

# CSE 140 Homework Six

March 13, 2007

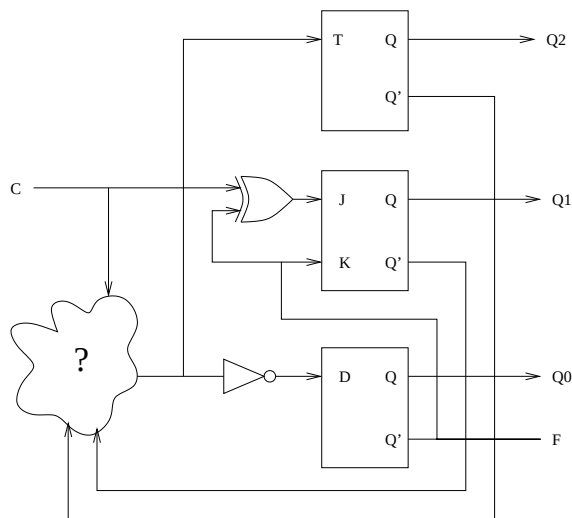
*This homework will neither be collected nor (obviously) graded.*

## 1 Problem Set One

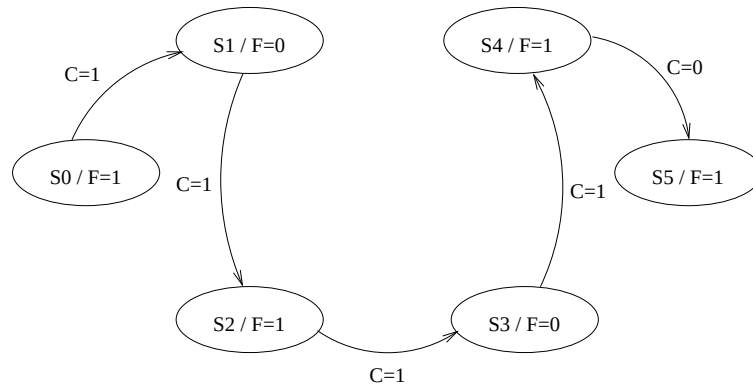
- textbook 6.1(c)
- textbook 6.2
- textbook 6.8
- textbook 6.10
- textbook 6.11
- textbook 6.12
- textbook 6.14
- textbook 6.17
- textbook 6.19

## 2 Problem Set Two

**1 (FSM Analysis)** The following sequential circuit consists of three different flip-flops and some combinational gates. The input signal is  $C$ . Each state is encoded with  $Q_2Q_1Q_0$ . The output signal is  $F$ . However, a part of the combinational circuit is unknown.



The circuit above implements the FSM below, which consists of 6 states, together with the output of each state and a **partially specified** transition set. The initial state is  $S_0$ .



(Part A) In this part you are asked to figure out the code for each state. Please analyze the sequential circuit and the FSM provided on the previous page and fill in the following table. The code for the initial state  $S_0$  is already known. (Hint: The state codes can be computed completely based on the transition information we have given you. You may also need to refer to the characteristic equations of all four flip-flops at the end of the test.)

|       | State Code |       |       | Output |
|-------|------------|-------|-------|--------|
|       | $Q_2$      | $Q_1$ | $Q_0$ | $F$    |
| $S_0$ | 0          | 0     | 0     | 1      |
| $S_1$ |            |       |       | 0      |
| $S_2$ |            |       |       | 1      |
| $S_3$ |            |       |       | 0      |
| $S_4$ |            |       |       | 1      |
| $S_5$ |            |       |       | 1      |

(Part B) In this part you are asked to figure out the next state and output table for the FSM. In order to provide you a hint, we have broken the states into two groups, essentially based on their outputs. As you can see from the state diagram on the previous page,  $S_1$  and  $S_3$  have the same output of 0, while the other 4 states have the same output of 1. We name the former set of states **Group A**, while the latter set **Group B**. In the following partially filled next state table, we have presented the group of the next states for some cases. Please complete this table by filling in the missing state names.

| Present State | Next State/Group |         |
|---------------|------------------|---------|
|               | $C = 0$          | $C = 1$ |
| $S_0$         | /                | $S_1/A$ |
| $S_1$         | $/A$             | $S_2/B$ |
| $S_2$         | $/B$             | $S_3/A$ |
| $S_3$         | $/A$             | $S_4/B$ |
| $S_4$         | $S_5/B$          | $/A$    |
| $S_5$         | /                | $/A$    |

**2 (PART A)** Determine the **minimal** state diagram representing the State Transition Table below. X's indicate "don't cares."

|       | Next State |         | Output<br>YZ |
|-------|------------|---------|--------------|
|       | $A = 0$    | $A = 1$ |              |
| $S_0$ | $S_1$      | $S_2$   | 00           |
| $S_1$ | $S_0$      | $S_7$   | 01           |
| $S_2$ | $S_0$      | X       | 10           |
| $S_3$ | $S_3$      | $S_1$   | 00           |
| $S_4$ | $S_3$      | $S_3$   | 01           |
| $S_5$ | $S_6$      | $S_8$   | 10           |
| $S_6$ | $S_7$      | $S_5$   | 00           |
| $S_7$ | X          | $S_1$   | 01           |
| $S_8$ | $S_0$      | $S_2$   | X0           |

Table 1: State Transition Table

**(PART B)** Would your minimal state diagram change if we *restricted* the state transition from state  $S_2$  on input  $A = 1$  to a state in the set  $\{S_0, S_1, S_2, S_3, S_4\}$ ? If so, how? If not, why not?

**(PART C)** Would your minimal state diagram change if we *changed* the state transition from state  $S_2$  on input  $A = 0$  to state  $S_3$ ? If so, how? If not, why not?