Test 2

First Name: _____

Last Name: _____

Student Number: _____

This test lasts 80 minutes. *No aids allowed.*
You may use any result that was proved in class or in the textbook without reproving it.
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.)*
DFA stands for deterministic finite automaton and TM stands for Turing machine
Write legibly.

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

[2] **1.** State the Church-Turing Thesis in your own words.

[2] **2.** Let L be a language. Explain the difference between a TM that decides L and a TM that recognizes L.

[3] **3.** Let $P = \{w \in \{0,1\}^* : w = w^R\}$. (In other words, P is the language of all binary palindromes.) Show that P is countable.

[3] **4.** Let $L_4 = \{\langle M \rangle : M \text{ is a TM that takes more than 1000 steps on input } \varepsilon\}$. Prove that L_4 is decidable.

[3] **5.** Is the following statement true or false? For all languages L_1 and L_2, if L_1 is undecidable and L_1 is a subset of L_2, then L_2 is also undecidable. Explain why your answer is correct.

[4] **6.** Let $L_6 = \{\langle M \rangle : M \text{ is a TM and for some string } w,\ M \text{ accepts both } w \text{ and } w^R\}$.

(a) Give a deterministic algorithm (in pseudocode) that recognizes L_6. Explain why your algorithm is correct.

(b) Is $\overline{L_6}$ recognizable? You do *not* have to prove your answer is correct.

[5] **7.** Let $L_7 = \{\langle D, M\rangle :$ each string accepted by the DFA D is also accepted by the TM $M\}$. Prove that L_7 is undecidable.