University of California, Los Angeles
CS 181 Formal Languages & Automata Theory

Student: First & Last Name
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Regularities, DFA Minimization, and Decidability

- 100% = Problem 1 (30%) + Problem 2 (20%) + Problem 3 (20%) + Problem 4 (30%)
- Homework 1 is due no later than Thursday 07/28/2016 23:55 as a file on `ccle.ucla.edu`, or submitted at the discussion section on a paper
- Homework file can be in LaTeX (template to be given) or Microsoft Word

Problem 1. (30 pts) For each of the languages below, find whether it is regular or not? Prove that your answer is correct.

(a) $L_1 = \{1^k y \mid y \in \{0,1\}^* \text{ and } y \text{ contains at least } k \text{ 1s, for all } k \geq 1\}$

(b) $L_1 = \{1^k y \mid y \in \{0,1\}^* \text{ and } y \text{ contains at most } k \text{ 1s, for all } k \geq 1\}$

(c) $L_3 = \{1^k 0 y \mid y \in \{0,1\}^* \text{ and } y \text{ contains at least } k \text{ 1s, for all } k \geq 1\}$

Answer for Problem 1:

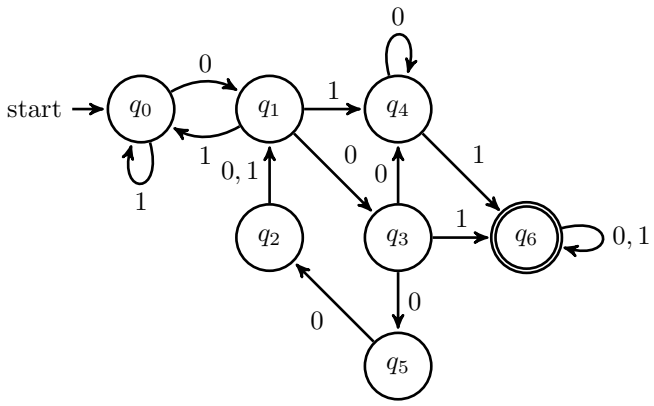
Problem 2. (20 pts) For each of the languages below, find whether it is regular or context free or neither? Prove that your answer is correct.

(a) $L_4 = \{a^{3m} b^2 c^m \mid m \geq 0\}$

(b) $L_5 = \{a^{3m} b^2 c^n \mid n, m \geq 0\}$

Answer for Problem 2:

Problem 3. (20 pts) Convert the following NFA to DFA and minimize:



ANSWER for Problem 3:

PROBLEM 4. (30 pts) Find if the following problem is algorithmically decidable and prove that your answer is correct:

Given three regular languages L_1, L_2, and L_3 in an alphabet Σ, find if:

$$L_1 \cap L_2 \subseteq L_3$$

ANSWER for Problem 4: