

Homework 7

Instructions

For each of the following problems, construct a PDA in **JFLAP** that recognizes the given language. Each PDA should be in its own file. The name of each file should be the problem number with the `.jff` extension: `1.jff`, `2.jff`, and so on.

Upload your solutions to GradeScope by dragging all of the `.jff` files onto the website. (If you wish to upload just a single file, for example, `1.jff`, you'll also need to upload some other file such as a blank text file. This is a limitation of GradeScope.)

If you want to test if the stack is empty, you should start by pushing a \$ on the stack and checking for it later. You should not rely on the Z that JFLAP includes on the stack.

Problem 1 [10 points] $A = \{w \mid \text{every prefix of } w \in \{a, b\}^* \text{ has at least as many } a\text{s as } b\text{s}\}$.
[Hint: As the PDA reads its input, think about the number of as minus the number of bs. What does it mean if this number is positive, negative, or zero?]

Problem 2 [10 points] $B = \{xc^n \mid n \geq 0 \text{ and } x \in \{a, b\}^* \text{ has } n \text{ as or } n \text{ bs}\}$ Here, the alphabet is $\Sigma = \{a, b, c\}$ but x is composed only of as and bs. *[Hint: Think about how the PDA will decide if it's counting as or bs.]*

Problem 3 [10 points] $C = \{a^i b^j c^m d^n \mid i, j, m, n \geq 0 \text{ and } i + j = m + n\}$. Use the stack alphabet $\Gamma = \{x, \$\}$.

Problem 4 [10 points] Convert the following CFG to a PDA using the construction described in class and in the book. *[Hint: Your PDA should use 10 states.]*

$$\begin{aligned} S &\rightarrow aSb \mid bT \mid Ta \\ T &\rightarrow bT \mid aT \mid \varepsilon \end{aligned}$$