COT 4210 Homework #2: Regular Expressions and Pumping Lemma
Due Date: Tuesday September 14, 2010 (in class)

1) Give a regular expression generating the following languages:

L_1 = {w | w begins with a 1 and ends with a 0.}
L_2 = {w | w contains the substring 0101}
L_3 = {w | the length of w does not exceed 5}
L_4 = {w | every odd position of w is a 1}
L_5 = { w | w contains an odd number of 1s, or exactly 2 0s. }

2) Use the procedure shown in class and shown in the textbook to convert the following regular expressions to NFAs:

a. $(0 \cup 1)^*000(0 \cup 1)^*$
b. $(((00)^*(11)) \cup 01)^*$

3) 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}, Σ = {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}, Σ = {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

4) Prove that the following languages are nor regular via the Pumping Lemma:

L_1: $\{0^n1^n2^n \mid n \geq 0\}$
L_2: {ww | $w \in \Sigma^*$}
L_3: $\{a^{2^n} \mid n \geq 0\}$

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

L_1: {w | contains the same number of occurrences of 01 as 10}
L_2: {w | contains the same number of occurrences of 00 as 11}

6) Determine a DFA with the minimum number of states that is equivalent to the DFA described below:

DFA D: Q = {0, 1, 2, 3, 4, 5, 6}, Σ = {a, b}, F = {1,3,5,6}, 0 is the start state, and δ is described as follows:

Q	Σ	Q
0	a	1
0	b	3
1	a	2
1	b	4
2	a	5
2	b	5
3	a	4
3	b	2
4	a	5
4	b	5
5	a	6
5	b	5
6	a	6
6	b	6

Please use the algorithm shown in class.