$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$

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

- 1: while there are a's do
- 2: Find and Replace a with X
- 3: **while** there are b's **do**
- 4: Find and Replace b with Y
- 5: Find and Replace c with Z
- 6: Roll back all Y's to b's
- 7: Check if only b's and Z's are left

$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$

$$\cdots \mid B \mid a \mid a \mid b \mid b \mid c \mid c \mid c \mid c \mid c \mid c \mid B \mid \cdots$$

$$\begin{bmatrix} a \to a]L & [Z \to Z]L \\ [Y \to b]L & [b \to b]L \end{bmatrix}$$

$$\downarrow q_1 & \downarrow q_2 \\ \downarrow q_3 & \downarrow q_4 \\ \downarrow q_4 & \downarrow q_5 \\ \downarrow q_4 & \downarrow q_5 \\ \downarrow q_5 & \downarrow q_7 \\ \downarrow q_7 & \downarrow q_7$$

Find and Replace a with X.

$$L(M) = \{a^{i}b^{j}c^{i \times j} \mid i, j \geq 0\}$$

$$\cdots \mid B \mid X \mid a \mid b \mid b \mid c \mid c \mid c \mid c \mid c \mid B \mid \cdots$$

$$[a \to a]L \quad [Z \to Z]L \quad [b \to b]L$$

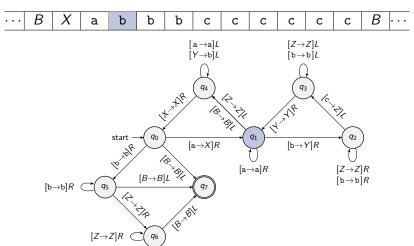
$$[a \to a]L \quad [a \to a]R \quad [Z \to Z]R \quad [b \to b]R$$

$$[a \to a]R \quad [a \to a]R \quad [Z \to Z]R \quad [b \to b]R$$

$$[z \to Z]R \quad q_{0} \quad q_{0} \quad q_{1} \quad [a \to a]R$$

Find and Replace b with Y.

$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



$$L(M) = \{a^{i}b^{j}c^{i \times j} \mid i, j \geq 0\}$$

$$\cdots \mid B \mid X \mid a \mid Y \mid b \mid b \mid c \mid c \mid c \mid c \mid c \mid B \mid \cdots$$

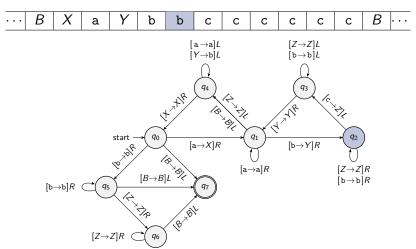
$$[a \to a]L \quad [Z \to Z]L \quad [b \to b]L$$

$$q_{4} \quad q_{3} \quad q_{4} \quad q_{5} \quad q_{7} \quad [a \to a]R \quad [Z \to Z]R \quad [b \to b]R$$

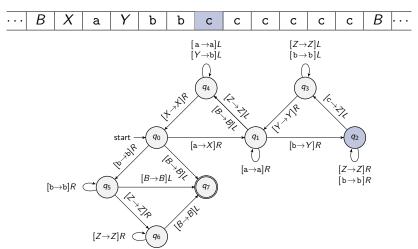
$$[a \to a]R \quad [a \to a]R \quad [Z \to Z]R \quad [b \to b]R$$

Find and Replace c with Z.

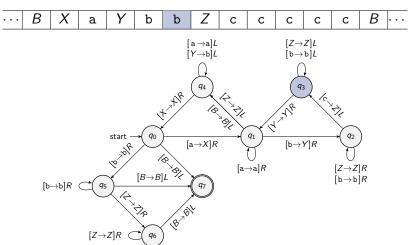
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



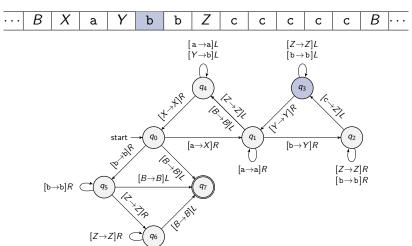
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



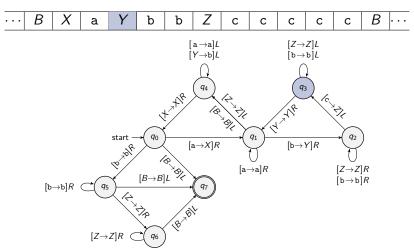
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



$$L(M) = \{a^{i}b^{j}c^{i \times j} \mid i, j \geq 0\}$$

$$\dots \mid B \mid X \mid a \mid Y \mid b \mid b \mid Z \mid c \mid c \mid c \mid c \mid B \mid \dots$$

$$\begin{bmatrix} a \to a]L & [Z \to Z]L \\ [Y \to b]L & [b \to b]L \end{bmatrix}$$

$$\downarrow q_{1}$$

$$\downarrow q_{2}$$

$$\downarrow q_{3}$$

$$\downarrow q_{4}$$

$$\downarrow q_{4}$$

$$\downarrow q_{4}$$

$$\downarrow q_{4}$$

$$\downarrow q_{5}$$

$$\downarrow q_{4}$$

$$\downarrow q_{4}$$

$$\downarrow q_{4}$$

$$\downarrow q_{4}$$

$$\downarrow q_{5}$$

$$\downarrow q_{5}$$

$$\downarrow q_{5}$$

$$\downarrow q_{5}$$

$$\downarrow q_{5}$$

$$\downarrow q_{7}$$

$$\downarrow q_{1}$$

$$\downarrow q_{2}$$

$$\downarrow q_{2}$$

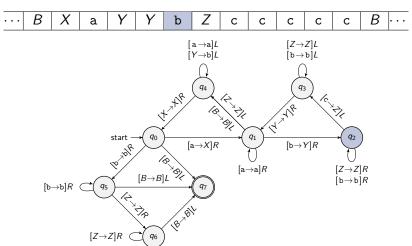
$$\downarrow q_{3}$$

$$\downarrow q_{4}$$

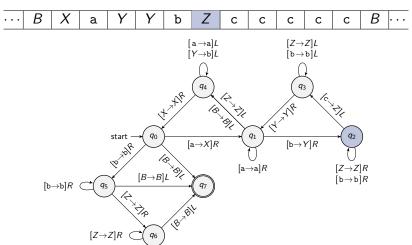
$$\downarrow q_{5}$$

Repeat until no b's left.

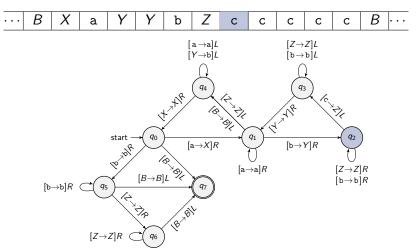
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



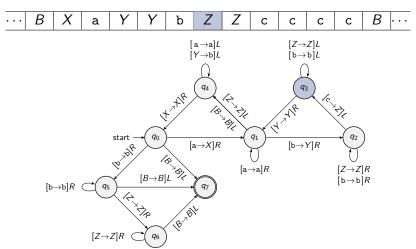
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



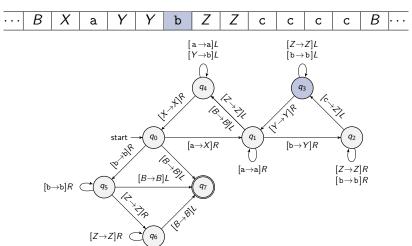
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



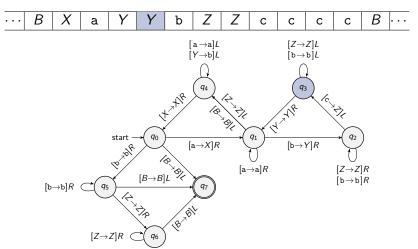
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



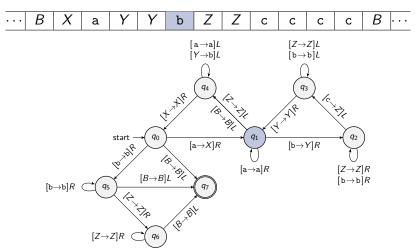
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



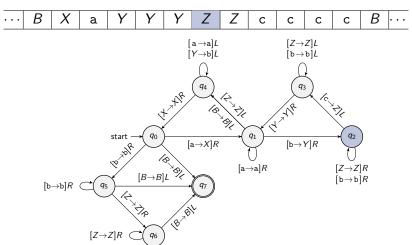
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



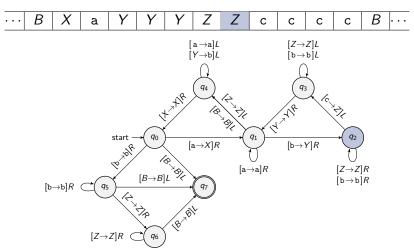
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



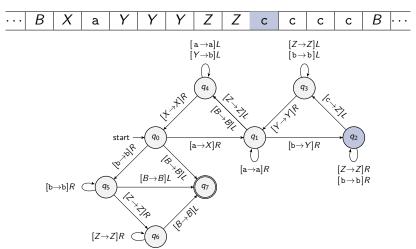
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



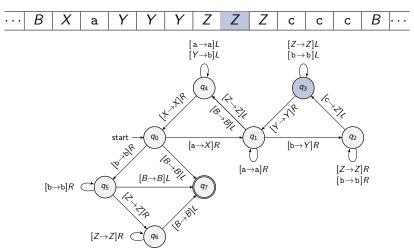
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



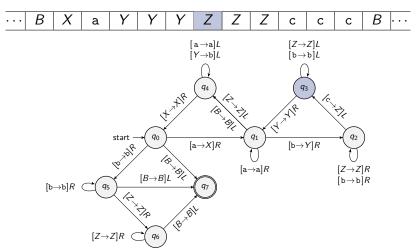
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



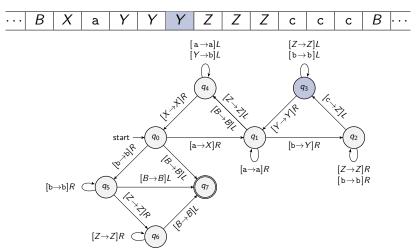
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



$$L(M) = \{a^{i}b^{j}c^{i \times j} \mid i, j \geq 0\}$$

$$\dots \mid B \mid X \mid a \mid Y \mid Y \mid Z \mid Z \mid Z \mid c \mid c \mid c \mid B \mid \dots$$

$$\begin{bmatrix} a \to a]L & [Z \to Z]L \\ [Y \to b]L & [b \to b]L \end{bmatrix}$$

$$\downarrow q_{1}$$

$$\downarrow q_{2}$$

$$\downarrow q_{3}$$

$$\downarrow q_{4}$$

$$\downarrow q_{4}$$

$$\downarrow q_{4}$$

$$\downarrow q_{4}$$

$$\downarrow q_{5}$$

$$\downarrow q_{4}$$

$$\downarrow q_{4}$$

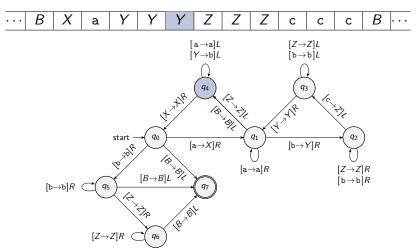
$$\downarrow q_{4}$$

$$\downarrow q_{5}$$

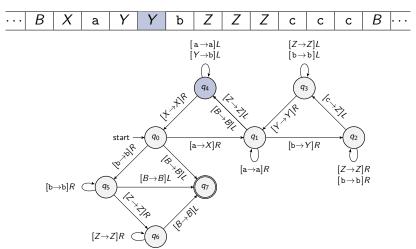
$$\downarrow q_{7}$$

Roll back all Y's to b's

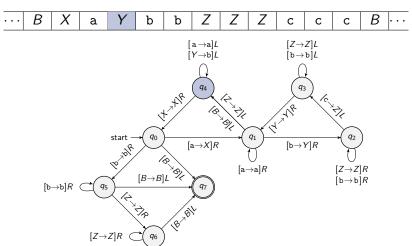
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



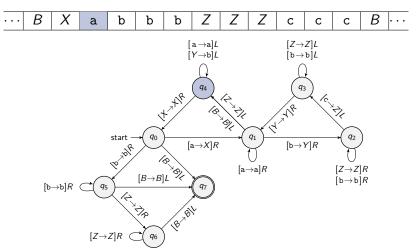
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



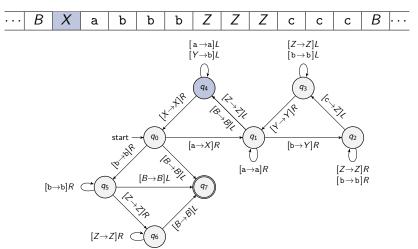
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$

$$\dots \mid B \mid X \mid a \mid b \mid b \mid D \mid Z \mid Z \mid C \mid c \mid c \mid B \mid \dots$$

$$[a \to a]L \qquad [Z \to Z]L \qquad [b \to b]L$$

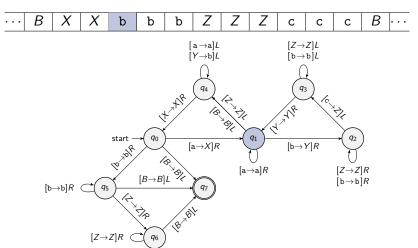
$$[Y \to b]L \qquad [q_4]$$

$$[a \to a]R \qquad [a \to a]R \qquad [Z \to Z]R \qquad [b \to b]R$$

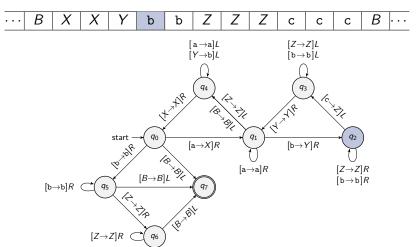
$$[a \to a]R \qquad [a \to a]R \qquad [Z \to Z]R \qquad [b \to b]R$$

Repeat until no a's left.

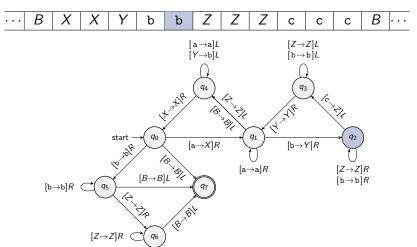
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



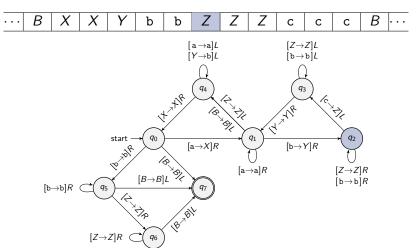
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



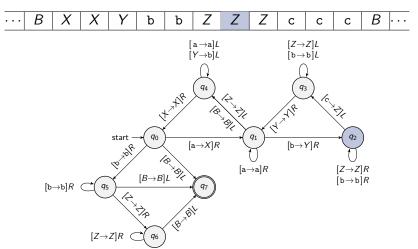
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



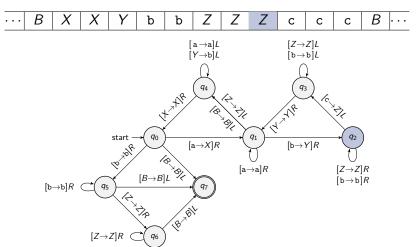
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



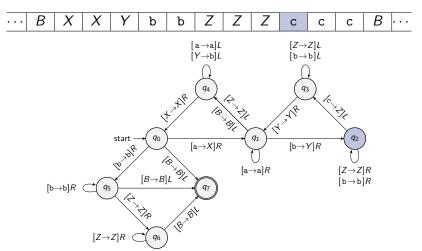
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



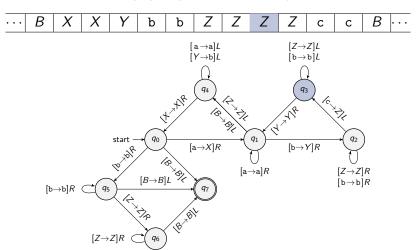
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



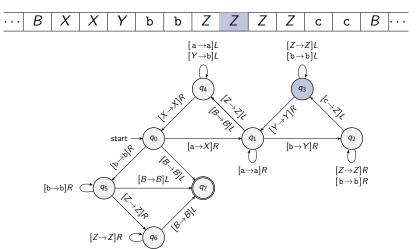
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



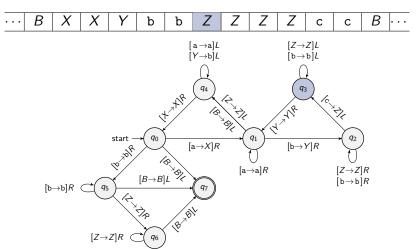
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



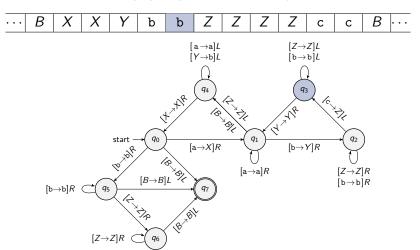
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



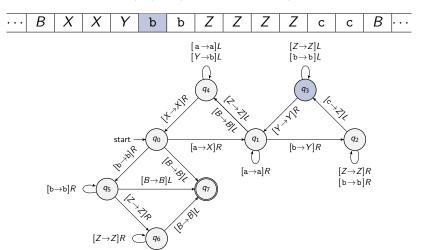
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



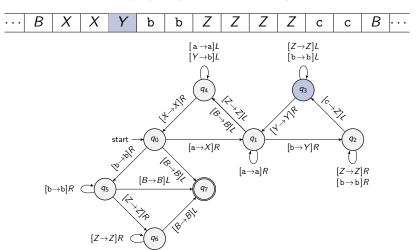
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



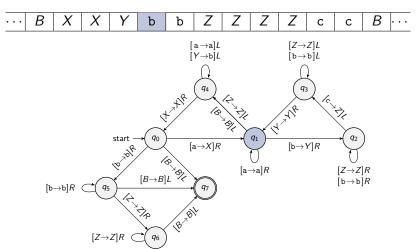
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



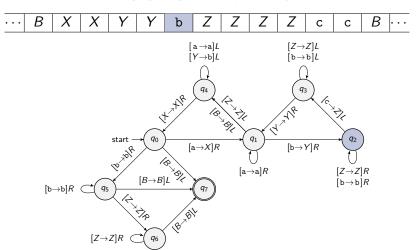
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



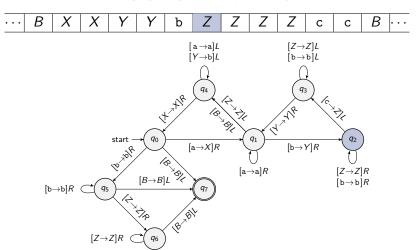
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



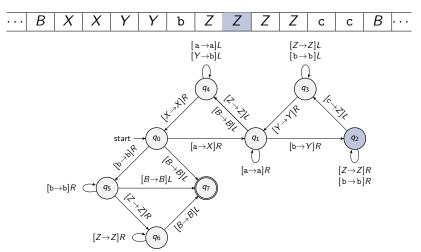
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



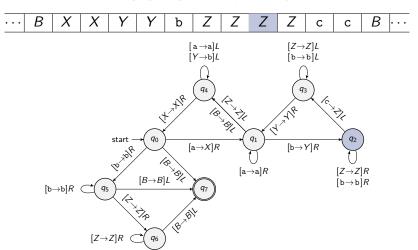
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



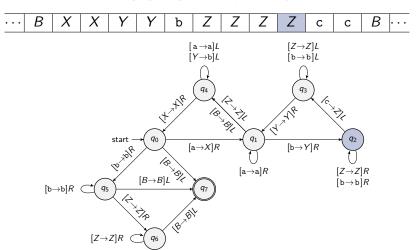
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



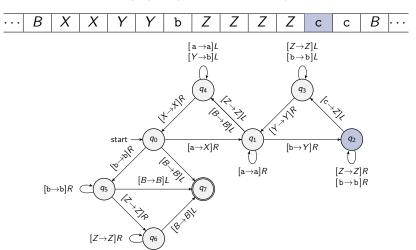
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



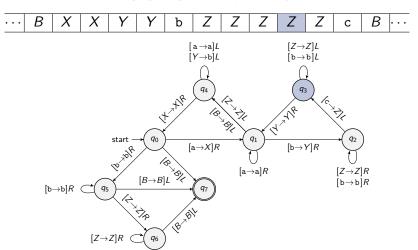
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



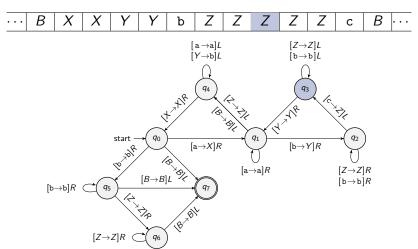
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



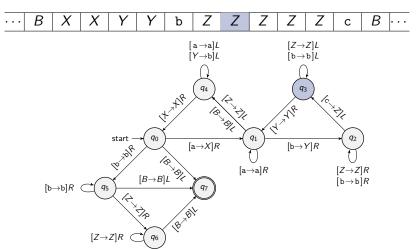
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



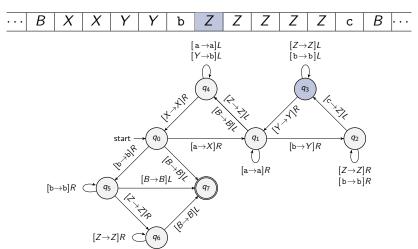
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



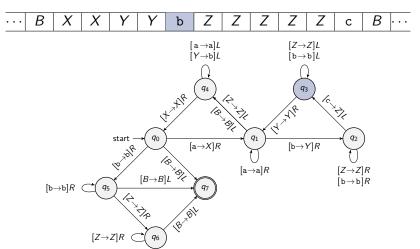
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



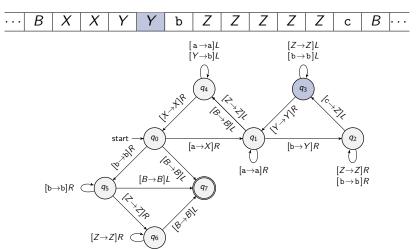
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



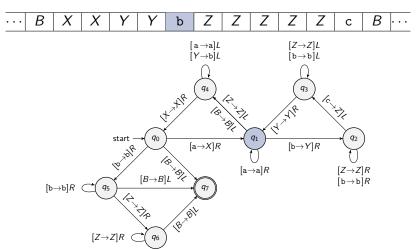
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



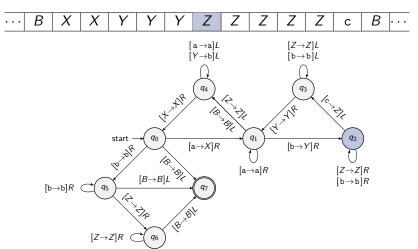
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



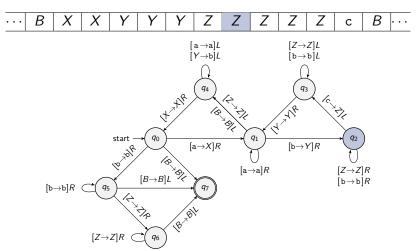
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



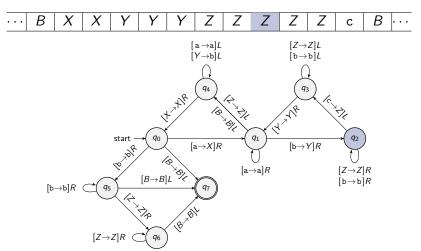
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



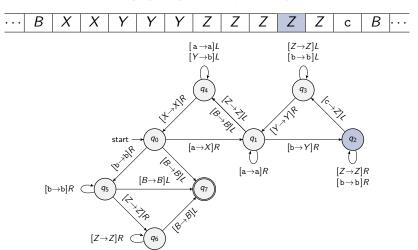
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



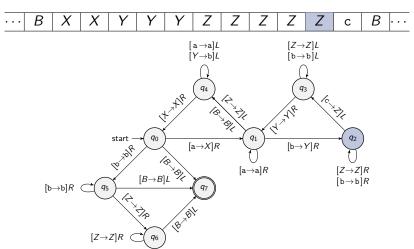
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



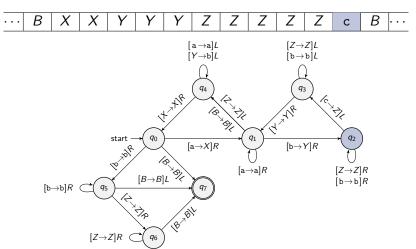
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



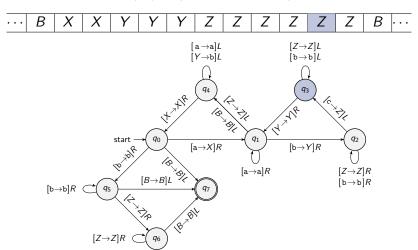
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



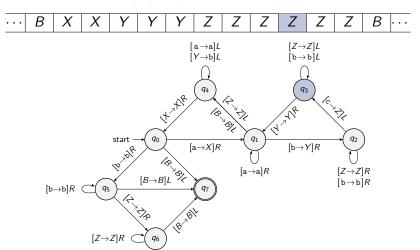
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



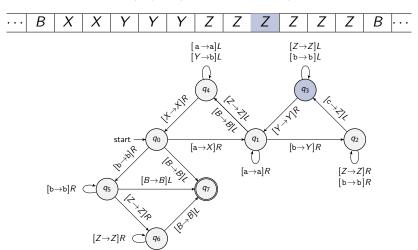
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



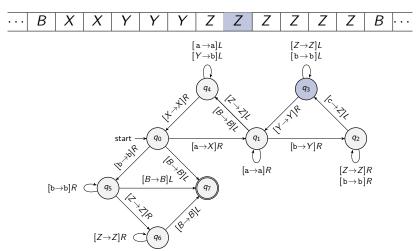
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



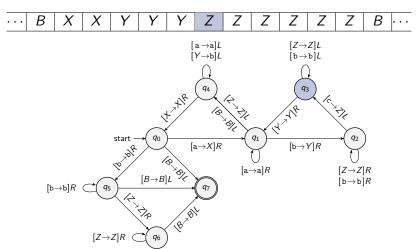
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



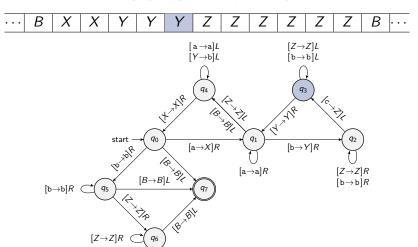
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



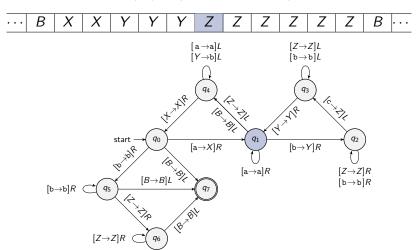
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



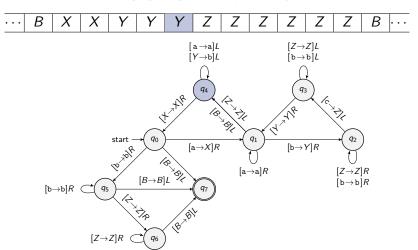
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



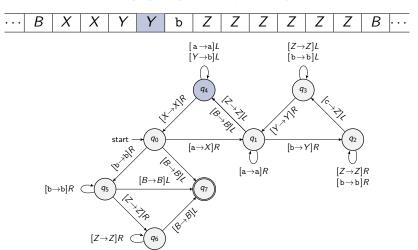
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



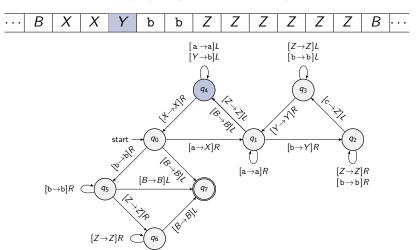
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



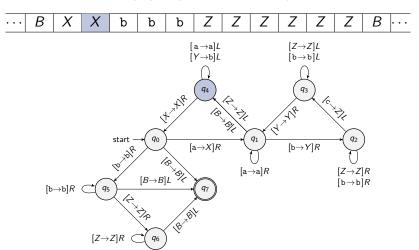
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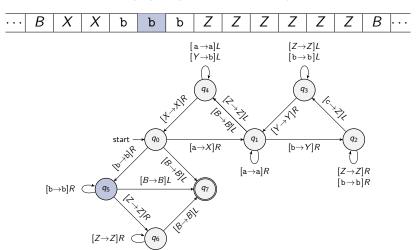


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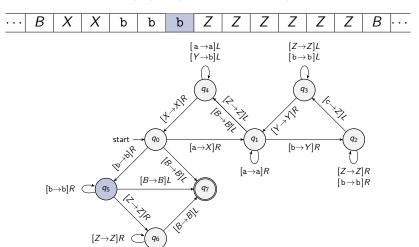


Check if only b's and Z's are left.

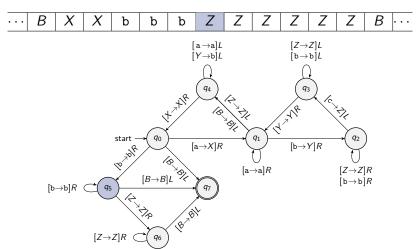
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



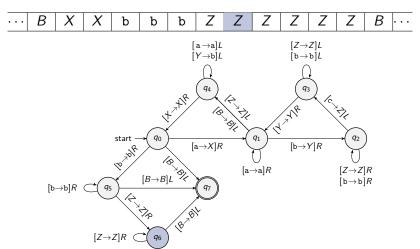
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



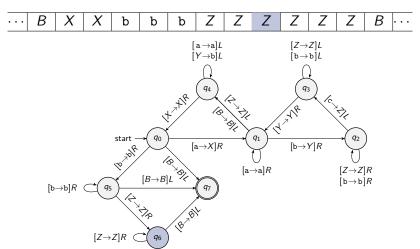
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



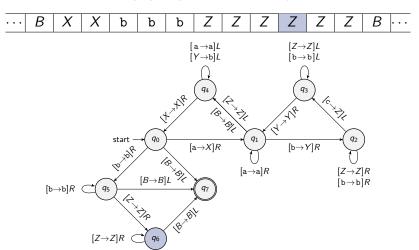
$$L(M) = \{a^i b^j c^{i \times j} \mid i, j \ge 0\}$$



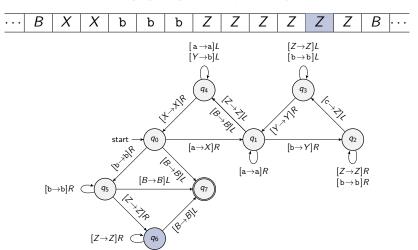
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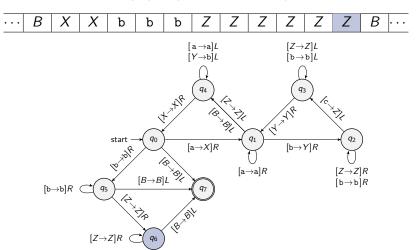
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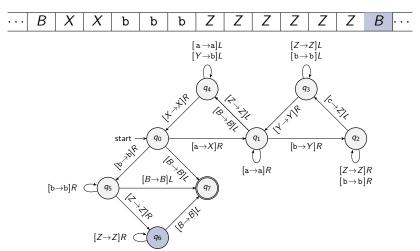
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Accept!