CS 383
HW 5 Solutions

1. Design a PDA to accept the strings in \((0+1)^*\) such that no prefix has more 1's than 0's. 01001011001 is a string in this language. Say whether your PDA accepts by final state or empty stack.

![Diagram of PDA for Problem 1]

Accepts by empty stack (or final state)

2. Design a PDA to accept \(\{a^ib^jc^k : i=j \text{ or } j=k\}\). Say whether this accepts by final state or empty stack.

![Diagram of PDA for Problem 2]

Accepts by empty stack
3. Design a PDA to accept \( \{0^n1^m \mid n \leq m \leq 2n\} \)

4. Convert the following grammar into a PDA that accepts by empty stack.

   \[
   S \rightarrow 0S1 \mid A \\
   A \rightarrow 1A0 \mid S \mid \epsilon
   \]

   Here is a PDA that accepts strings in \((0+1)^*\) with the same number of 0’s and 1’s. This PDA accepts by empty stack. Chomsky’s algorithm gives a grammar equivalent to this PDA, with grammar symbols of the form \([pXq]\). Give a derivation in this grammar for the string 0101.

   \[
   \begin{align*}
   (1,1)|11 \\
   (1,0)|\epsilon \\
   (1,Z_0)|1Z_0 \\
   (0,0)|00 \\
   (0,1)|\epsilon \\
   (0,Z_0)|0Z_0
   \end{align*}
   \]

   Derivation:
   
   Start => [PZ_0Q]
   
   => 0[P0P][PZ_0Q]
   
   => 01[PZ_0Q]
   
   => 010[P0P][PZ_0Q]
   
   => 0101[PZ_0Q]
   
   => 0101