

Weekly Proof Questions (Sections 1.3, 1.4)

Assigned: 1/22/2015

Due: 1/29/2015

1) Give a regular expression generating the following languages:

$L_1 = \{w \mid w \text{ begins with a 1 and ends with a 0.}\}$

$L_2 = \{w \mid w \text{ contains the substring 0101}\}$

$L_3 = \{w \mid \text{the length of } w \text{ does not exceed 5}\}$

$L_4 = \{w \mid \text{every odd position of } w \text{ is a 1}\}$

$L_5 = \{w \mid w \text{ contains an odd number of 1s, or exactly 2 0s.}\}$

2) Use the algorithm described in class to convert a DFA to a regular expression on the two following DFAs described below:

DFA D_1 : $Q = \{1, 2\}$, $\Sigma = \{a, b\}$, $F = \{2\}$, 1 is the start state, and δ is described as follows:

Q	Σ	Q
1	a	1
1	b	2
2	a	2
2	b	1

DFA D_2 : $Q = \{1, 2, 3\}$, $\Sigma = \{a, b\}$, $F = \{1, 3\}$, 1 is the start state, and δ is described as follows:

Q	Σ	Q
1	a	2
1	b	2
2	a	2
2	b	3
3	a	1
3	b	2

3) Prove that the following languages are not regular via the Pumping Lemma:

$L_1: \{0^n 1^n 2^n \mid n \geq 0\}$

$L_2: \{ww \mid w \in \Sigma^*\}$

$L_3: \{a^{2^n} \mid n \geq 0\}$

4) Determine, with proof, whether or not the following languages are regular:

$L_1: \{w \mid \text{contains the same number of occurrences of 01 as 10}\}$

$L_2: \{w \mid \text{contains the same number of occurrences of 00 as 11}\}$