$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

•••	В	a	a	b	b	С	С	В	
	В	В	В	В	В	В	В	В	

- 1: while there are unmarked a's do
- 2: Mark the first unmarked a with X
- 3: Mark the first unmarked b with X
- 4: Mark the first unmarked c with X
- 5: Check if all symbols are marked

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

 В	a	a	b	Ъ	С	С	В	
 В	В	В	В	В	В	В	В	

$$[(a,B)\rightarrow(a,B)]R \qquad [(b,B)\rightarrow(b,B)]R \\ [(b,X)\rightarrow(b,X)]R \qquad [(c,X)\rightarrow(c,X)]R$$

$$[(c,X)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_3$$

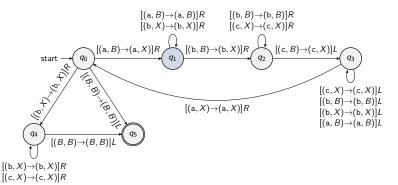
$$[(c,X)\rightarrow(c,X)]L \qquad q_4 \qquad [(c,X)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_3$$

$$[(b,B)\rightarrow(b,B)]L \qquad [(c,B)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_4 \qquad [(c,B)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_6 \qquad q$$

Mark the first unmarked a with X.

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

•••	В	a	a	b	Ъ	С	С	В	• • •
	В	X	В	В	В	В	В	В	



Mark the first unmarked b with X.

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

•••	В	a	a	b	b	С	С	В	
	В	X	В	В	В	В	В	В	

$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

• • •	В	a	a	b	b	С	С	В	
	В	X	В	X	В	В	В	В	

Mark the first unmarked c with X.

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

•••	В	a	a	b	Ъ	С	С	В	
	В	X	В	X	В	В	В	В	

$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

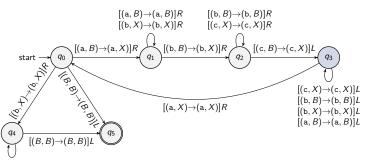
$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

•••	В	a	a	Ъ	b	С	С	В	
• • •	В	X	В	X	В	X	В	В	

$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

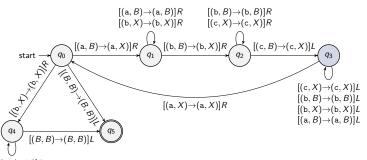
•••	В	a	a	b	b	С	С	В	
• • •	В	X	В	X	В	X	В	В	



$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

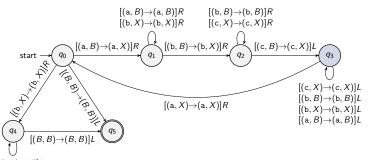
•••	В	a	a	b	Ъ	С	С	В	
•••	В	X	В	X	В	X	В	В	



$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

•••	В	a	a	Ъ	Ъ	С	С	В	
	В	X	В	X	В	X	В	В	



$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

 В	a	a	b	Ъ	С	С	В	
 В	X	В	X	В	X	В	В	

$$[(a,B)\rightarrow(a,B)]R \qquad [(b,B)\rightarrow(b,B)]R \\ [(b,X)\rightarrow(b,X)]R \qquad [(c,X)\rightarrow(c,X)]R$$

$$[(c,X)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_3$$

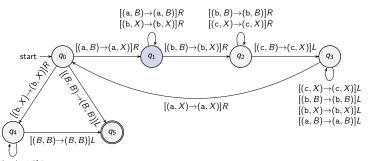
$$[(c,X)\rightarrow(c,X)]L \qquad q_4 \qquad [(c,X)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_3$$

$$[(b,B)\rightarrow(b,B)]L \qquad [(c,B)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_4 \qquad [(c,B)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_6 \qquad q$$

Repeat until all a's are marked.

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

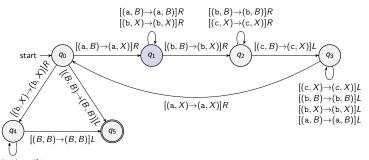
• • •	В	a	a	b	b	С	С	В	
• • •	В	X	Χ	X	В	X	В	В	



$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

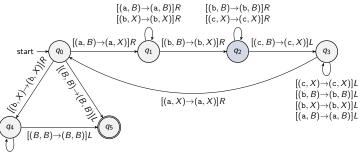
•••	В	a	a	b	b	С	С	В	
• • •	В	X	X	X	В	X	В	В	



$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

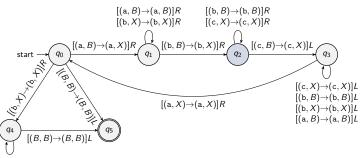
• • •	В	a	a	Ъ	Ъ	С	С	В	
• • •	В	X	Χ	X	Χ	X	В	В	



$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

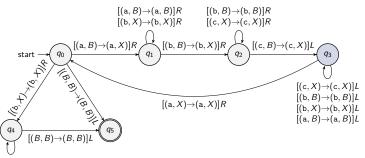
•••	В	a	a	b	Ъ	С	С	В	
	В	X	X	X	X	X	В	В	



$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

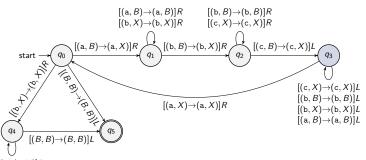
• • •	В	a	a	Ъ	Ъ	С	С	В	
• • •	В	X	Χ	Χ	X	X	X	В	



$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

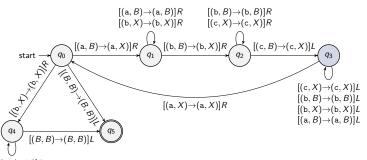
•••	В	a	a	b	Ъ	С	С	В	
• • •	В	X	X	X	X	X	X	В	



$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

•••			a			ı		В	
	В	X	X	X	X	X	X	В	

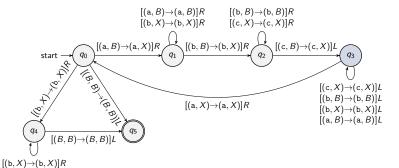


$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

 $[(c,X)\rightarrow(c,X)]R$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

• • • •	В	a	a	b	b	С	С	В	
	В	X	X	X	X	X	X	В	



$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

• • •	В	a	a	Ъ	b	С	С	В	• • •
	В	X	X	X	X	X	X	В	

$$[(a,B)\rightarrow(a,B)]R \qquad [(b,B)\rightarrow(b,B)]R \\ [(b,X)\rightarrow(b,X)]R \qquad [(c,X)\rightarrow(c,X)]R$$

$$[(c,X)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_3$$

$$[(c,X)\rightarrow(c,X)]L \qquad q_4 \qquad [(c,X)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_3$$

$$[(b,B)\rightarrow(b,B)]L \qquad [(c,B)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_4 \qquad [(c,B)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_5 \qquad q_6 \qquad q$$

Now, no more unmarked a's. Check if all symbols are marked.

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

•••	В	a	a	b	Ъ	С	С	В	
• • •	В	X	X	X	X	X	X	В	

$$[(a,B)\rightarrow(a,B)]R \qquad [(b,B)\rightarrow(b,B)]R \\ [(b,X)\rightarrow(b,X)]R \qquad [(c,X)\rightarrow(c,X)]R$$

$$[(c,X)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_3$$

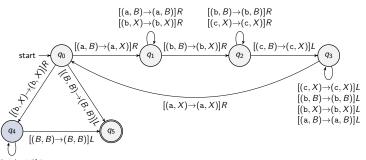
$$[(c,B)\rightarrow(c,X)]L \qquad q_4 \qquad [(c,B)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_5$$

$$[(c,B)\rightarrow(c,X)]L \qquad [(c,B)\rightarrow(c,X)]L \qquad [(c$$

$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

•••	В	a	a	b	b	С	С	В	
• • •	В	X	X	X	X	X	X	В	



$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

•••	В	a	a	Ъ	Ъ	С	С	В	
• • • •	В	X	Χ	X	X	Χ	X	В	

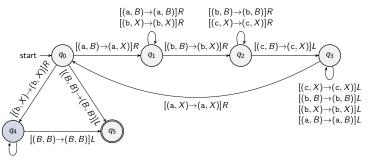
$$[(\mathbf{a},B)\rightarrow(\mathbf{a},B)]R \qquad [(\mathbf{b},B)\rightarrow(\mathbf{b},B)]R \\ [(\mathbf{b},X)\rightarrow(\mathbf{b},X)]R \qquad [(\mathbf{c},X)\rightarrow(\mathbf{c},X)]R$$

$$\text{start} \qquad q_0 \qquad [(\mathbf{a},B)\rightarrow(\mathbf{a},X)]R \qquad q_1 \qquad [(\mathbf{c},B)\rightarrow(\mathbf{b},X)]R \qquad [(\mathbf{c},B)\rightarrow(\mathbf{c},X)]L \qquad q_3 \qquad q_4 \qquad [(\mathbf{c},B)\rightarrow(\mathbf{a},X)]R \qquad [(\mathbf{c},B)\rightarrow(\mathbf{c},X)]L \qquad q_5 \qquad q_4 \qquad [(\mathbf{c},B)\rightarrow(\mathbf{a},B)]L \qquad q_5 \qquad q_6 \qquad q_6$$

$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

•••	В	a	a	b	b	С	С	В	• • • •
• • •	В	X	X	X	X	X	X	В	



$$[(b,X)\rightarrow(b,X)]R$$
$$[(c,X)\rightarrow(c,X)]R$$

$$L(M) = \{a^n b^n c^n \mid n \ge 0\}$$

• • • •	В	a	a	b	b	С	С	В	
	В	X	X	X	X	X	X	В	

$$[(a,B)\rightarrow(a,B)]R \qquad [(b,B)\rightarrow(b,B)]R \\ [(b,X)\rightarrow(b,X)]R \qquad [(c,X)\rightarrow(c,X)]R$$

$$[(c,X)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_3 \qquad q_4 \qquad [(c,B)\rightarrow(c,X)]R \qquad [(c,B)\rightarrow(c,X)]L \qquad q_5 \qquad [(c,B)\rightarrow(c,X)]L \qquad q_6 \qquad [(c,B)\rightarrow(c,X)]L \qquad q_8 \qquad [(c,B)\rightarrow(c,X)]L \qquad [$$

Accept!