

CS F351 Theory of Computation Tutorial-8

Problem 1 Design PDAs for the following languages:

- (A) $\{a^i b^j c^k \mid i, j, k \geq 0, \text{ and } i = j \text{ or } j = k\}$
- (B) $(*) \{a^i b^j c^k \mid i, j, k \geq 0, \text{ and } i + j = k\}$
- (C) $\{a^i b^j c^k \mid i, j, k \geq 0, \text{ and } i + k = j\}$
- (D) $\{a^{2n} b^{3n} \mid n \geq 0\}$

For solutions see <https://web.njit.edu/~marvin/cs341/hw/hwsoln06.pdf>

Problem 2 Consider a CFG $G = (V, T, P, S)$ where $V = \{S, A\}$, $T = \{a, b\}$ and the set of productions P is given by: $S \rightarrow aAa \mid bAb \mid \epsilon$ and $A \rightarrow SS$.

Find an equivalent PDA for the grammar G . Also, show that $baab$ is accepted by your PDA.

Solution:

$$P1 : \delta(p, \epsilon, \epsilon) = \{(q, S)\}$$

$$P2 : \delta(q, \epsilon, S) = \{(q, aAa), (q, bAb), (q, \epsilon)\}$$

$$P3 : \delta(q, \epsilon, A) = \{(q, SS)\}$$

$$P4 : \delta(q, a, a) = \{(q, \epsilon)\}$$

$$P5 : \delta(q, b, b) = \{(q, \epsilon)\}$$

Sequence of ID's for the string $baab$.

$$\begin{aligned} (p, baab, \epsilon) &\Rightarrow (q, baab, S) && \text{(by rule } P1) \\ &\Rightarrow (q, baab, bAb) && \text{(by rule } P2) \\ &\Rightarrow (q, aab, Ab) && \text{(by rule } P5) \\ &\Rightarrow (q, aab, SSb) && \text{(by rule } P3) \\ &\Rightarrow (q, aab, aAaSb) && \text{(by rule } P1) \\ &\Rightarrow (q, ab, AaSb) && \text{(by rule } P2) \\ &\Rightarrow (q, ab, SSaSb) && \text{(by rule } P4) \\ &\Rightarrow (q, ab, SaSb) && \text{(by rule } P2) \\ &\Rightarrow (q, ab, aSb) && \text{(by rule } P2) \\ &\Rightarrow (q, b, Sb) && \text{(by rule } P4) \\ &\Rightarrow (q, b, b) && \text{(by rule } P2) \\ &\Rightarrow (q, \epsilon, \epsilon) && \text{(by rule } P5) \end{aligned}$$
