Assignment 3: Due Friday February 25, 2023, 11:59 PM

Incomplete. More problems will be added later.

Name:___________________________________________________

You are permitted to work in groups, get help from others, read books, and use the internet. You will receive a message from the graduate assistant, Sandeep Maharjan, telling you how to turn in the assignment.

1. Read the handout pdaDef.pdf on my website or on canvas.
   (a) The PDA \( M_1 \) given as Example 1 accepts the language \( L = \{ a^n b^n : n \geq 0 \} \).

   ![Diagram of \( M_1 \)]

   Diagram of \( M_1 \).

   (b) Is \( M_1 \) a DPDA? Explain your answer.

2. The PDA \( M_2 \) given as Example 2 in that handout accepts the language \( L \) of all palindromes over \( \{a, b\} \).
   (a) Using the transitions given, write an accepting computation of \( M_2 \) for the input string \( abbabba \).

   (b) Draw a diagram of \( M_2 \).
3. What language does this PDA accept? Hint: Instead of just staring at it, hoping for inspiration, try some strings; such as \textit{aaaabbbb}.

\begin{center}
\begin{tikzpicture}

\node (0) at (0,0) [state] {0};
\node (1) at (2,0) [state] {1};
\node (2) at (1,-2) [state] {2};
\node (3) at (4,0) [state] {3};

\draw[->] (0) -- node[above]{$\lambda/a/a$} (1);
\draw[->] (1) -- node[above]{$\lambda/z/z$} (3);
\draw[->] (1) -- node[above]{$a/z/az$} (0);
\draw[->] (1) -- node[above]{$a/a/aa$} (2);
\draw[->] (1) -- node[above]{$b/a/a$} (2);
\draw[->] (2) -- node[above]{$b/a/\lambda$} (1);
\end{tikzpicture}
\end{center}

4. The Dyck language, \( L_{\text{dyck}} \), is the language of all parenthetical strings where left and right parentheses match in the usual way. For example, \((()) \in L_{\text{dyck}}.\)

Since it left and right parentheses look similar, especially if you’re in a hurry, we will substitute \(a\) and \(b\) for left and right parentheses. Thus, \(abaabb \in L_{\text{dyck}}.\) A more formal definition is that \( L_{\text{dyck}} \) is the set of all strings over \( \{a, b\} \) which have equal numbers of \(a\)'s and \(b\)'s, and every prefix of which has at least as many \(a\)'s as \(b\)'s.

Design a DPDA which accepts \( L_{\text{dyck}}.\)