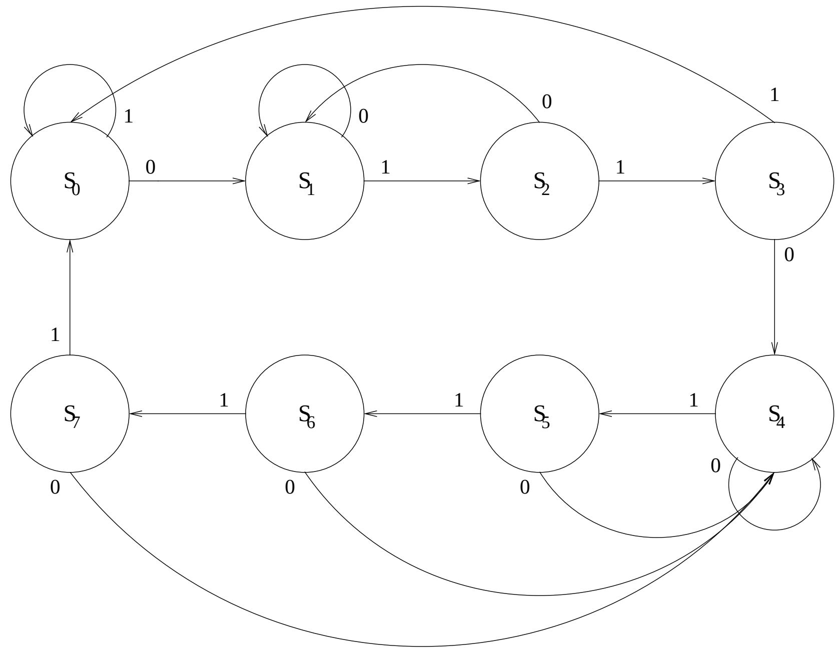
Problem Set 3 Solutions
CS 111 Fall 2001

Part 1

The input is a sequence of bits, read one at a time. The output is a bit indicating if the lock is closed or open. The state machine is:



Part 2

Since we have 8 states, we need 3 bits:

State	Representation
S_0	000
S_1	001
S_2	010
S_3	011
S_4	100
S_5	101
S_6	110
S_7	111

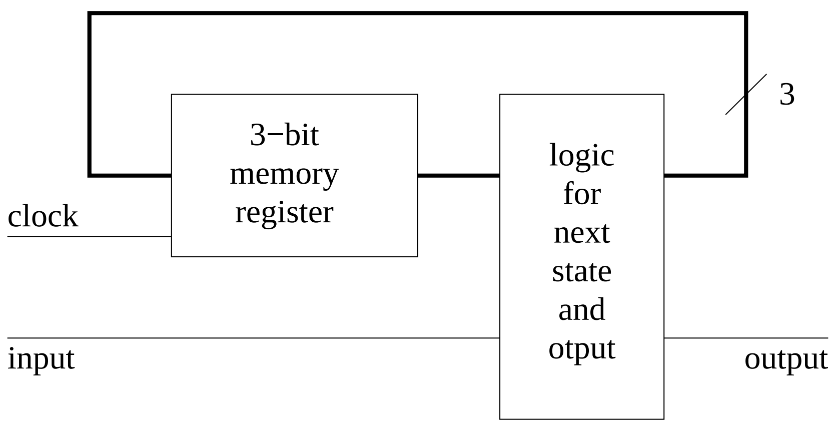
Part 3

The truth table is:

Current state	Input	Next state	Output
S_0	0	S_1	0
S_0	1	S_0	0
S_1	0	S_1	0
S_1	1	S_2	0
S_2	0	S_1	0
S_2	1	S_3	0
S_3	0	S_4	1
S_3	1	S_0	0
S_4	0	S_4	1
S_4	1	S_5	1
S_5	0	S_4	1
S_5	1	S_6	1
S_6	0	S_4	1
S_6	1	S_7	1
S_7	0	S_4	1
S_7	1	S_0	0

Part 4

The final structure of the circuit is:



Numeracy Exercise

Case A

From problem set 1, we know that a 800MHz computer can execute 3.6×10^{12} instructions during a 75-minute lecture. And from problem set 2, we know that using such computer we can crack 3.6×10^6 passwords per lecture. Thus, to crack 45424 passwords, we need:

$$\frac{45424 \text{ passwords}}{3.6 \times 10^6 \ \frac{\text{passwords}}{\text{lecture}}} = 0.0126 \text{ lectures} = 0.946 \text{ min} = 56.8 \text{ s}$$

Case B

With 8 digits, we can have 10^8 passwords. To crack a 8-digit password, we need:

$$\frac{10^8 \text{ passwords}}{3.6 \times 10^6 \ \frac{\text{passwords}}{\text{lecture}}} = 28 \text{ lectures}$$

Case C

If we have 40 students cracking passwords during 25 lectures, we can crack:

$$40 \times 25 \times 3.6 \times 10^6 = 3.6 \times 10^9 \text{ passwords}$$