Project 4

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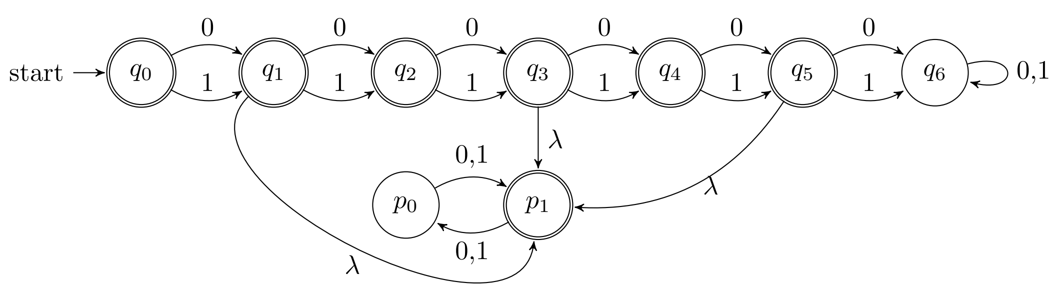
1 Using the construction proof we developed to argue that the class of regular languages is closed under concatenation (Th. 1.47), draw an NFA that the recognizes the concatenation of the following languages:

$\Sigma = \{0, 1\}$
Let w be a string over Σ
$L1 = \{w|\text{length of } w \text{ is at most } 5\}$
$L2 = \{w|\text{every odd position of } w \text{ is a } 1\}$



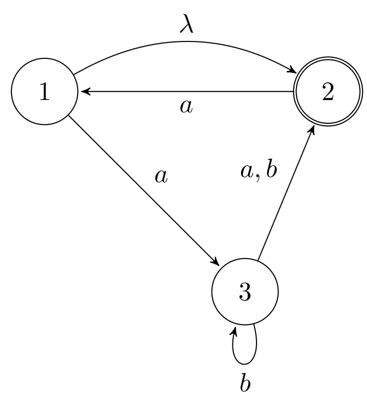
2 For regular languages, A and B, the interleave of A, A_B is defined as follows:

$A\_B = \{w|w = a_1b_1...a_nb_n$ where $s_A = a_1...a_n \in A$ and $s_B = b_1...b_n \in B\}$
That is, for each string s_A in A and s_B in B, there is a string s_{A_B} in A_B whos elements are taken from S_A and S_B alternate and in order.

Use a construction to show that the class of regular languages is closed under interleaving. A way to begin thinking about this is to define two machines, M_A and M_B that recognize languages A and B. Then design a machine M_{A_B} that alternates between the states of M_A and M_B as it reads an interleaved string.

To get started, design two simple machines, one that accepts an even number of 0s over $\{0, 1\}$, the other that accepts an even number of Xs over $\{X, Y\}$. Then the states of M the machine that accepts the interleaved strings of the two machines are 3-tuples, $Q_A \times Q_A \times \{1, 2\}$ where 1 in the 3rd position indicates that M_A runs and and a 2 in the in the 3rd position indicates that M_B runs. The trick is in defining the transition functions.

3 Here is an NFA. Using construction, convert the NFA to an equivalent DFA.



3.1 What is the full formal definition of the DFA?

3.2 What is the state transition diagram of the DFA.