

Exercise 30

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The context free grammar

$$\begin{aligned} S &= aSb \mid S' \\ S' &= bS'a \mid \epsilon \end{aligned}$$

generates the language

$$\{a^m b^n a^n b^m \mid m, n \geq 0\}.$$

This language is recognized by the pushdown automaton

$$(\{S, A_1, B_1, A_2, B_2, F\}, \{a, b\}, \{\$, E, I\}, \delta, S, \{F\})$$

where δ maps everything to \emptyset except for

$$\begin{aligned} (S, \epsilon, \epsilon) &\rightarrow \{(A_1, \$)\}, \\ (A_1, a, \epsilon) &\rightarrow \{(A_1, E), (B_1, E)\}, \\ (B_1, b, \epsilon) &\rightarrow \{(B_1, I), (A_2, I)\}, \\ (A_2, a, I) &\rightarrow \{(A_2, \epsilon), (B_2, \epsilon)\}, \\ (B_2, b, E) &\rightarrow \{(B_2, \epsilon)\}, \text{ and} \\ (B_2, \epsilon, \$) &\rightarrow \{(F, \epsilon)\}. \end{aligned}$$