

CSE105 (spring 2008): Homework 1

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Due on Tuesday, April 15, 2008, noon.

Solutions to the homework should be typed up, printed out, and turned in at the beginning of class. A homework submission page for the two JFLAP files will appear on the course webpage shortly. The files must be named *exactly* as shown in the problem description.

1 Review

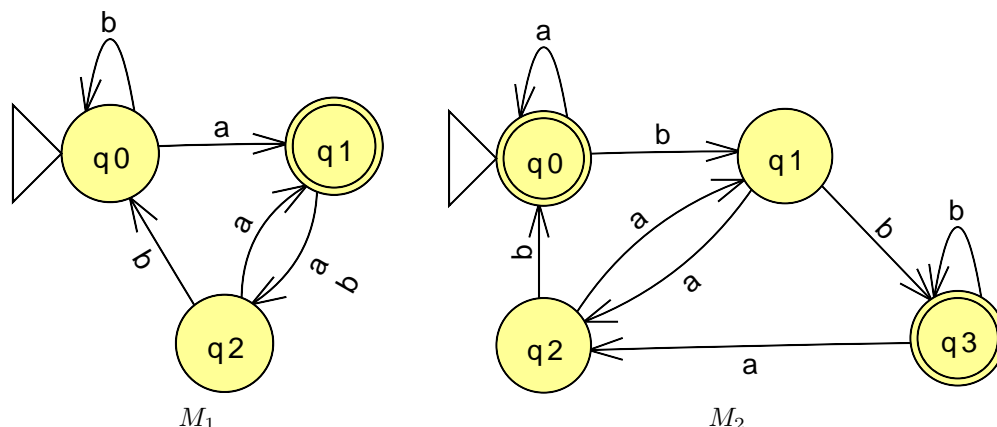
- Let A and B be the sets $A = \{x, y, z\}$ and $B = \{x, y\}$.
 - Is $A \subset B$?
 - Is $B \subset A$?
 - What is $A \cup B$?
 - What is $A \cap B$?
 - What is $A \times B$?
 - What is the powerset of A , denoted $\mathcal{P}(A)$ or 2^A ?
 - Is $\mathcal{P}(A \times B) = \mathcal{P}(A) \times \mathcal{P}(B)$?
- If X is a finite set with n elements, how many elements are in the powerset $\mathcal{P}(X)$?

2 Formal Description of a DFA

Let M be the DFA with states $Q = \{q_1, q_2, q_3, q_4, q_5\}$, input alphabet $\Sigma = \{u, d\}$, transition function δ , start state q_3 and accept states $F = \{q_3, q_5\}$ where δ is given by the following transition table. State whether each of the strings ε , $uuddud$, $dduudu$, and $duddud$ are accepted by M . Give a *high level* English description of M using complete sentences and proper grammar and punctuation. This description should be no more than two reasonably short sentences.

δ	u	d
q_1	q_1	q_2
q_2	q_1	q_3
q_3	q_2	q_4
q_4	q_3	q_5
q_5	q_4	q_5

3 Simple DFAs



1. What is the start state of M_1 ?
2. What is the set of accept states of M_1 ?
3. What is the start state of M_2 ?
4. What is the set of accept states of M_2 ?
5. What sequence of states does M_1 go through on input $aabb$?
6. Does M_1 accept the string $aabb$?
7. What sequence of states does M_2 go through on input $baaba$?
8. Does M_2 accept the string $baaba$?
9. Does M_1 accept the empty string ε ?
10. Does M_2 accept the empty string ε ?

4 Keycode Checker

For this problem, you will need to use JFLAP to build a DFA and turn in the file named `hw1-4.jff`.

Your job is to build the control logic for a keycoded door. The keypad contains three buttons 0, 1, and c. The user enters her password using the buttons 0 and 1. After the password is entered, it is checked using the button c. If the password was entered correctly, the door opens, otherwise it remains closed and the keycode checker waits for the first input. The password to the door is 110101.

You need to model the control logic as a DFA. It should have a start state, an accept state for the open door, and some states to keep track of the password as it is entered. For example, the inputs 110101c, cc01c110101c, and 110101cc110101c should be accepted while c, 10101c, 110101cc, 110101c1, and 00110101c should be rejected. This can be done using 9 states although more states are acceptable.

5 Ternary Numbers mod 5

For this problem, you will need to use JFLAP to build a DFA and turn in the file named `hw1-5.jff`.

Build a 5 state DFA that recognizes input from the alphabet $\{0, 1, 2\}$ representing numbers in Ternary which are divisible by 5. For example, $2102_3 = 2 \cdot 3^3 + 1 \cdot 3^2 + 0 \cdot 3^1 + 2 \cdot 3^0 = 65$ and $2110_3 = 66$ so the input 2102 should be accepted while 2110 should be rejected. Assume that the empty string ε represents 0 and should be accepted. Leading zeros are also okay so both ε and 0002102 should be accepted.