Test 1

First Name: _____

Last Name: _____

Student Number: _____

This test lasts 80 minutes. No aids allowed.
Make sure your test has 5 pages, including this cover page.
Answer in the space provided. (If you need more space, use the reverse side of the page and indicate **clearly** *which part of your work should be marked.)*
Write legibly.

Question 1	/2
Question 2	/2
Question 3	/3
Question 4	/4
Question 5	/3
Question 6	/4
Question 7	/4
Total	/22

CONT'D. . .

[2]   **1.** Complete the following definition. A deterministic finite automaton $M = (Q, \Sigma, \delta, q_0, F)$ is said to *accept* an input string $w = w_1 w_2 \cdots w_n$ (where each $w_i \in \Sigma$) if and only if ...

[2]   **2.** In class, we proved that if language L is recognized by a non-deterministic finite automaton, then L is also recognized by a *deterministic* finite automaton. Give a high-level description of the main idea of this proof. Your answer must fit in the box below.

[3]   **3.** Is it true that every subset of every regular language is also regular? Circle the correct answer and then prove your answer is correct.

     YES   NO

[4] **4.** Let $L_4 = \{w \in \{0,1\}^* : w$ is any string except 11 and 111$\}$. Draw the transition diagram of a deterministic finite automaton that recognizes the language L_4.

[3] **5.** Let $M = (Q, \Sigma, \delta, q_0, F)$ be a non-deterministic finite automaton that recognizes language L. Let $M' = (Q, \Sigma, \delta, q_0, F')$ be another non-deterministic finite automaton, where $F' = Q - F$. Is it true (for all M) that M' recognizes the language $\overline{L}$? Circle the correct answer and then show that your answer is correct.

YES   NO

[4]   **6.** Let $A_1, A_2, \ldots, A_{10000}$ be regular languages over an alphabet Σ. Show that the intersection $A_1 \cap A_2 \cap A_3 \cap \cdots \cap A_{10000}$ must also be regular.
(You may use the following fact, which we proved in class: the intersection of *two* regular languages is regular.)

[4] **7.** Let $L_7 = \{w \in \{a,b\}^* : w$ contains more a's than b's$\}$. For example, *abbabaa* is in L_7 because it contains four a's and three b's, and four is greater than three. Prove that the language L_7 is not regular.