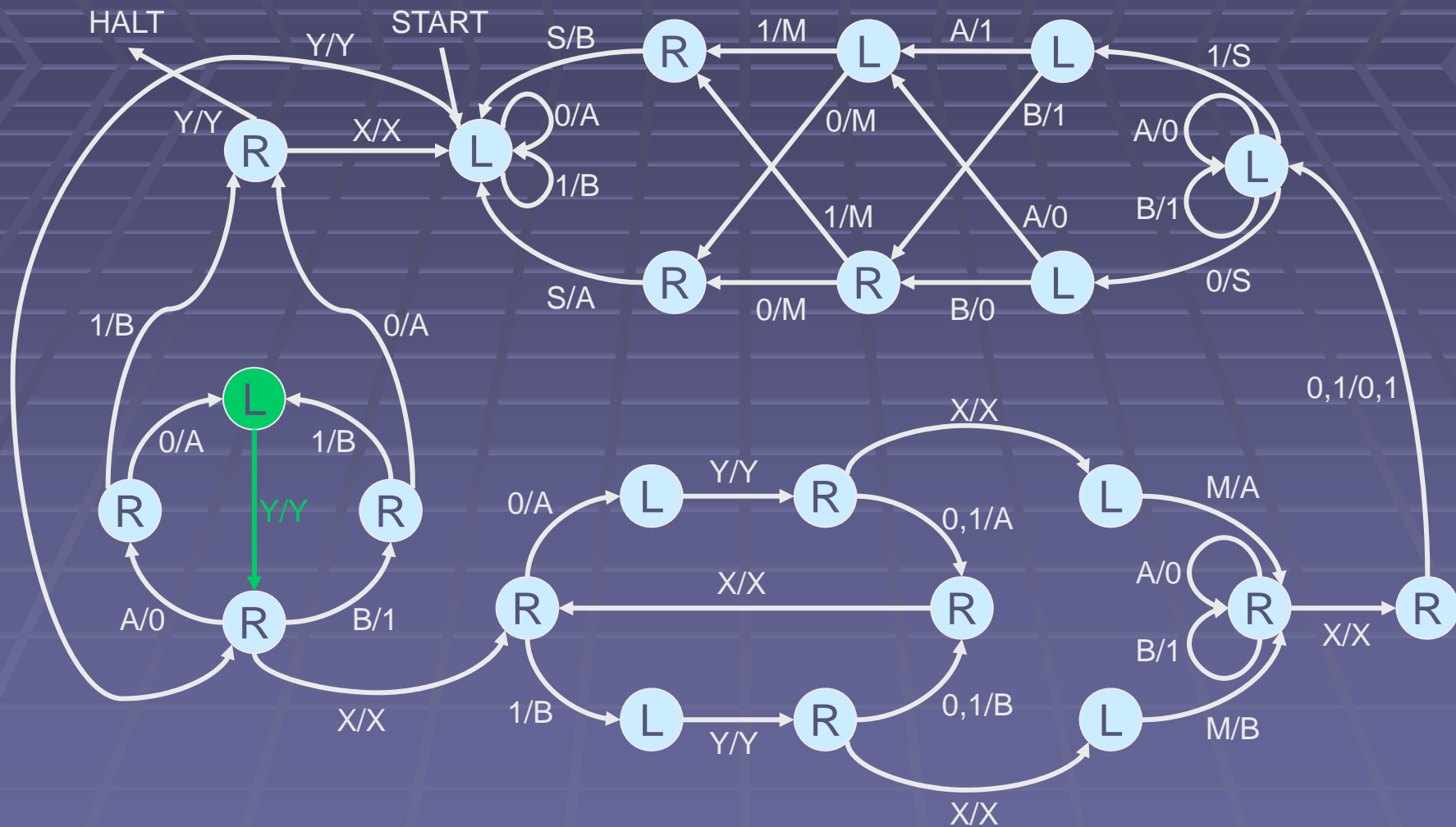
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Máquina de Turing Universal



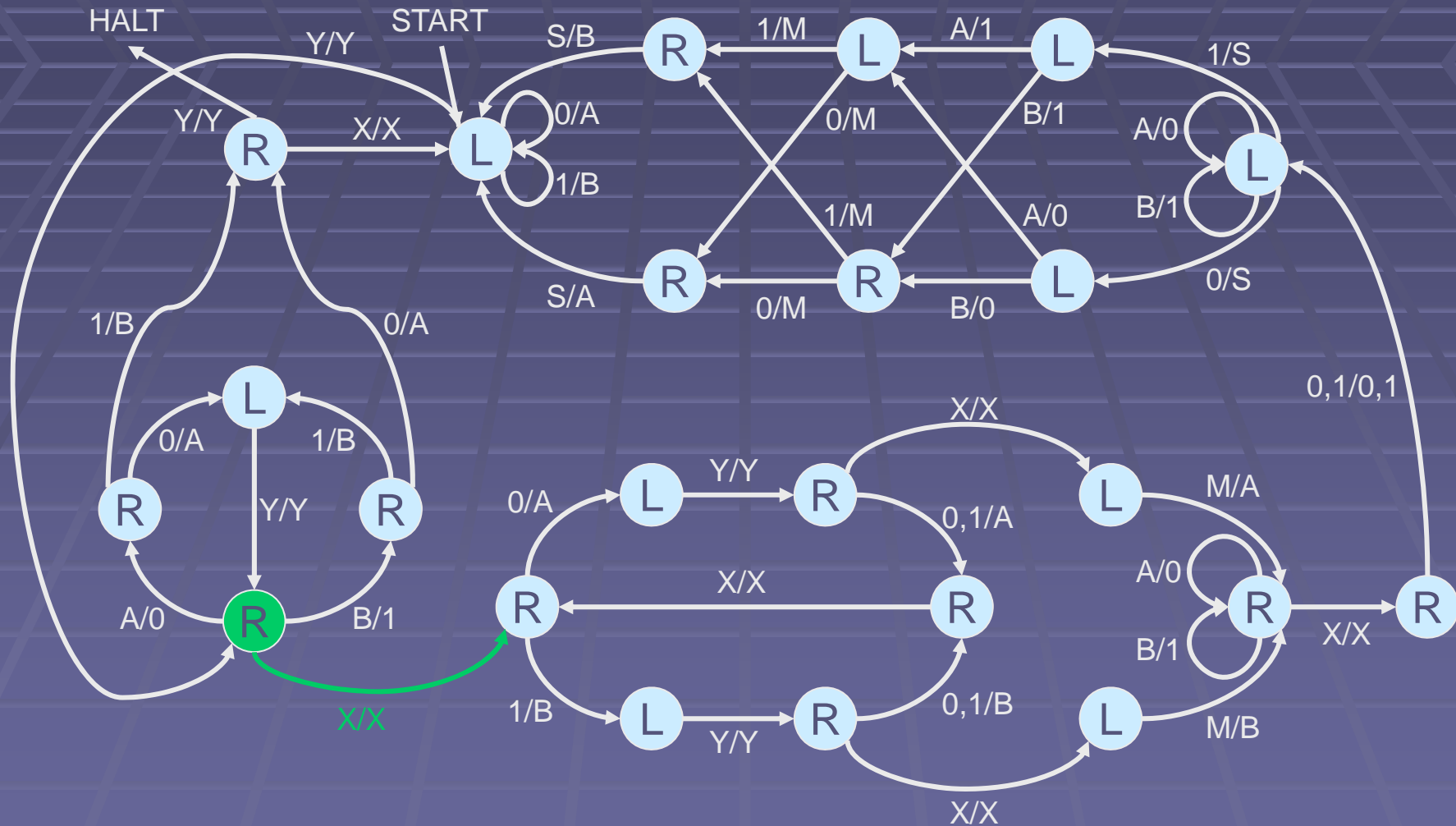
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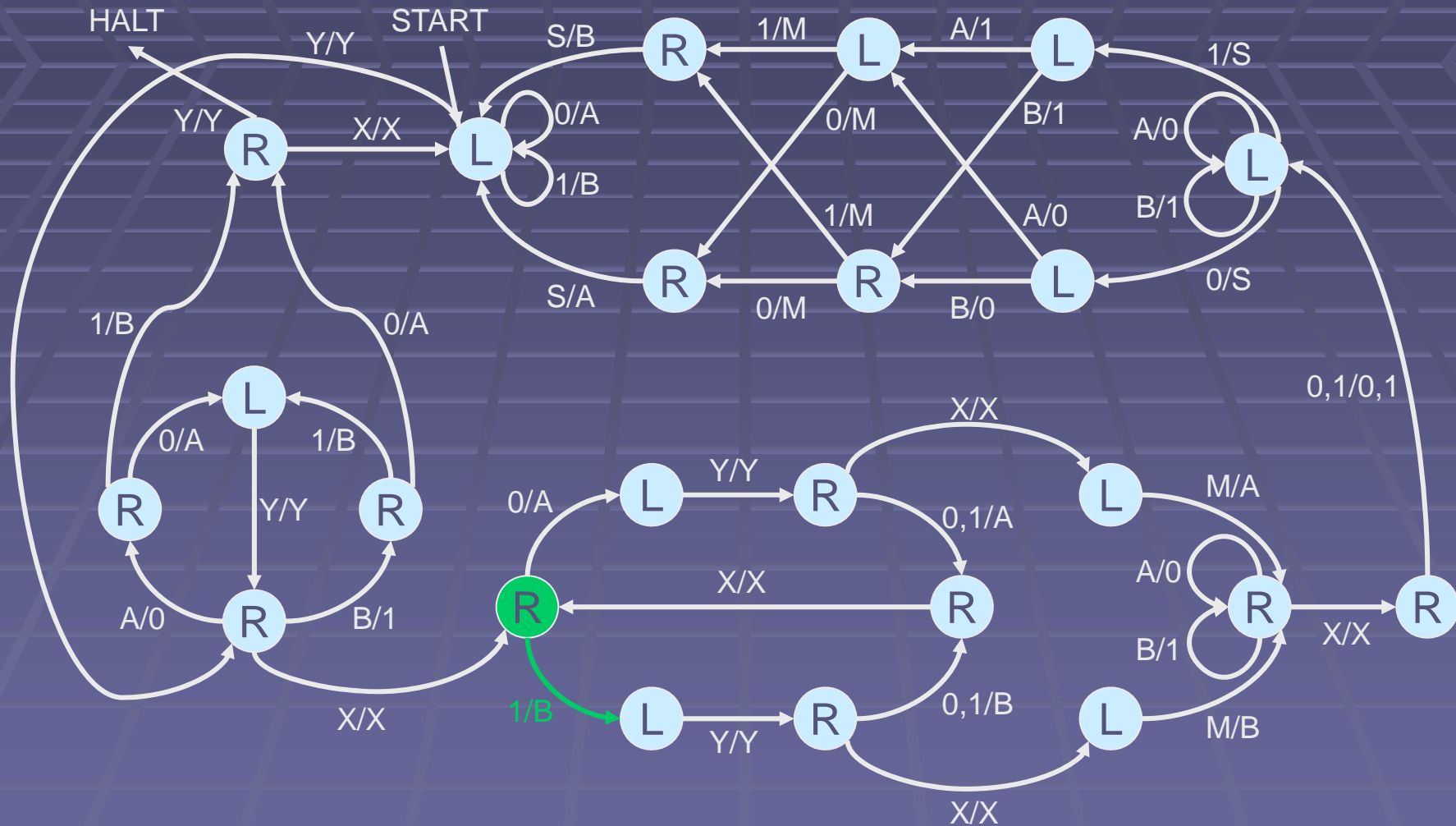
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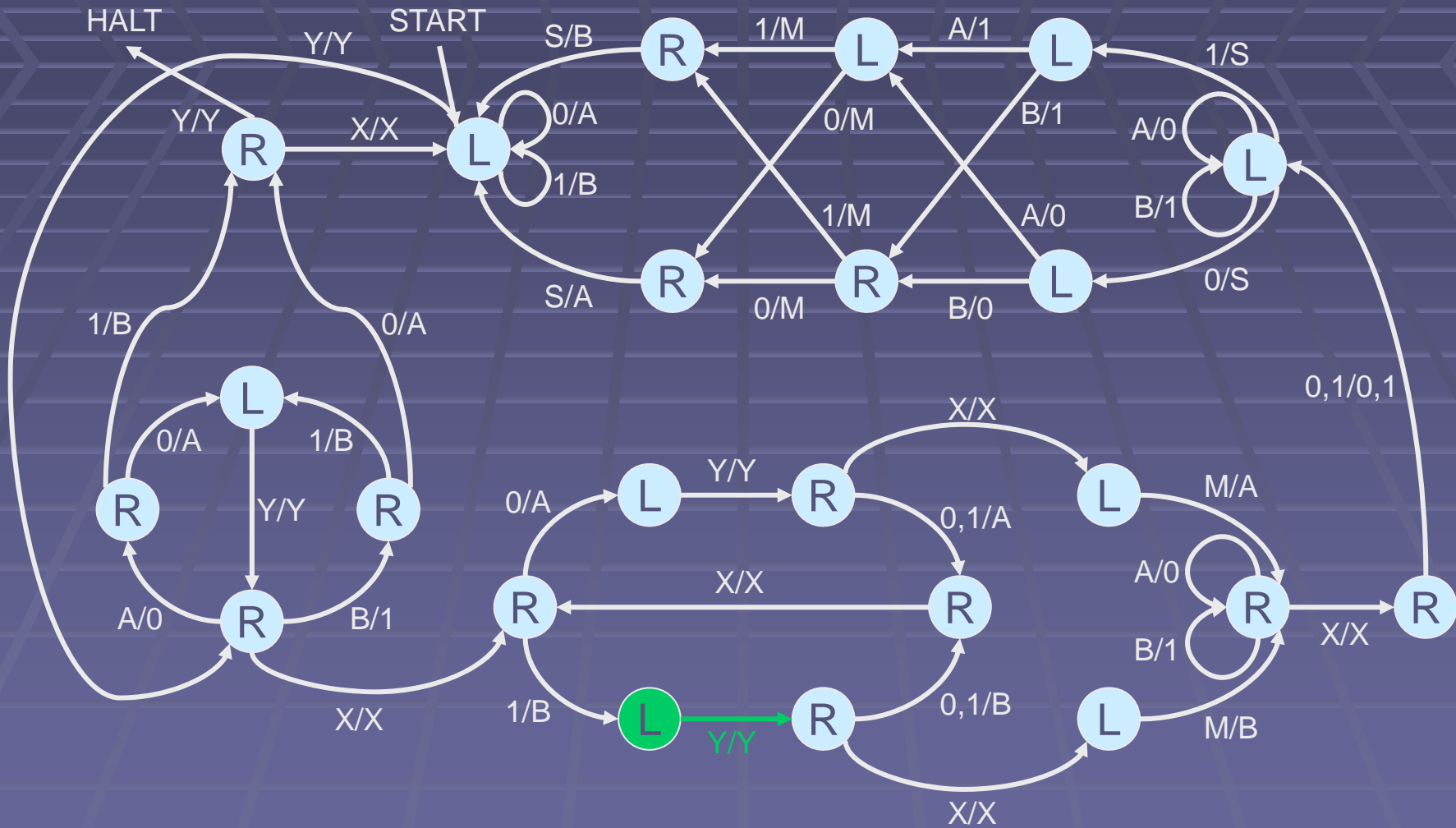
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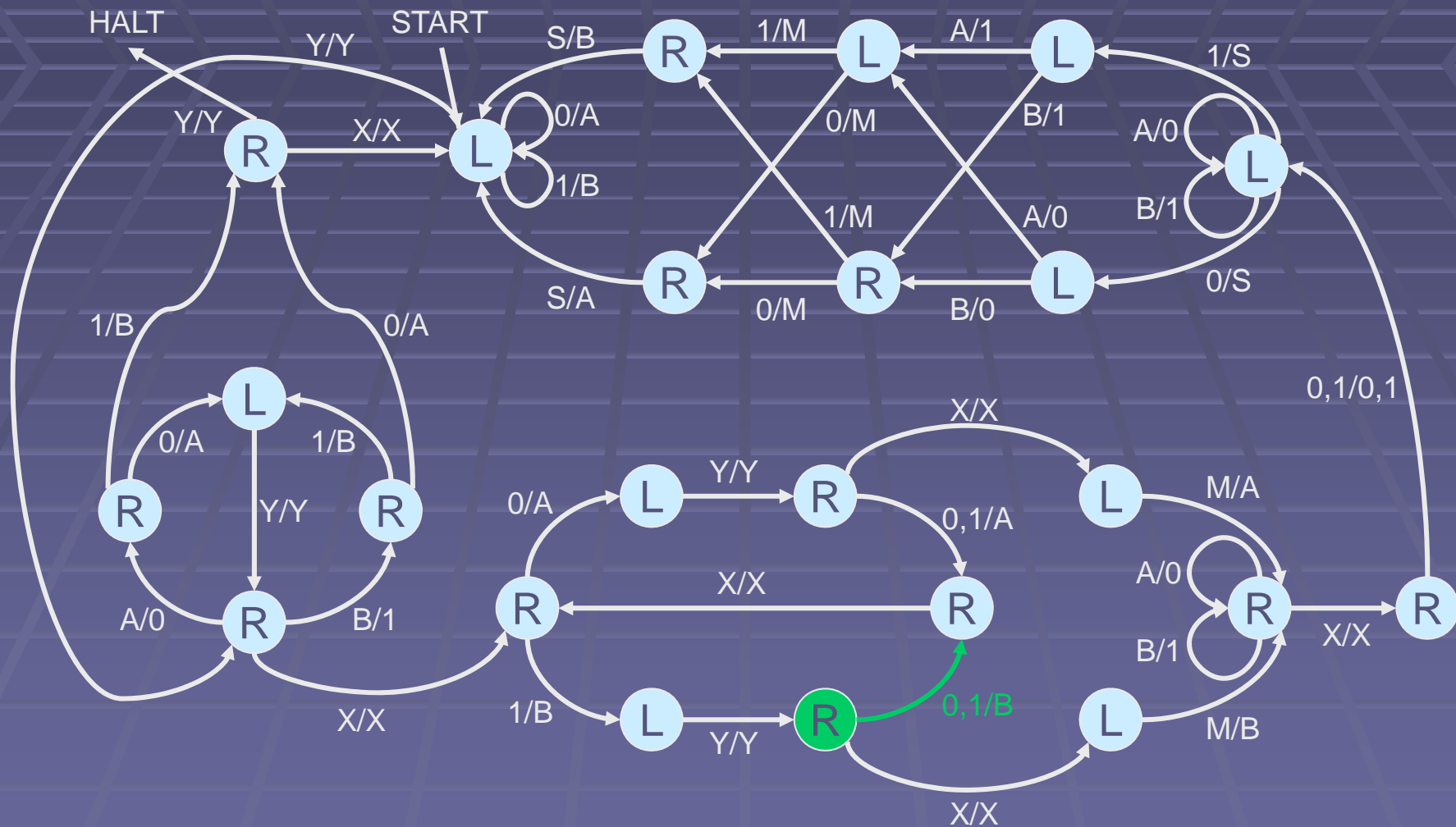
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Máquina de Turing Universal



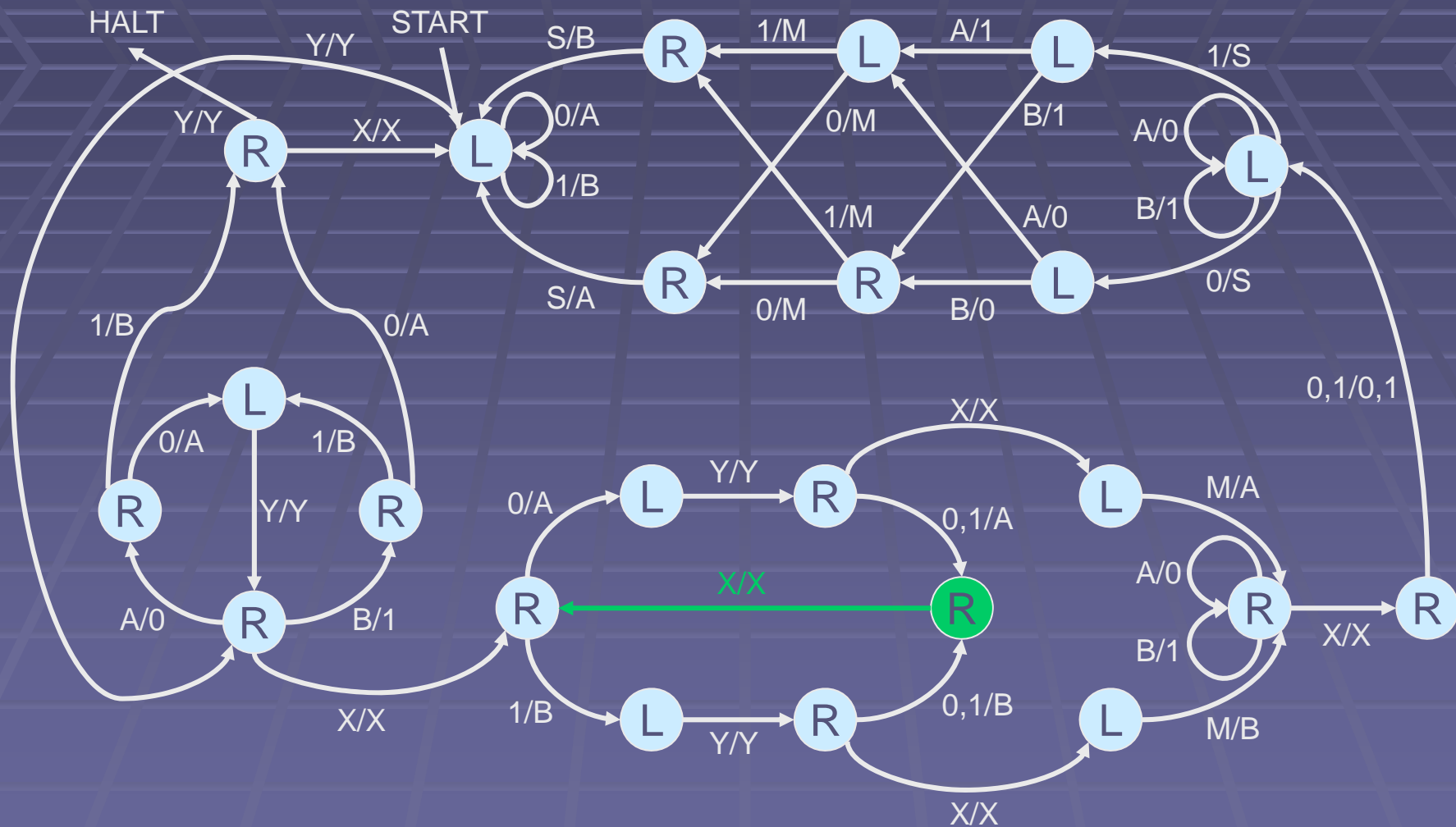
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Máquina de Turing Universal

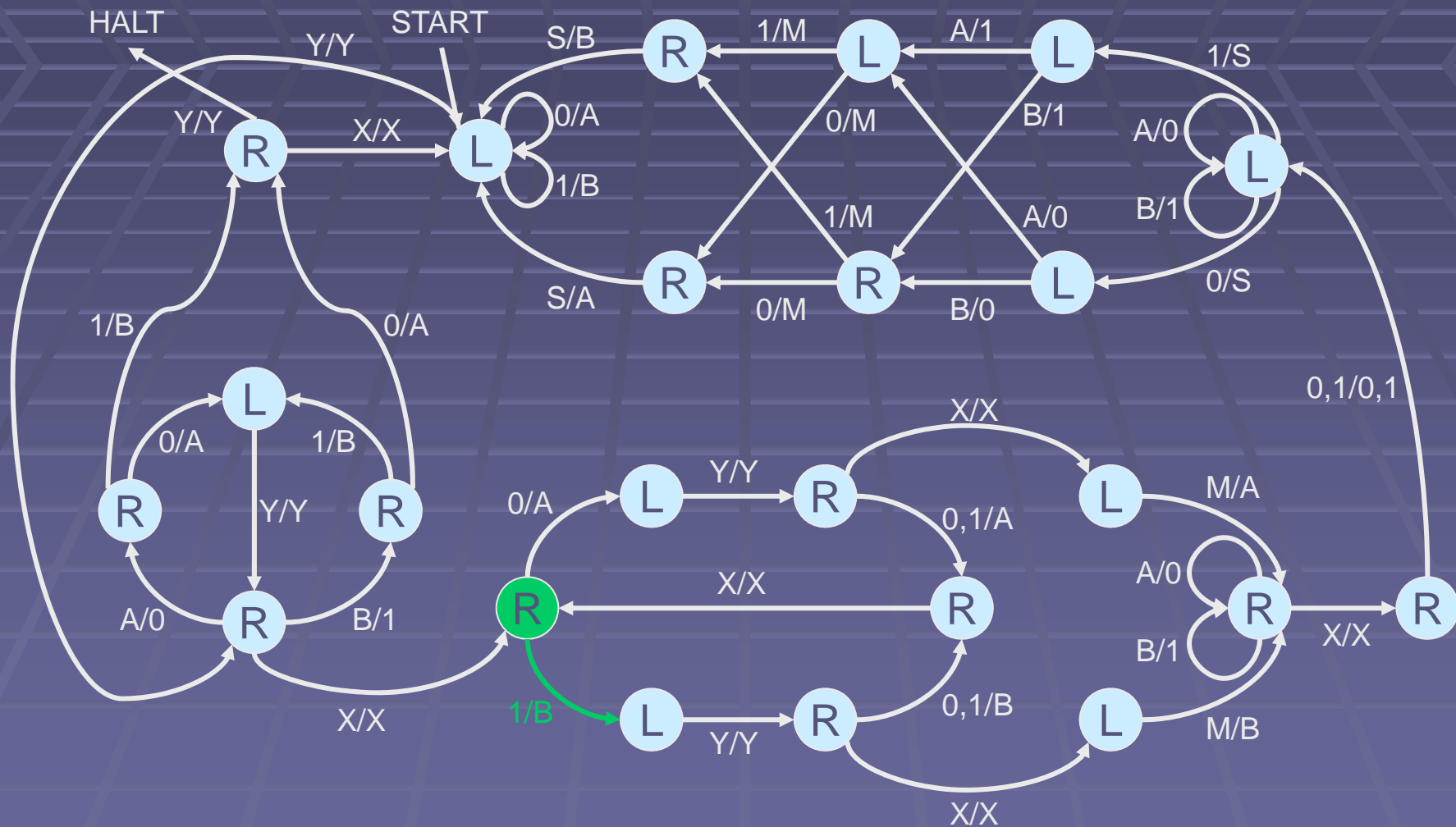


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Máquina de Turing Universal

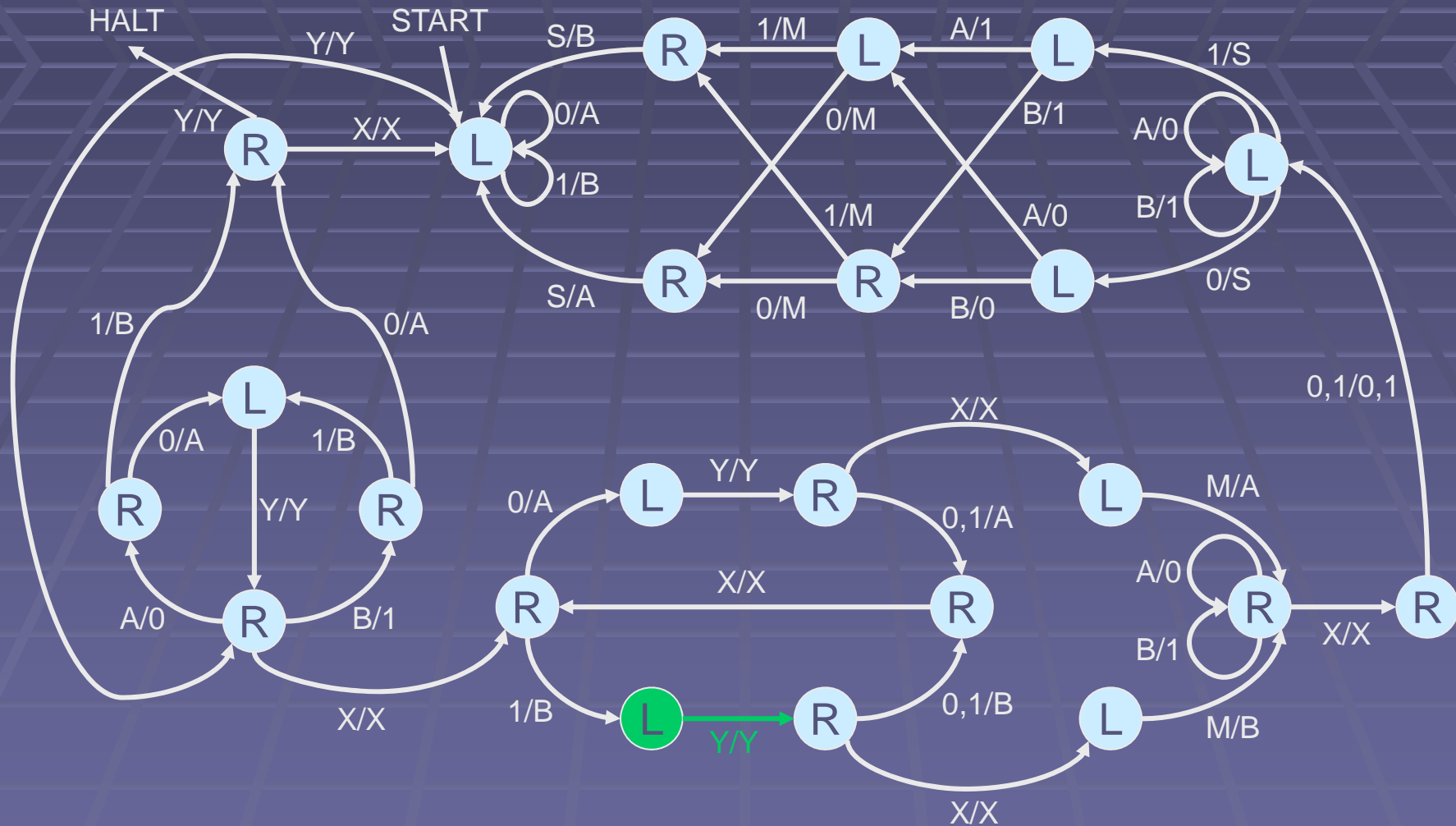


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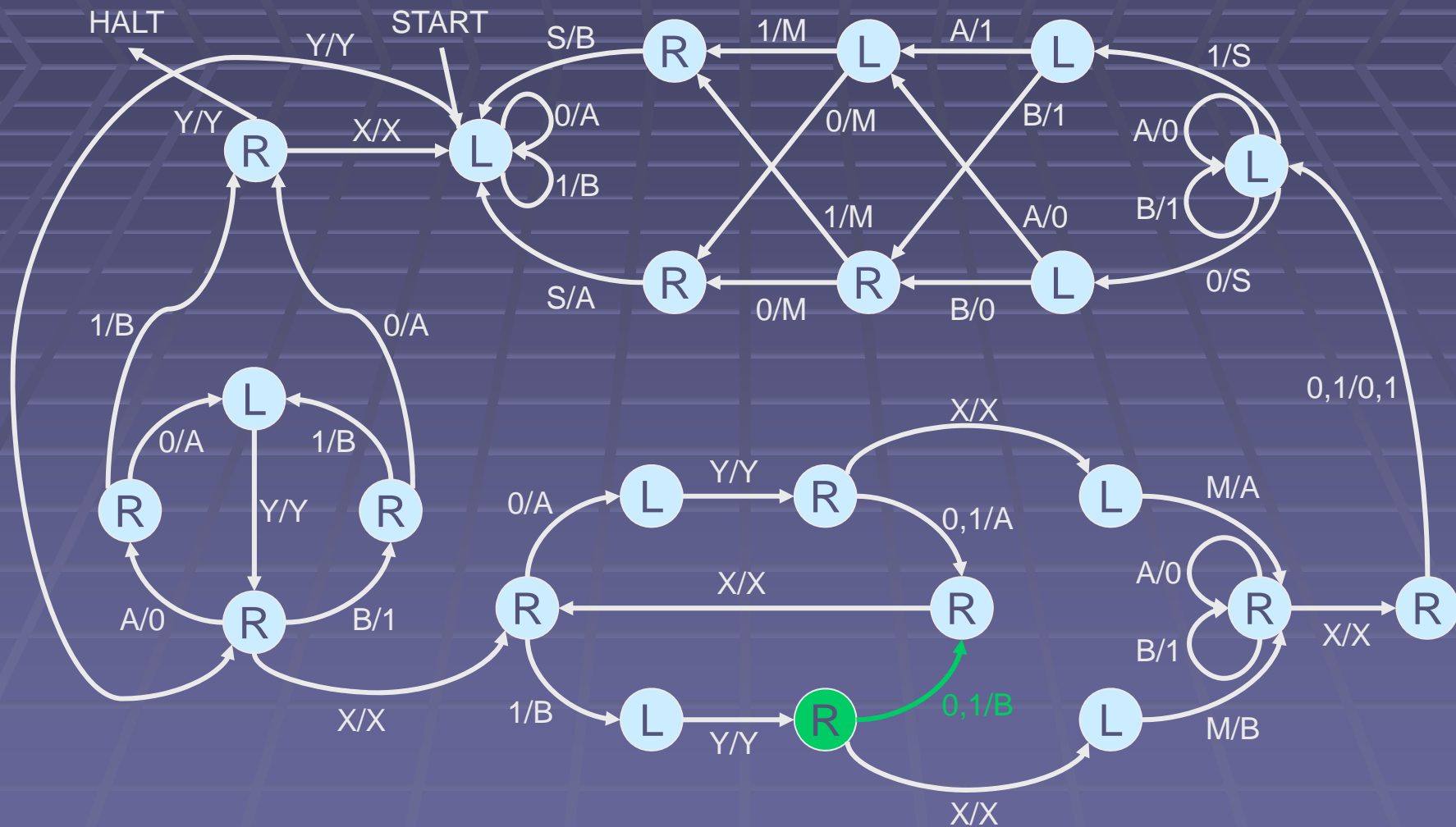
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Máquina de Turing Universal



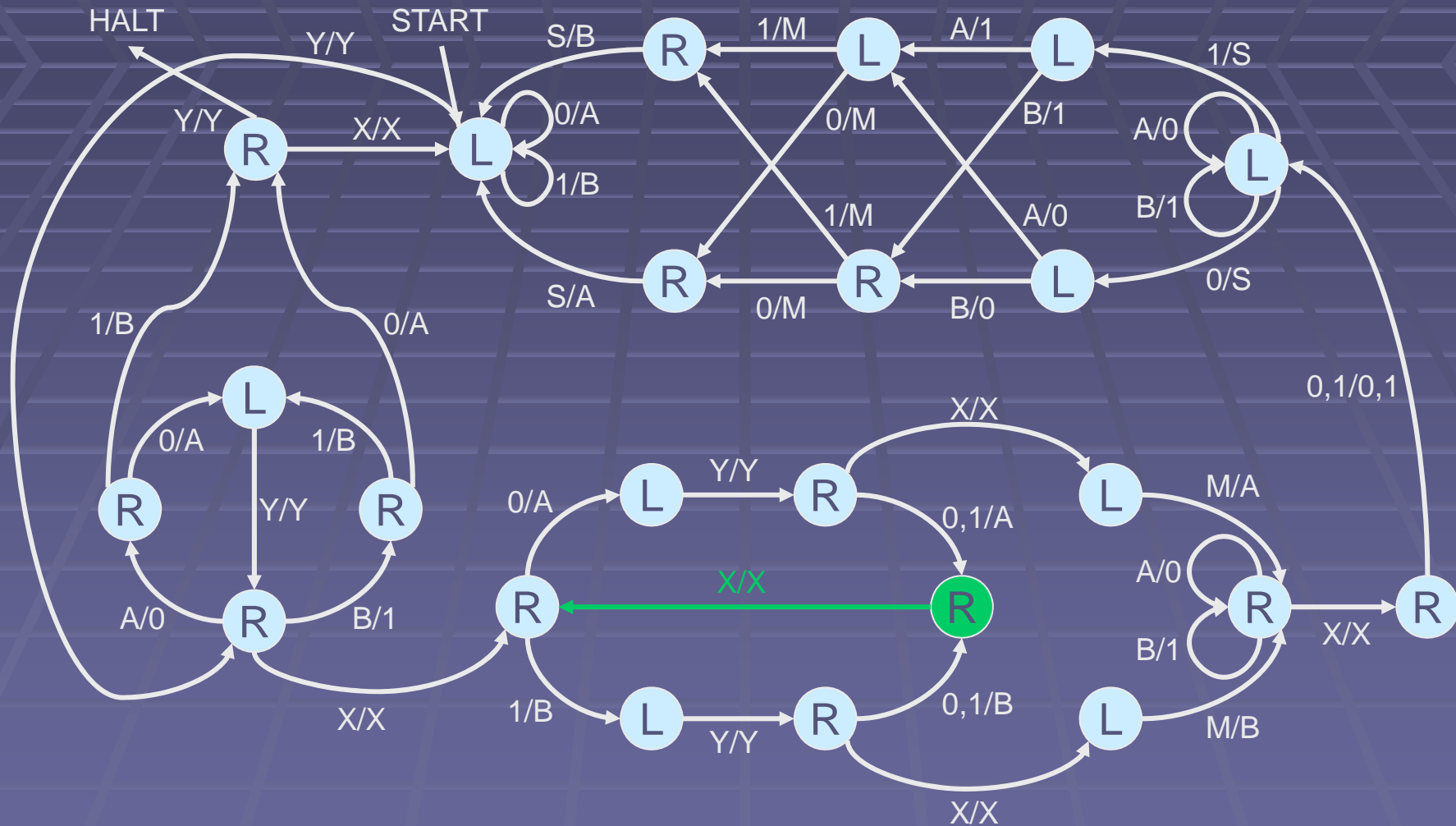
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Máquina de Turing Universal



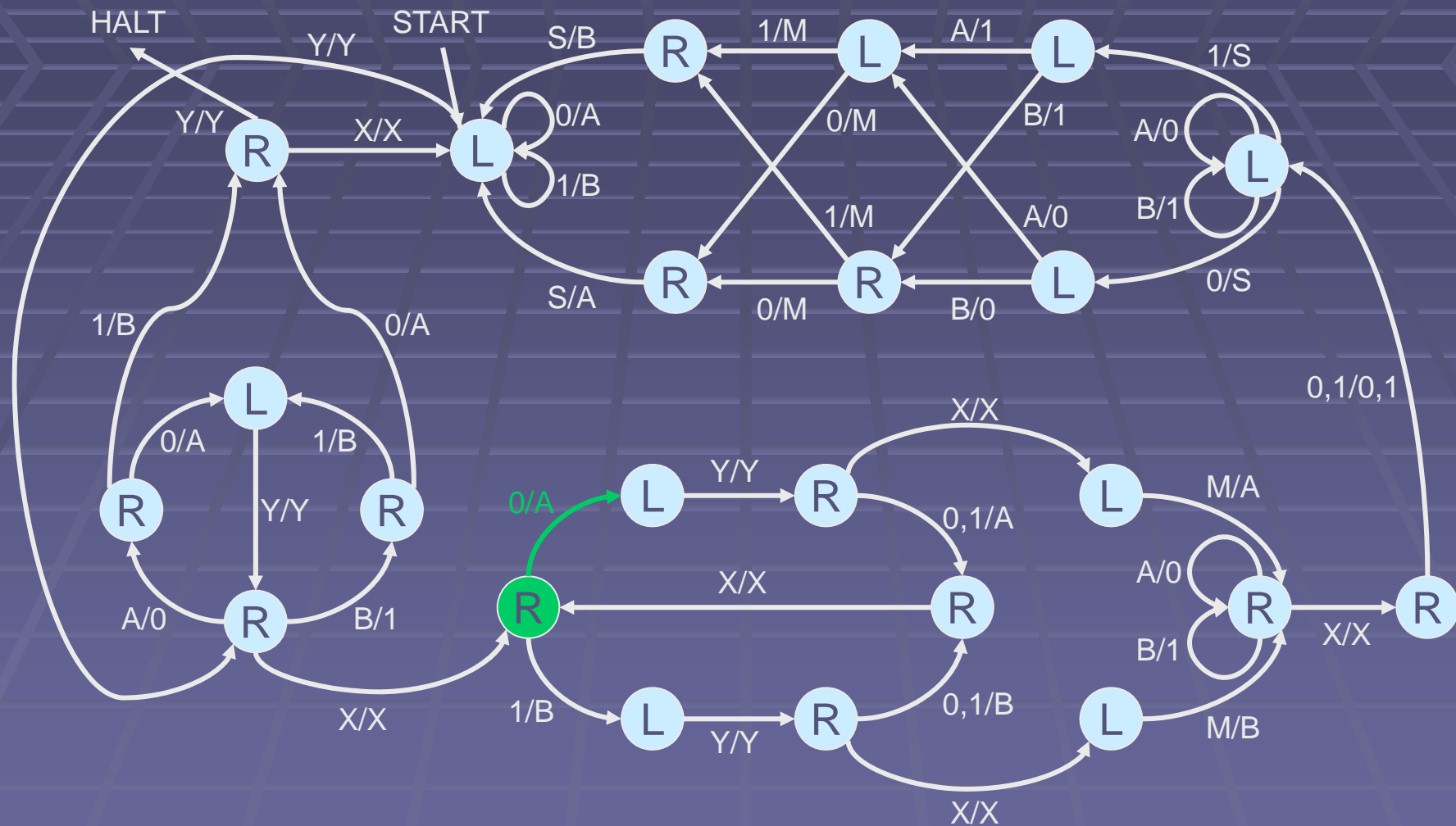
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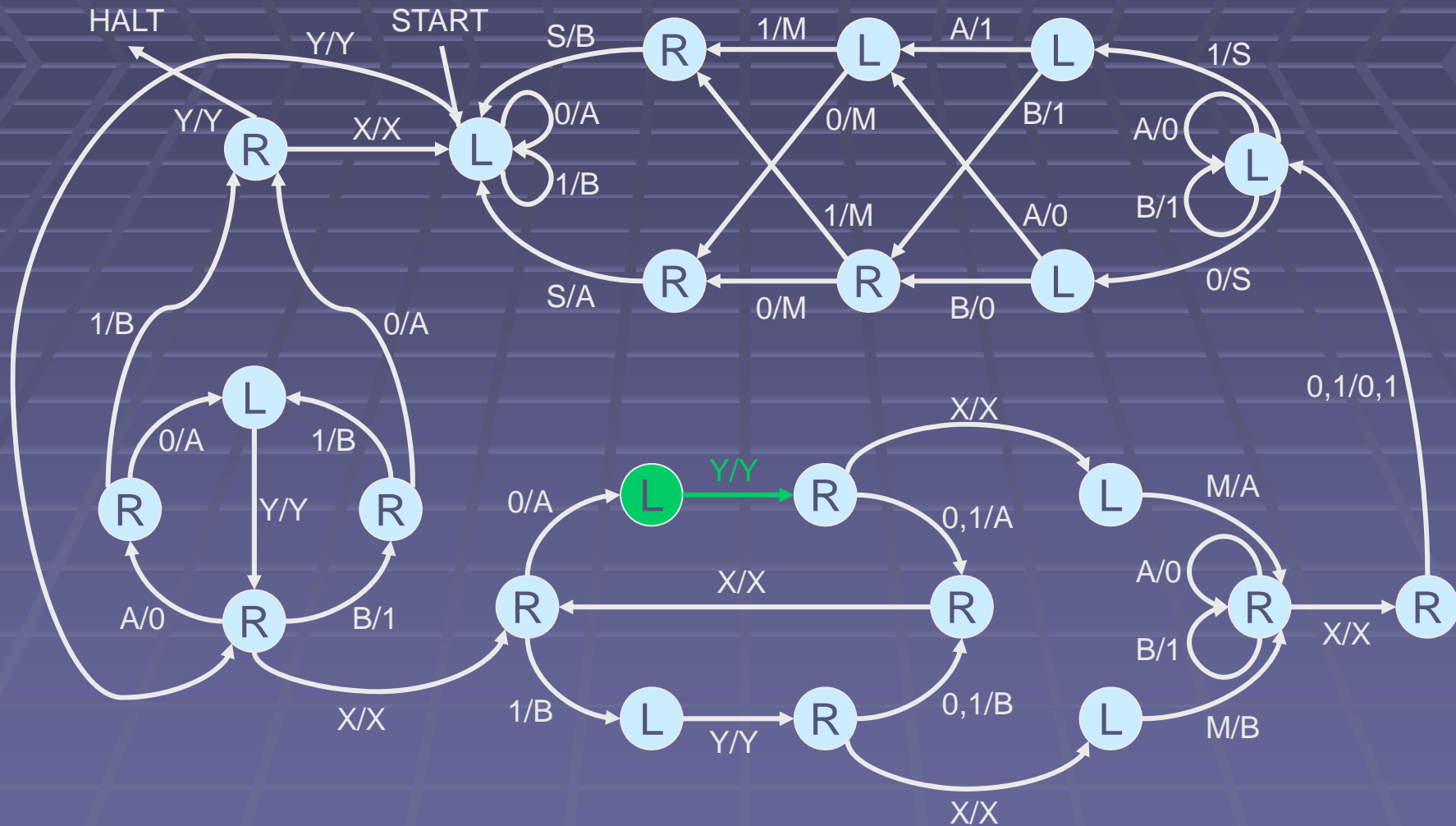
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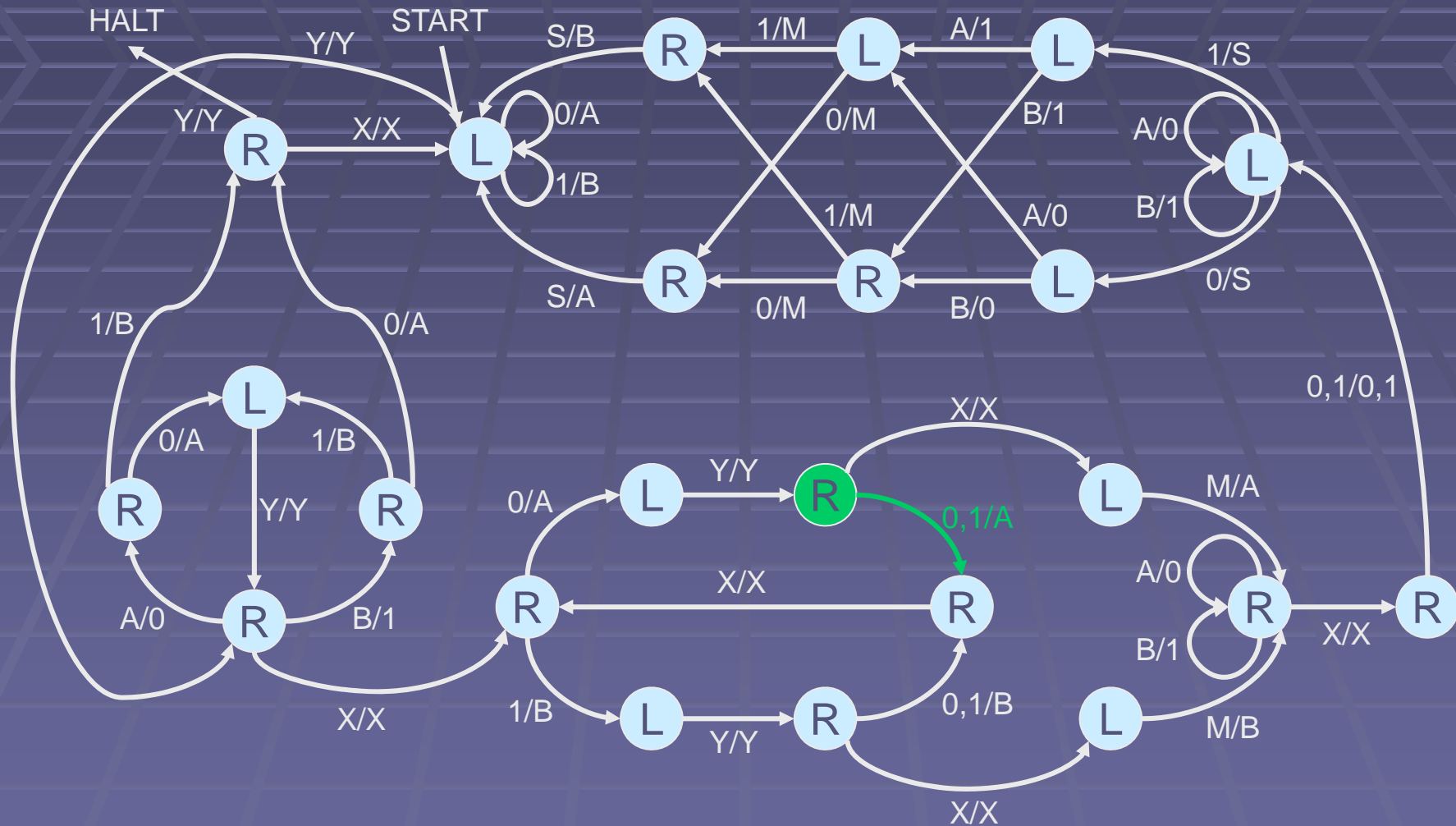
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Máquina de Turing Universal



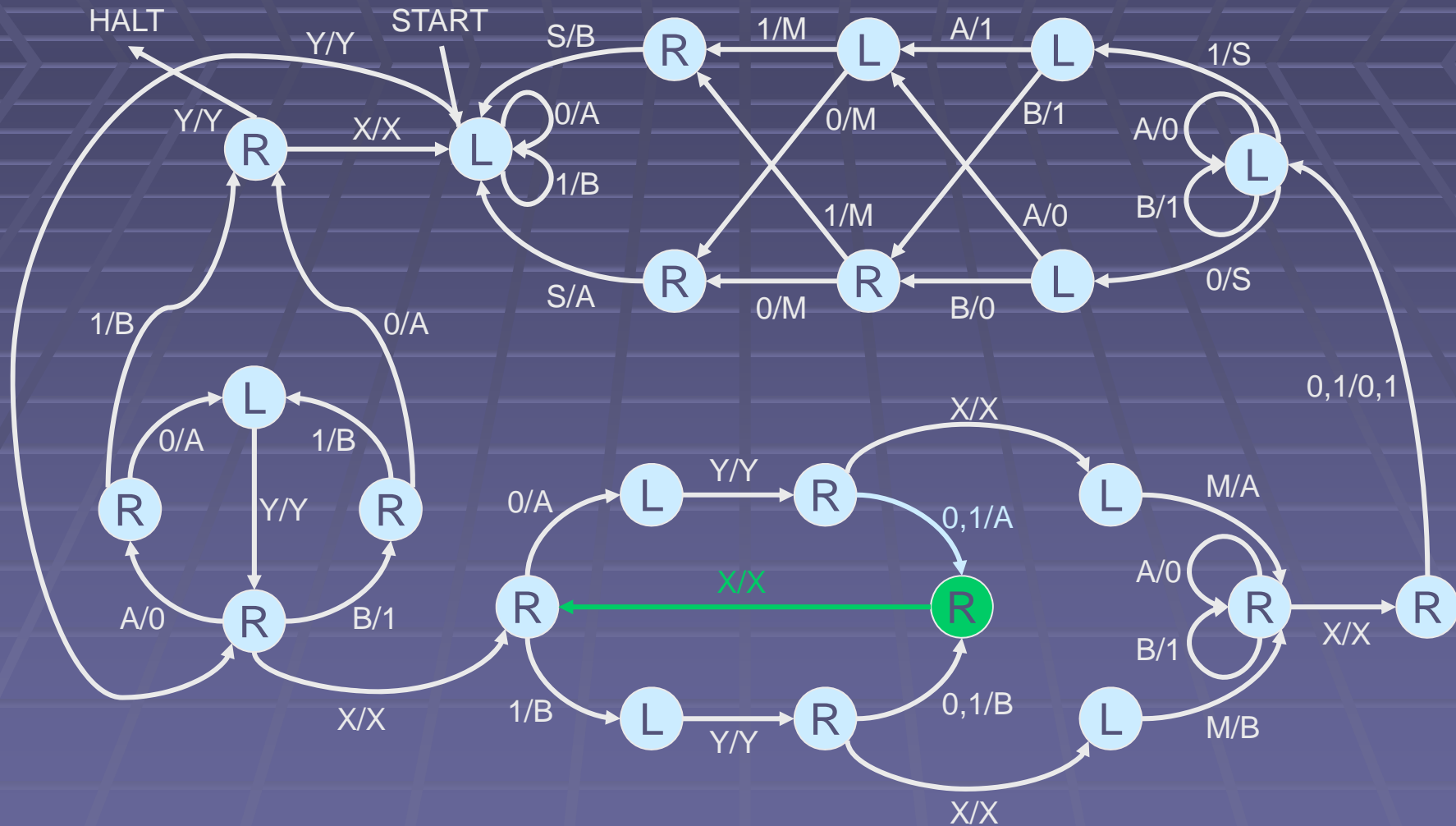
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Máquina de Turing Universal



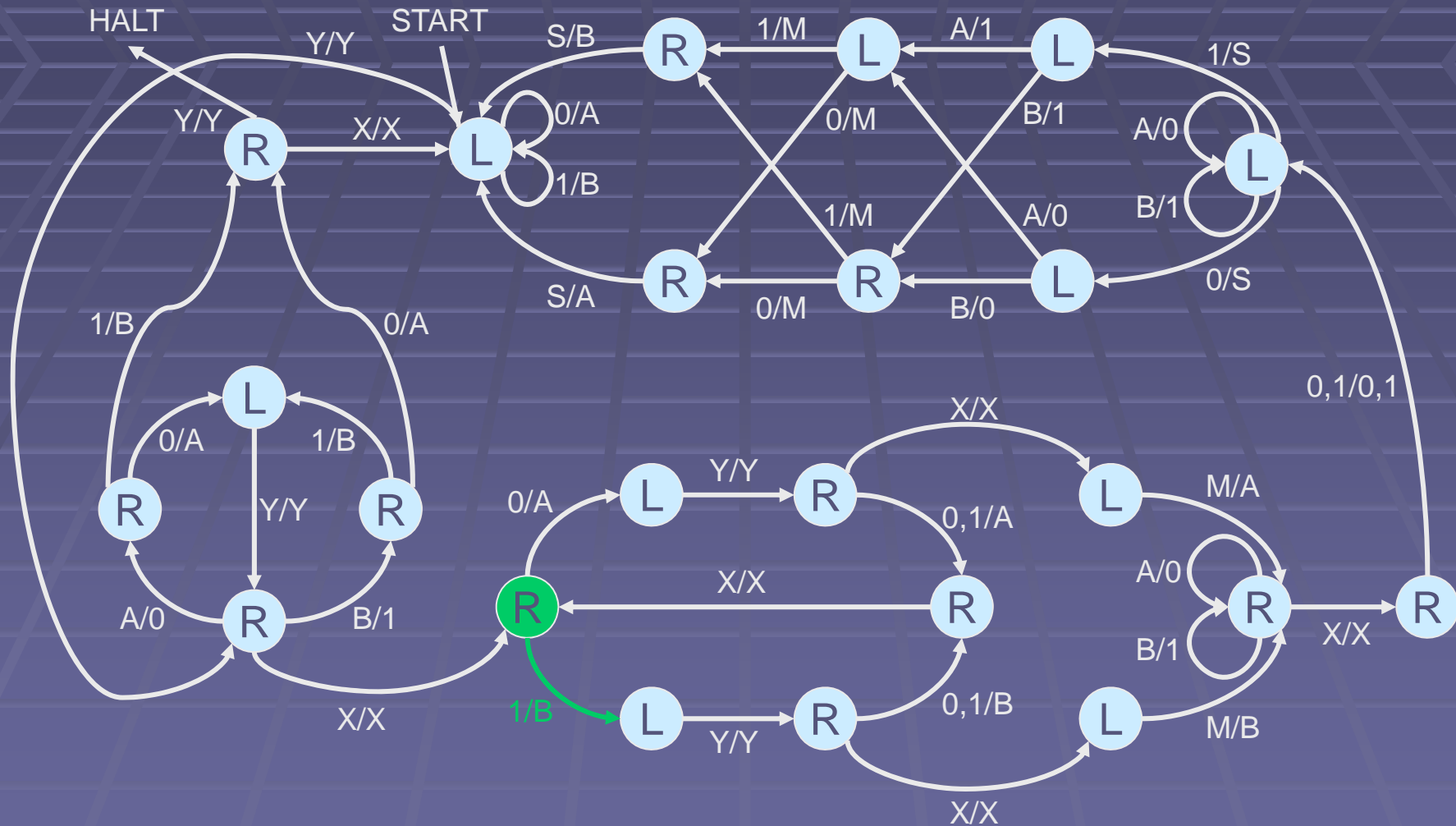
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Máquina de Turing Universal



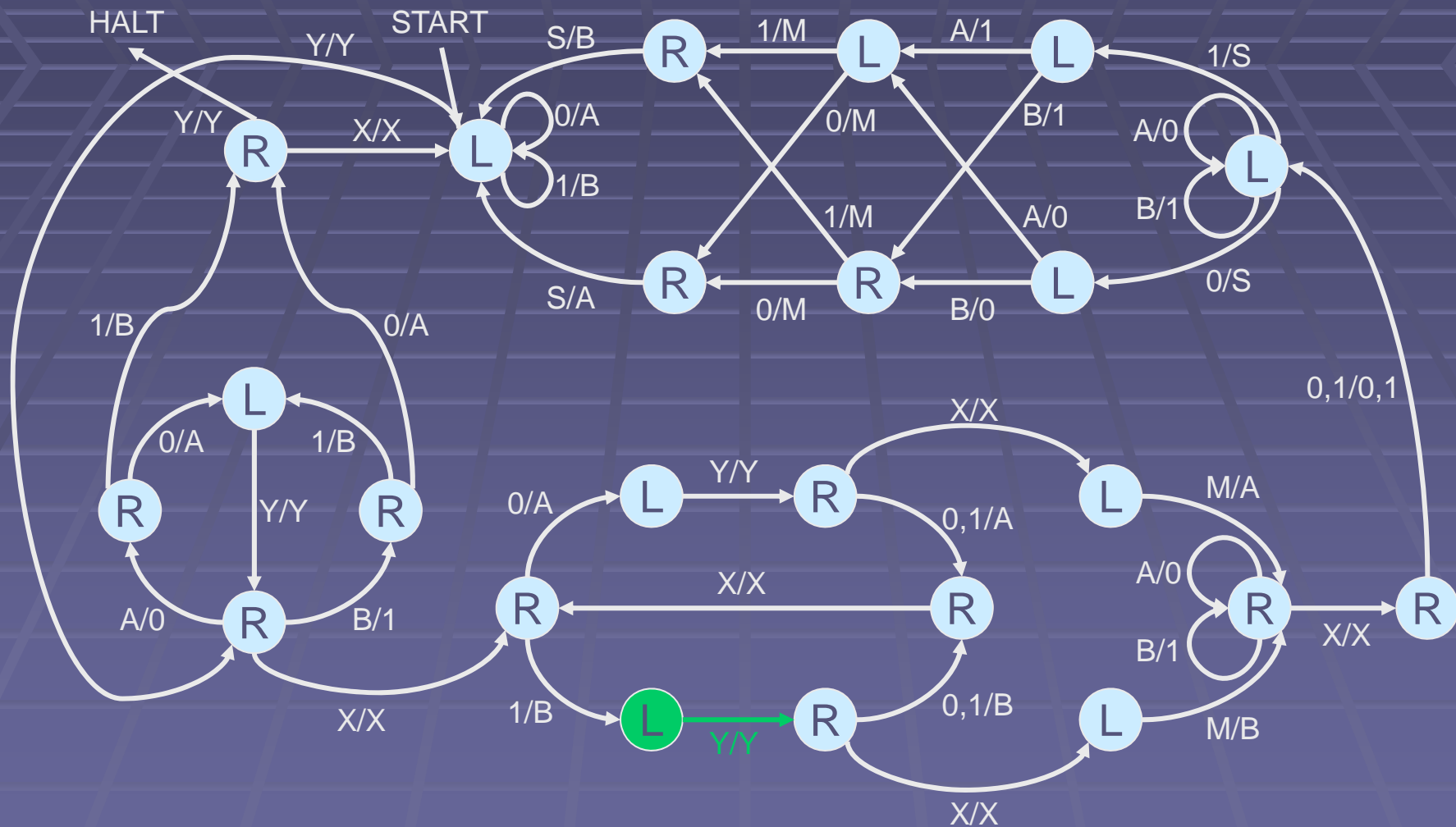
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Máquina de Turing Universal



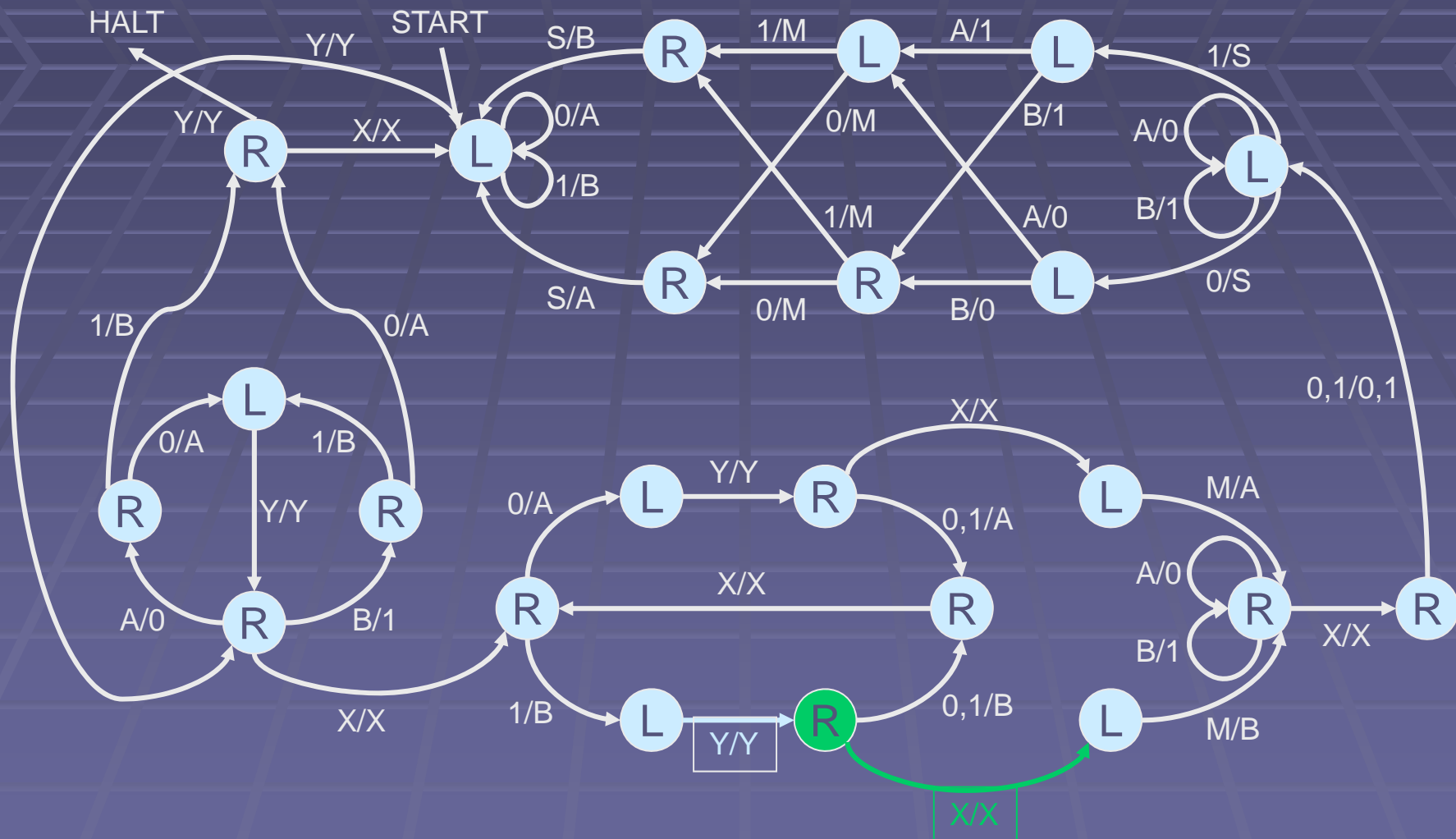
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Máquina de Turing Universal



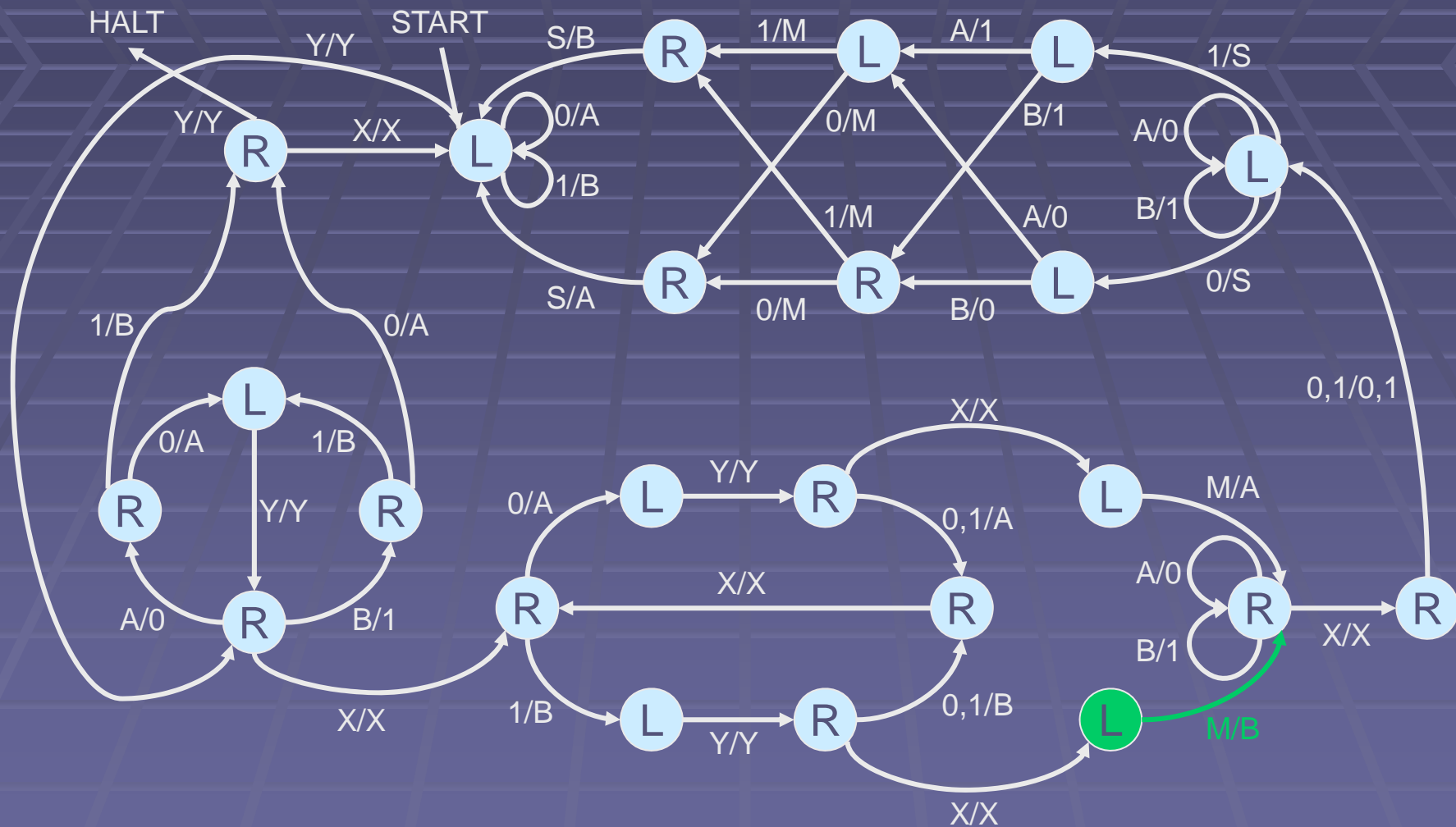
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Máquina de Turing Universal



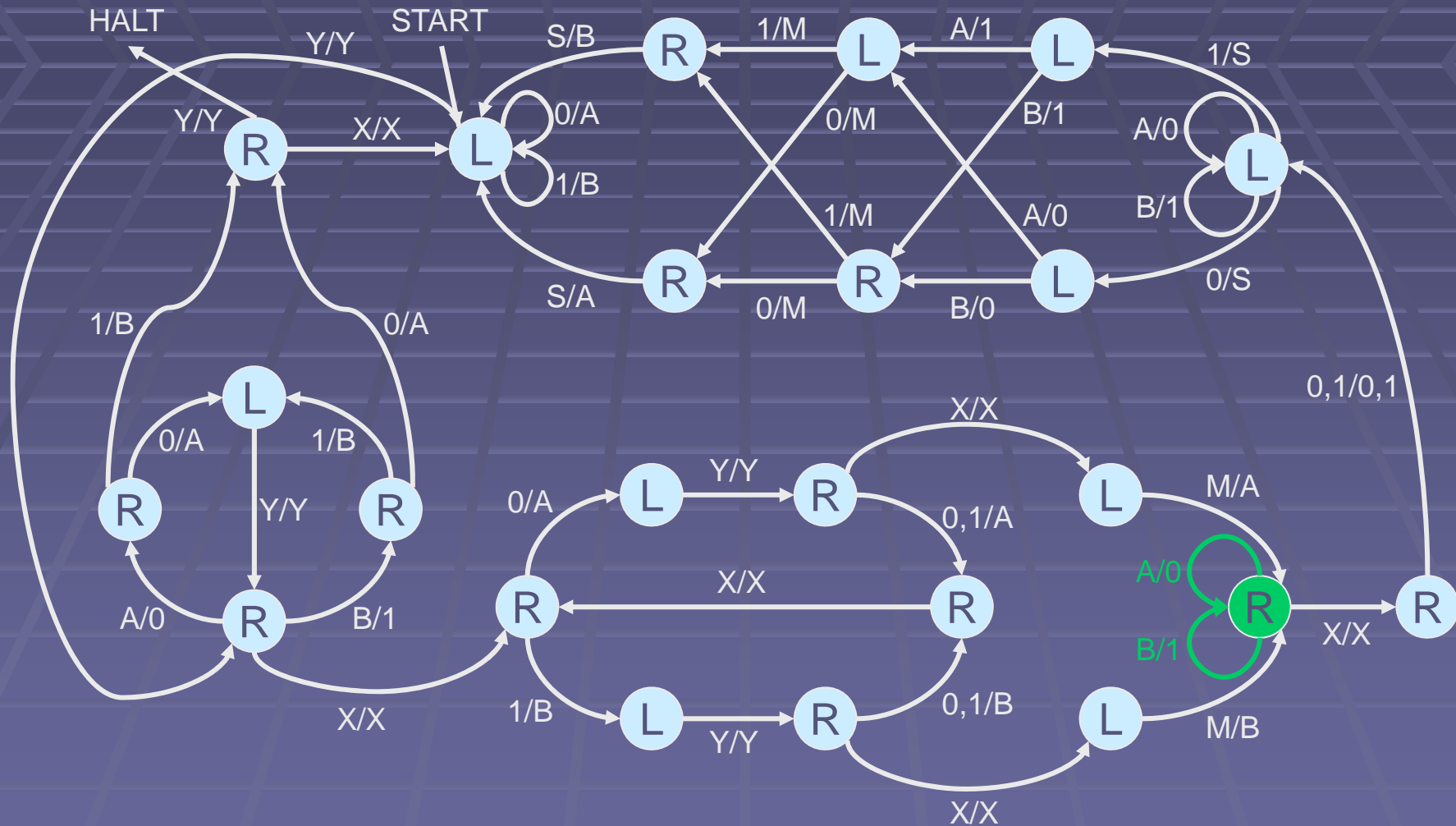
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Máquina de Turing Universal



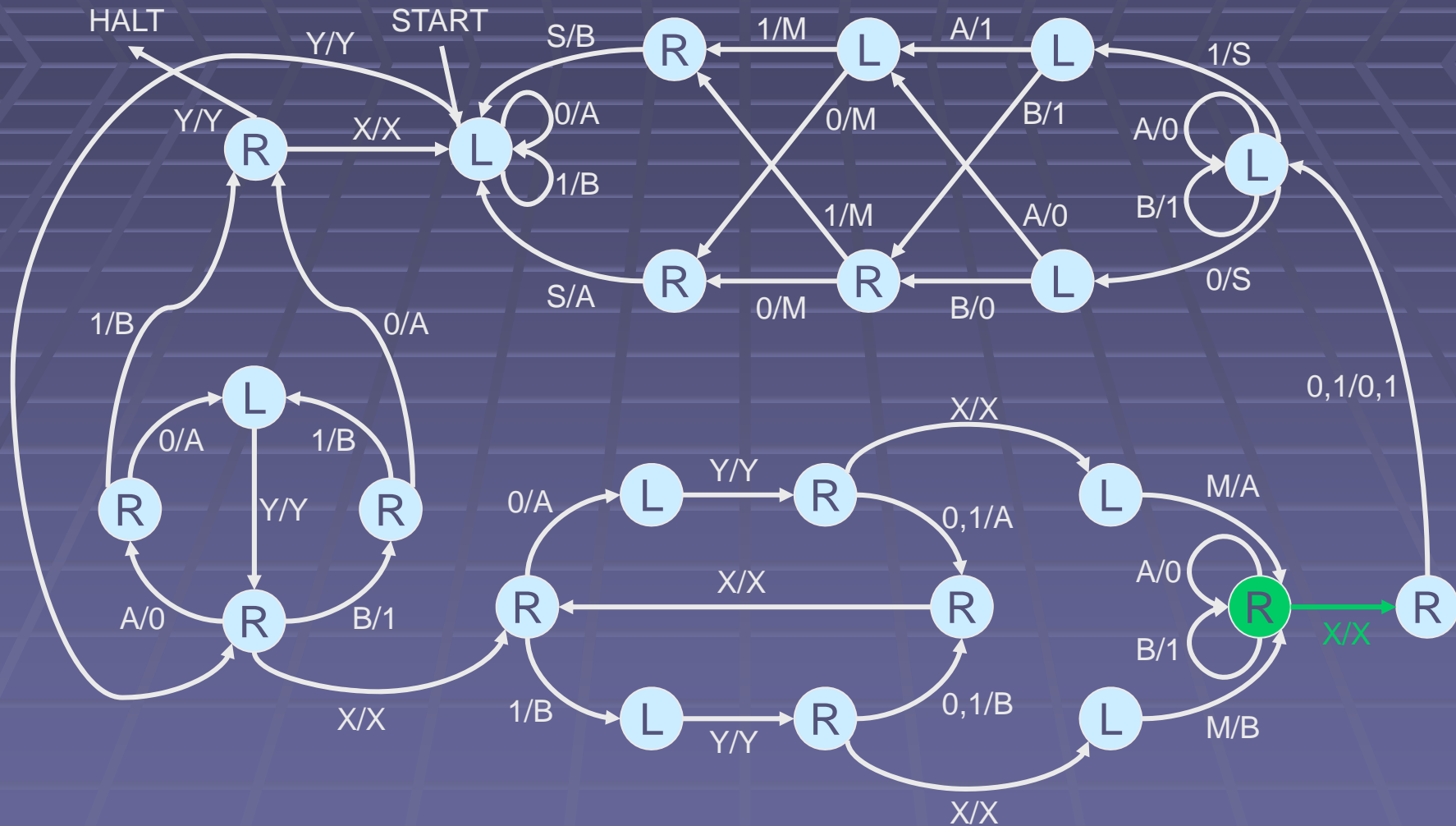
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Máquina de Turing Universal



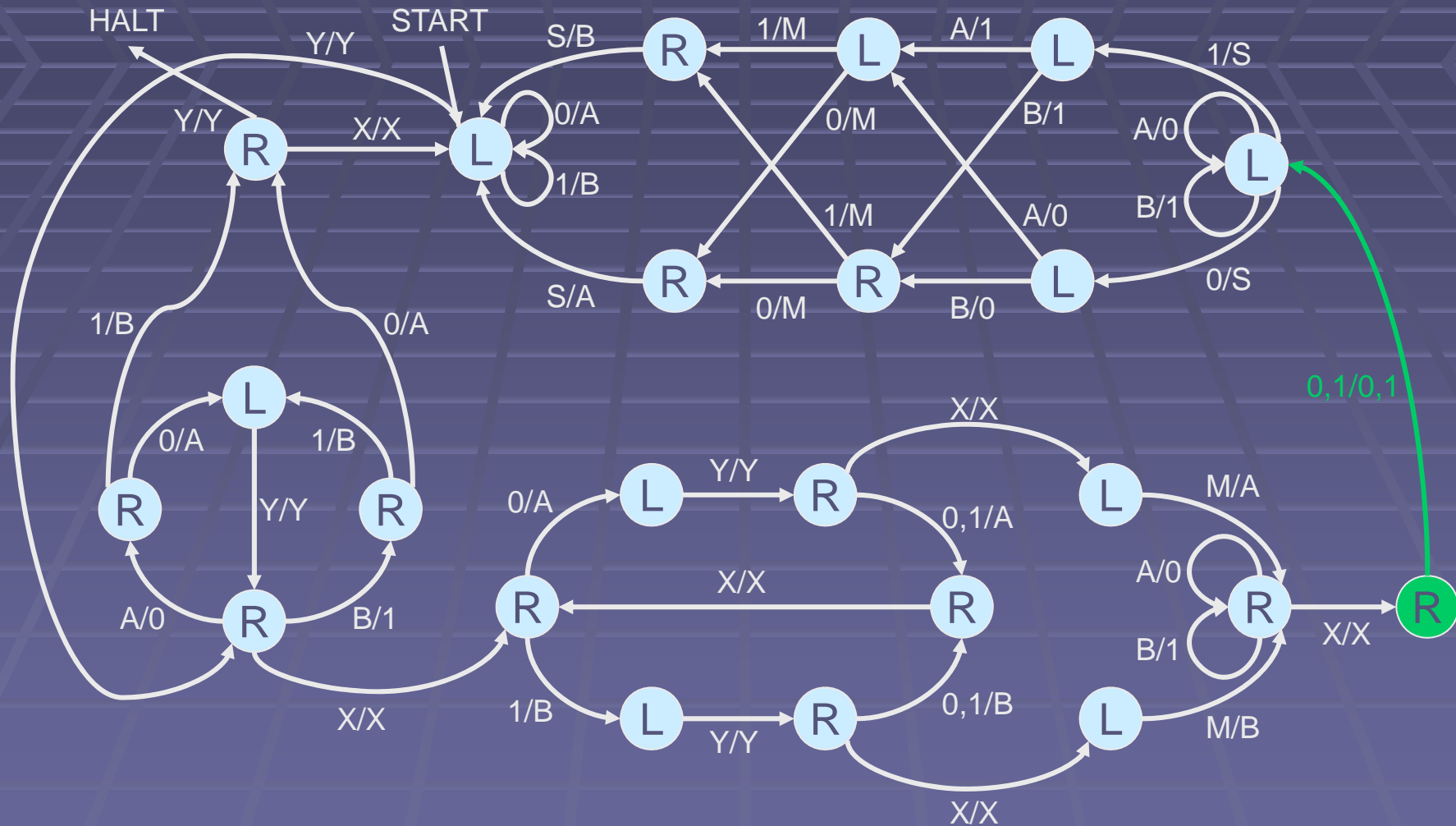
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Máquina de Turing Universal



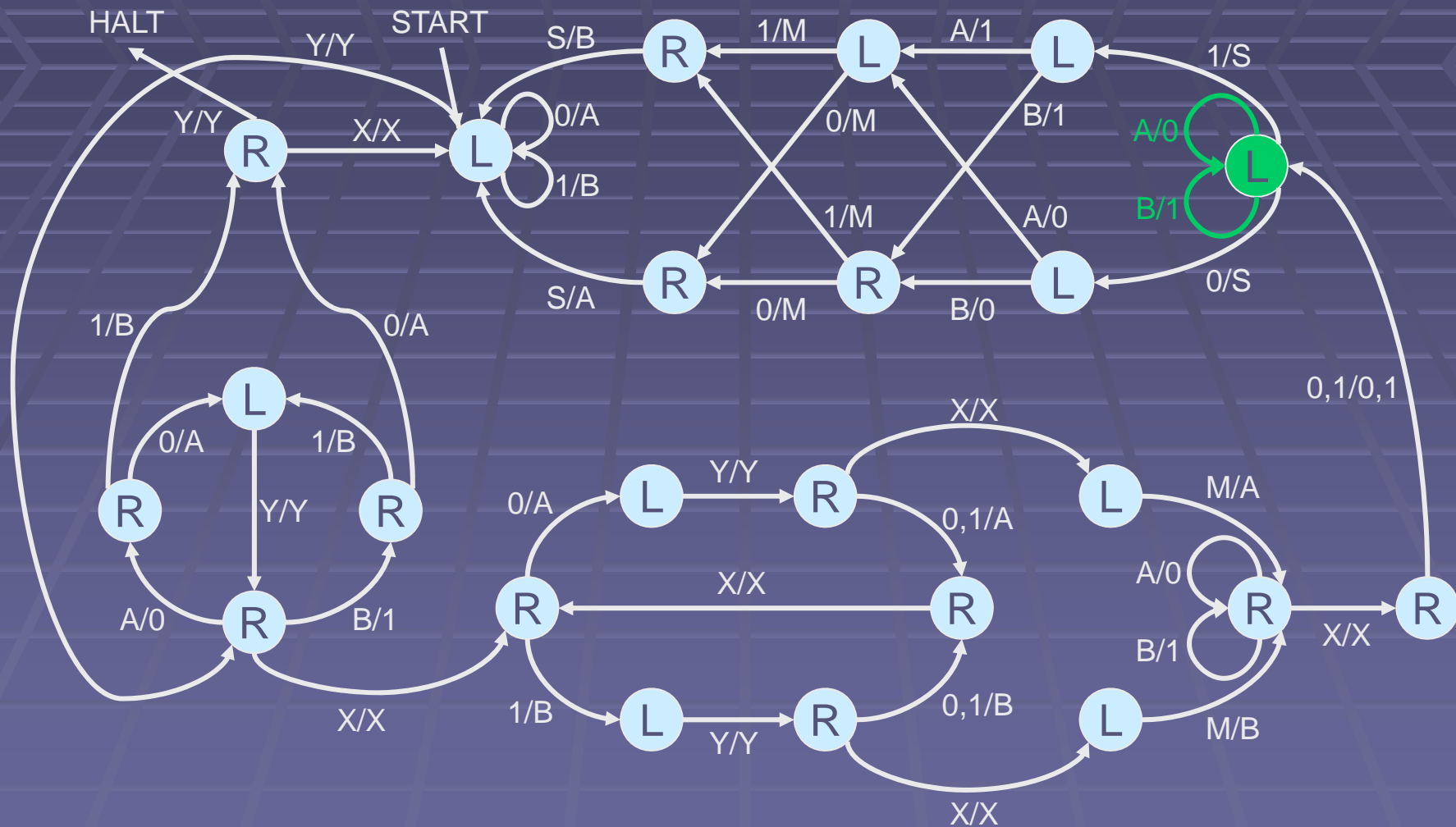
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Máquina de Turing Universal



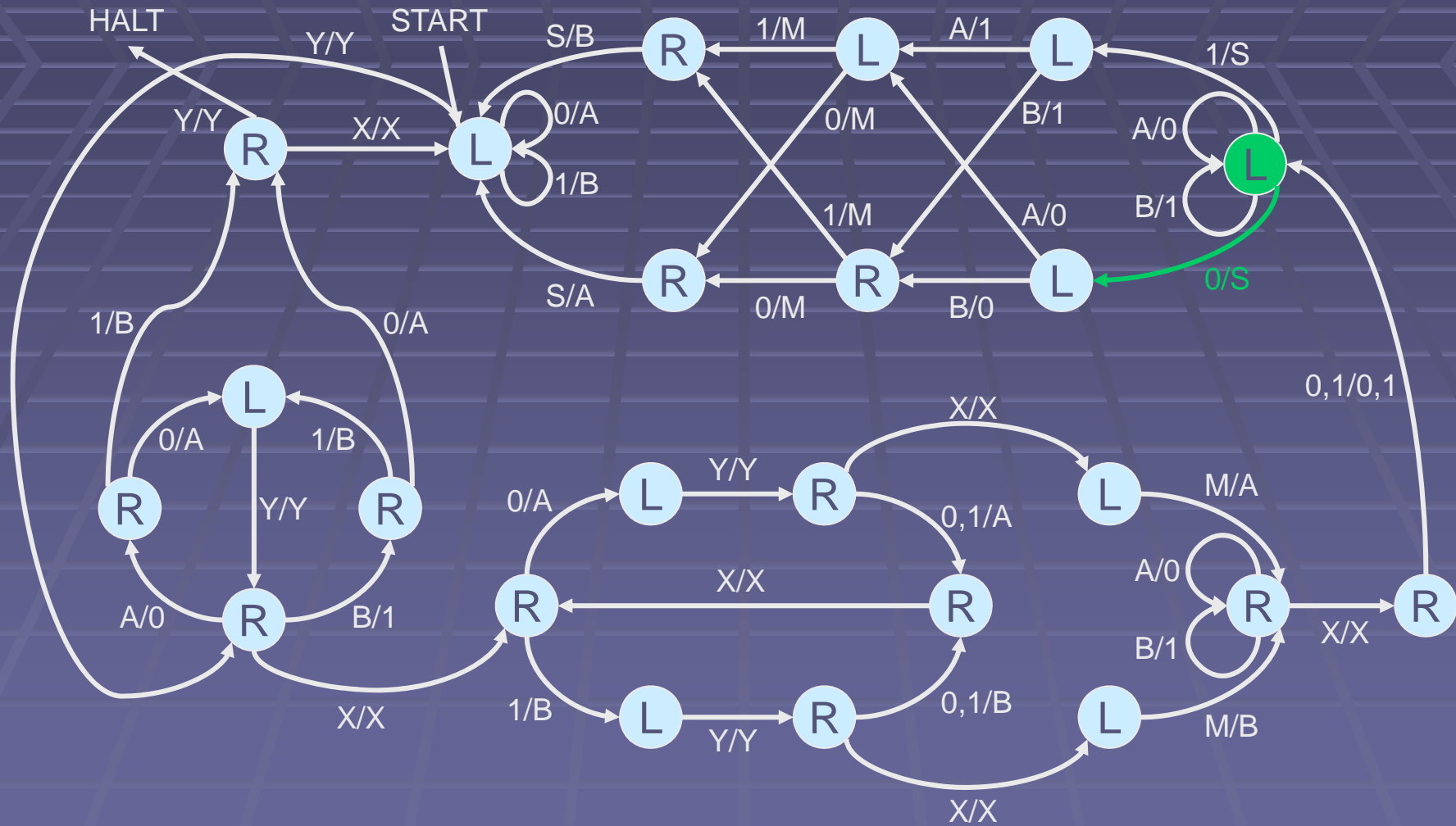
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Máquina de Turing Universal



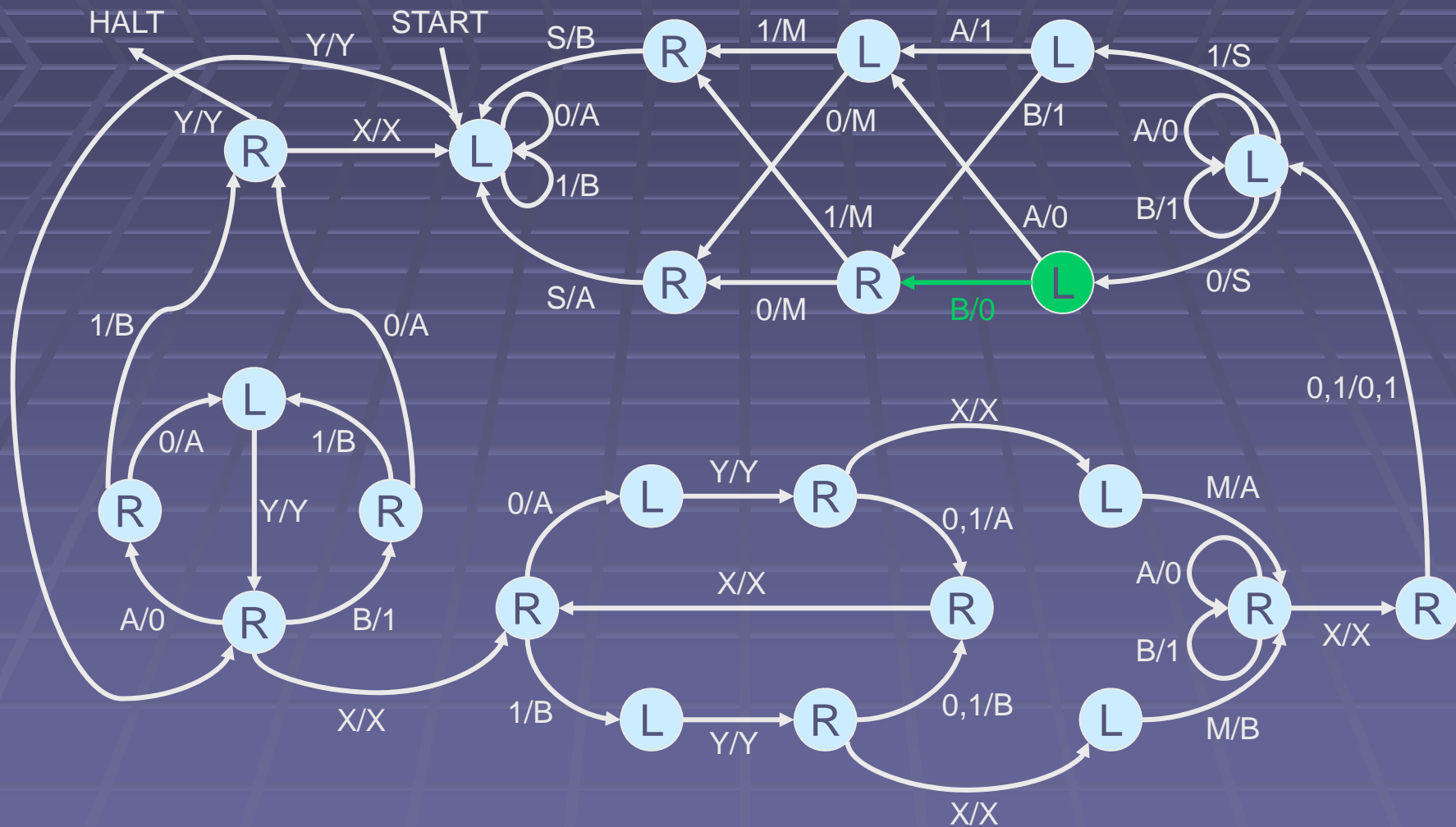
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Máquina de Turing Universal



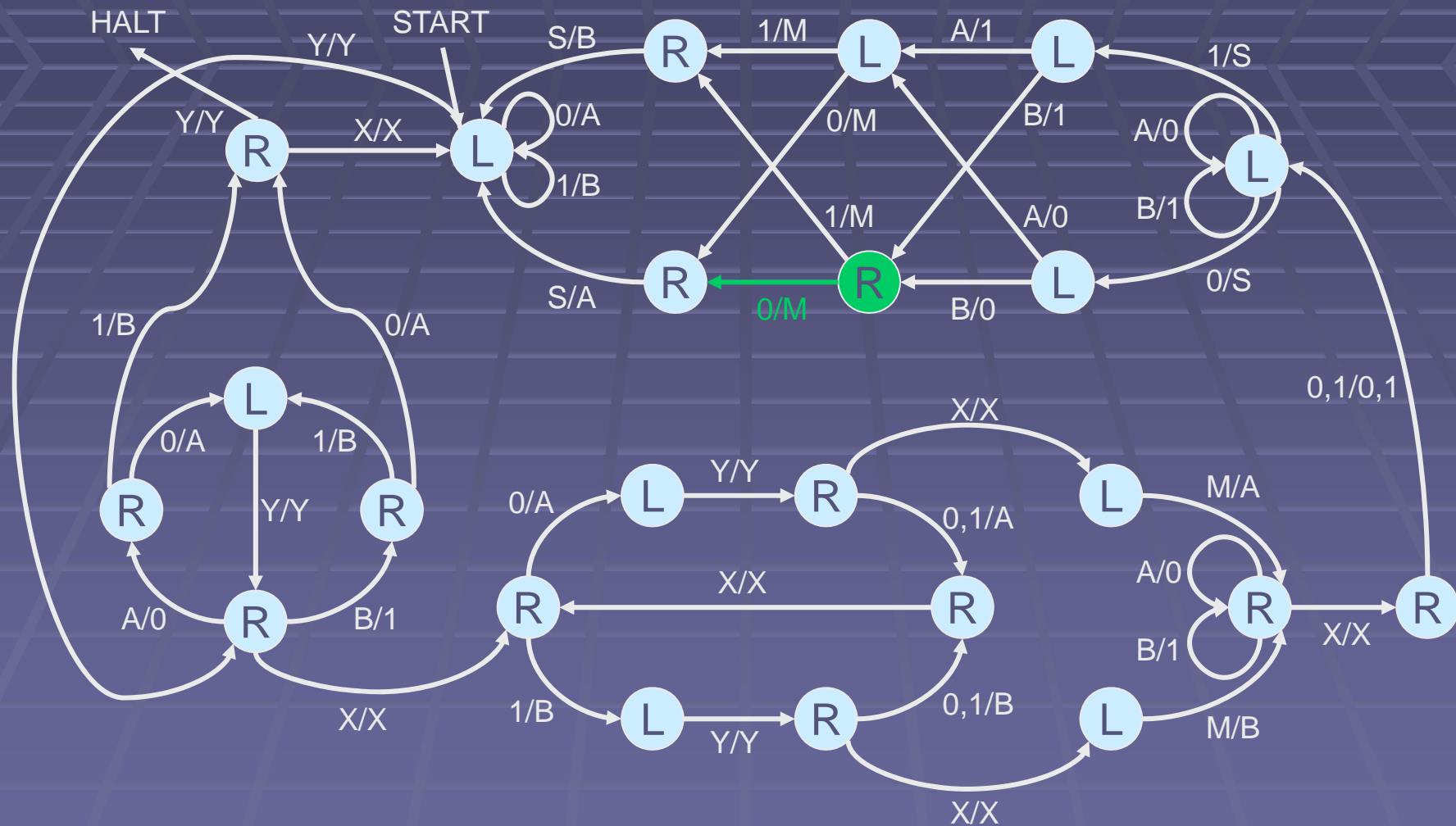
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Máquina de Turing Universal



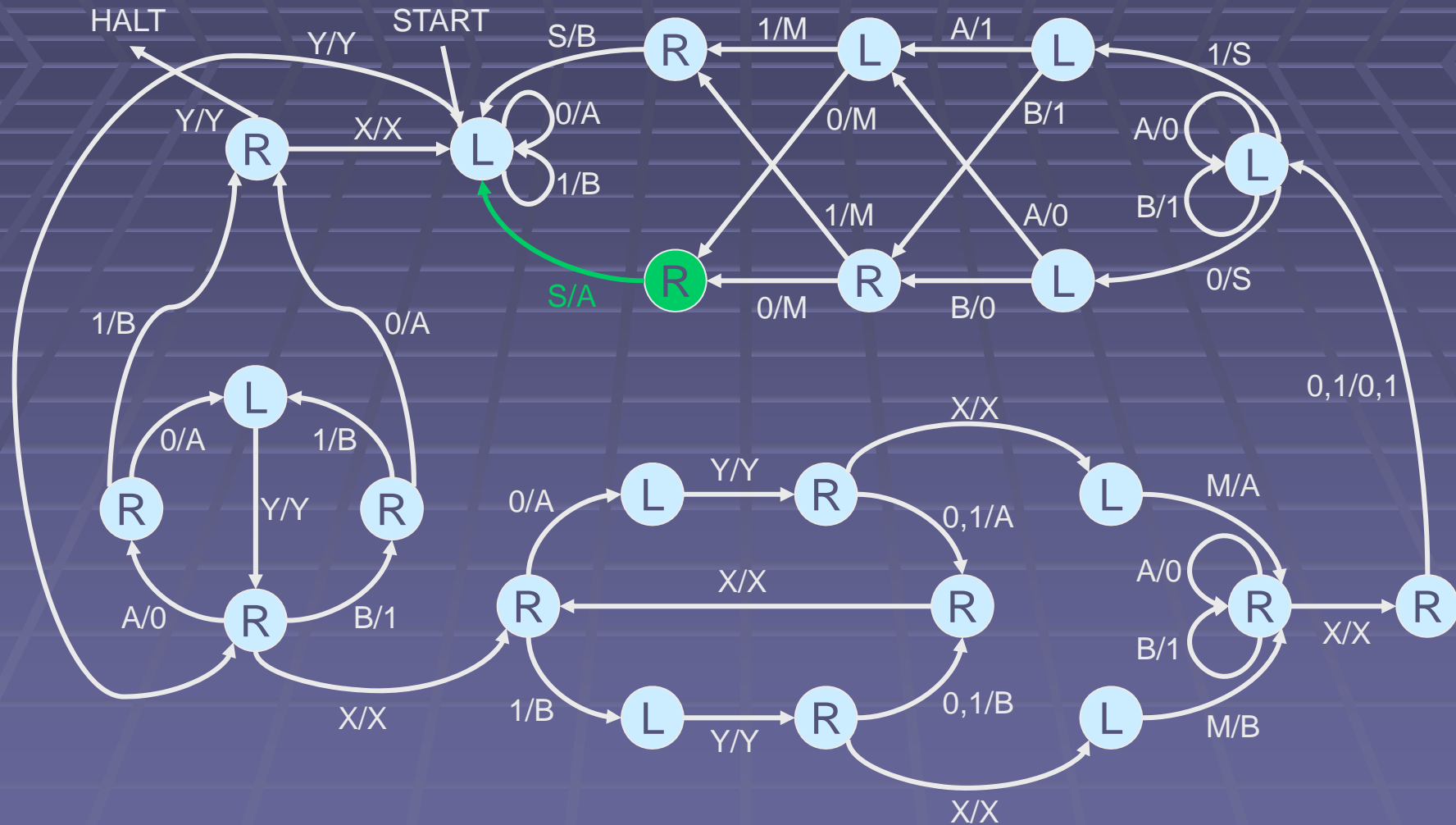
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Máquina de Turing Universal



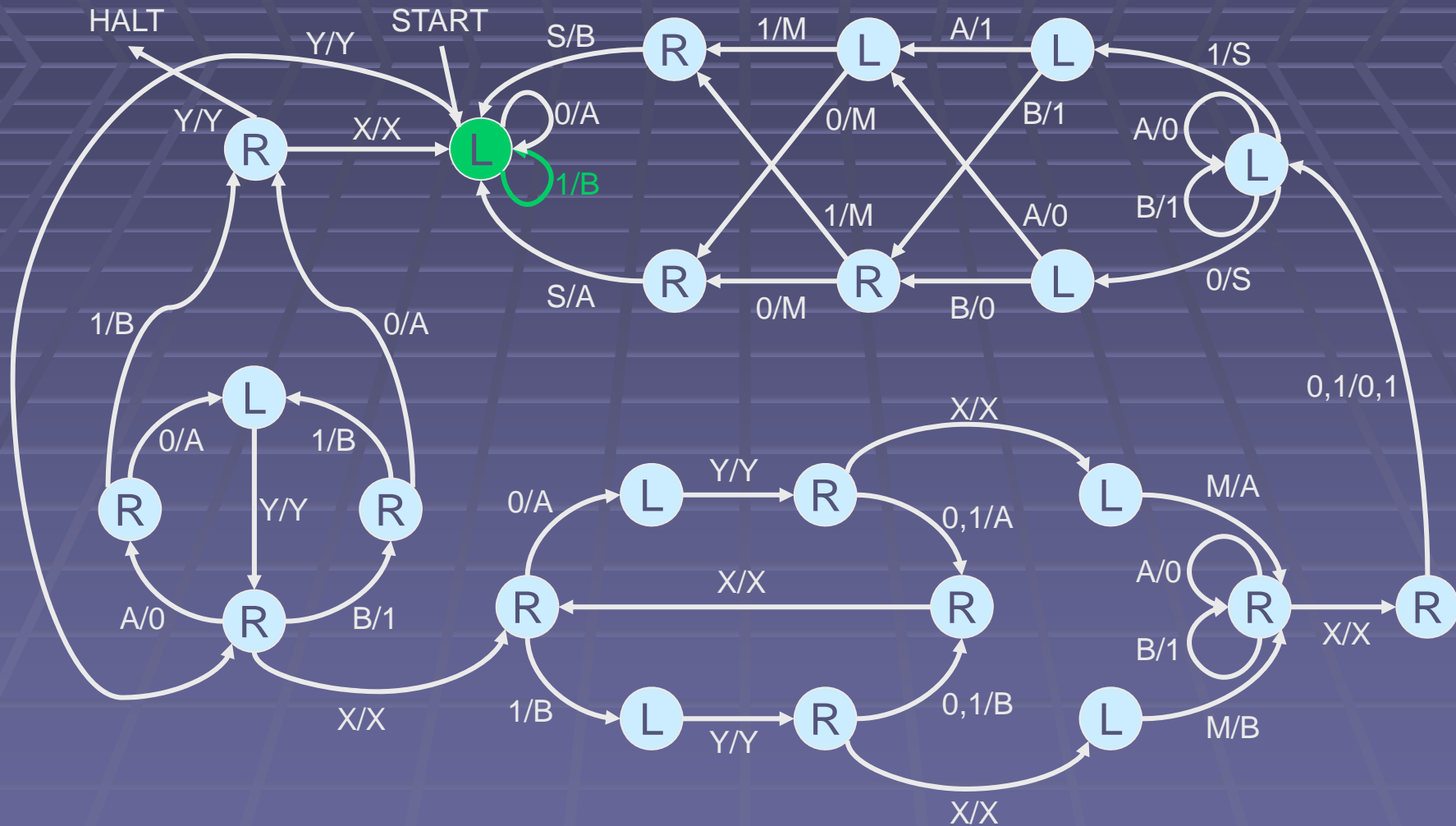
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Máquina de Turing Universal



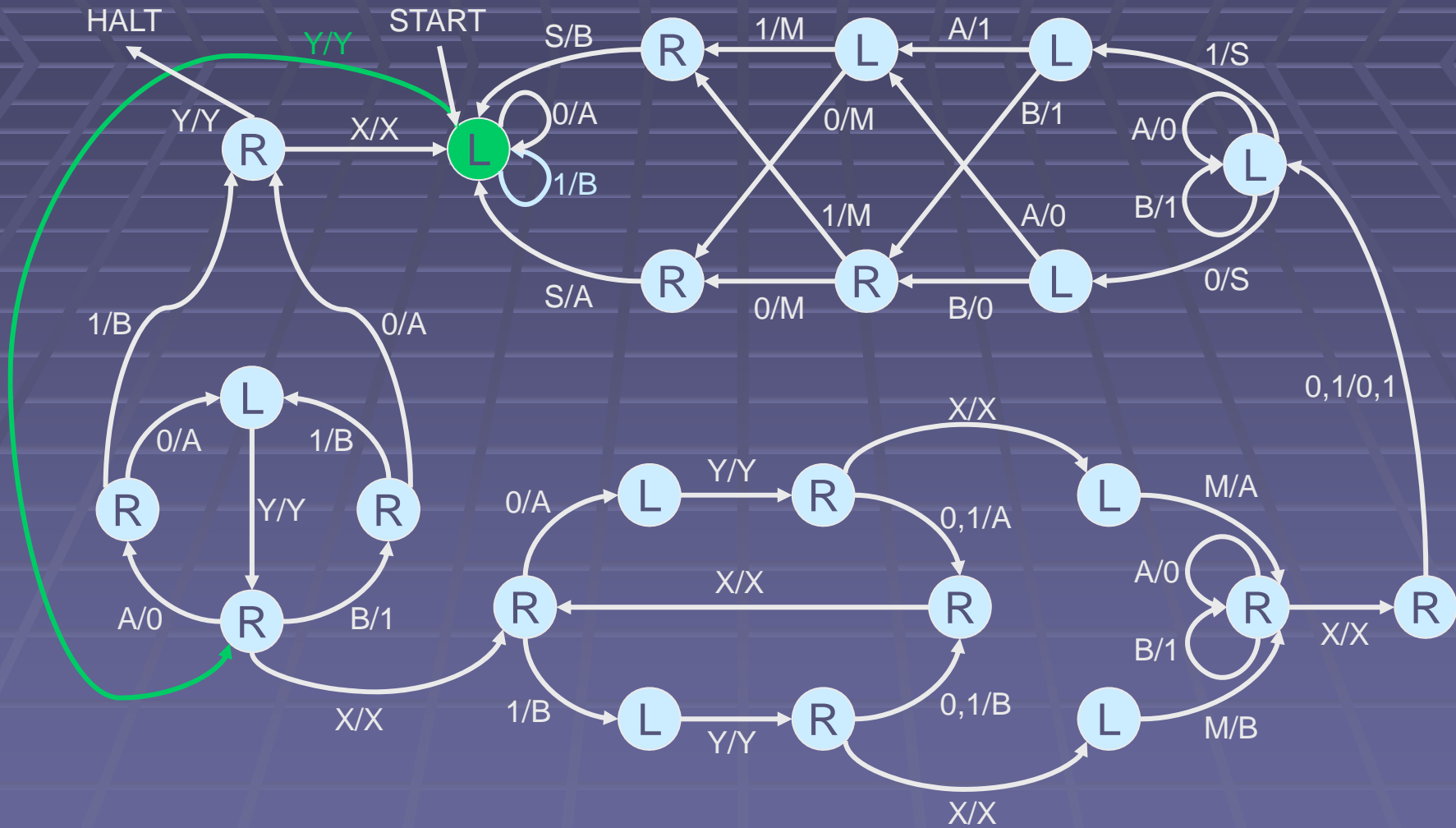
...0 0 M Y 11 **S** X 00 1 0 1 1 0 X 10 1 1 1 0 1 X 11 1 00 0 0 Y 0 0 0 ...

Máquina de Turing Universal



...0 0 M Y 1 **1** A X 00 1 01 1 0 X 10 1 11 0 1 X 11 1 00 0 0 Y 0 0 0 ...

Máquina de Turing Universal



...0 0 M **Y** BBAX 00 1 01 1 0 X 10 1 11 0 1 X 11 1 00 0 0 Y 0 0 0 ...

FIN