

# CS 381 - A6

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In order to construct a PDA  $M$  that recognizes the language  $A$  where  $A = \{0,1\}^* - \{0^n 1^n \mid n \geq 0\}$ , let us first consider what the language  $A$  is. We know from the definition of  $A$  that the complement of  $A$  contains exactly all the strings starting with some number of 0's and ending with that same number of 1's (including the empty string). Starting from here, we can now construct our rules and PDA for  $A$  by accepting all strings that do not fit this rule. For a given input string  $w = w_0, w_1 \dots w_n$ ,

1. If  $w$  is the empty string, stay at the start state, which does not an accept state. We do this because the empty string is not in  $A$ .
2. If  $w_0$  is a 1, move into a perpetual accept state. All strings that start with 1 cannot start with 0.
3. If  $w$  starts with a 0, begin by pushing a dollar sign followed by a 0 on to the stack. This way, we can keep track of the number of 0's it reads.
4. If  $w$  contains only 0's, we stay in the accept state  $q_2$  since  $w$  has an unequal number of 1's and 0's.
5. If  $w$  contains 0's followed by 1's stay in an accept state until we encounter the dollar sign. If that happens, pop it and move to a non accept state. We do this because then we know  $w$  is in the complement of  $A$ .
6. If we read an equal number of 0's and 1's followed by more input, move into a perpetual accept state since it would then be impossible for  $w$  to be in the complement of  $A$ .

