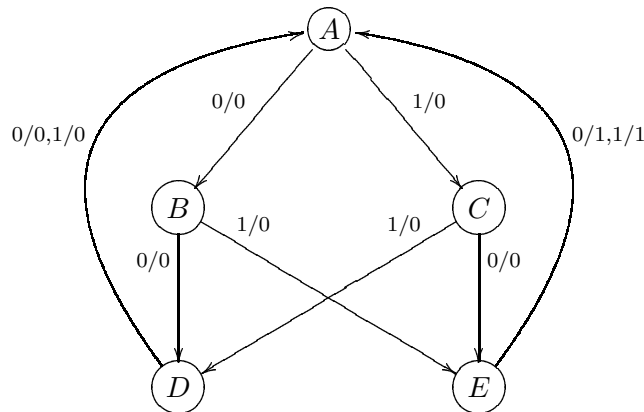


## DigSim Assignment 2: A Finite State Machine

Due: Tuesday November 30, 2004

**Objective:** The objective of this assignment is to implement a finite state machine using DigSim.

**Assignment:** Consider the finite state machine from question A.34 of Murdocca & Heuring:



This finite state machine starts in state  $A$  and has one input bit and one output bit. The machine outputs 1 only after it has entered state  $E$ .

Your assignment is to implement this finite state machine in DigSim. You must:

1. Use three D flip-flops to store the 5 states of the machine. State  $A$  will be represented as 000,  $B = 001$ ,  $C = 010$ ,  $D = 011$  and  $E = 100$ . The bit patterns 101, 110 and 111 are not used.
2. Let  $s_2, s_1, s_0$  be the state bits stored in the D flip-flops,  $x$  be the input bit and  $z$  be the output bit. Fill in the attached truth table for the next state bits  $s'_2, s'_1, s'_0$  and the output bit  $z$ .
3. For  $s'_2, s'_1, s'_0$  and  $z$ , use Karnaugh maps to obtain simplified SOP or POS Boolean formulas.
4. Implement the finite state machine in DigSim. You should study the “Sequence Detector” example in DigSim (use “Open example” under the File menu) for suggestions on the layout of your finite state machine.

### Implementation notes:

- Label the switches and flip-flops in your circuit appropriately.
- If you need a 4-input OR gate, you need to use two layers of 2-input or 3-input OR gates to accomplish the same function. Ditto for 4-input AND gates.
- The D flip-flops in DigSim are positive-edge triggered. To change the state of the flip-flop, change the input when the clock is low, then bring the clock from low to high. The input to the D flip-flop when the clock changes from low to high will be stored in the flip-flop.

**What to submit:**

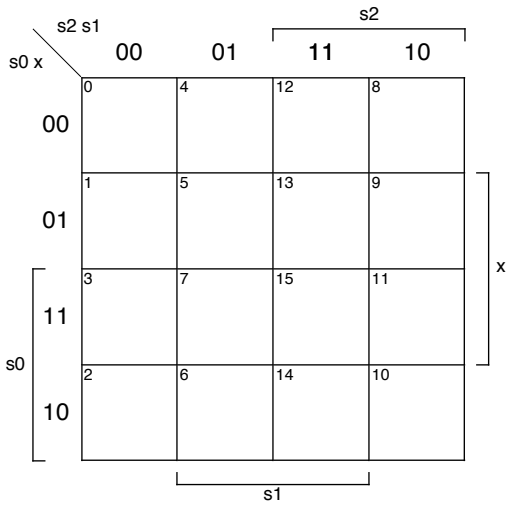
1. Make a copy of your truth-table and Karnaugh maps and submit the hard copy in class on Tuesday, November 30.
2. Save your circuit as you did in the DigSim Assignment 1. Submit the circuit file using the Unix `submit` command as in previous assignments. The submission name for this assignment is: `digsim1`. The UNIX command to do this should look something like:

```
submit cs313_0101 digsim2 a34.sim
```

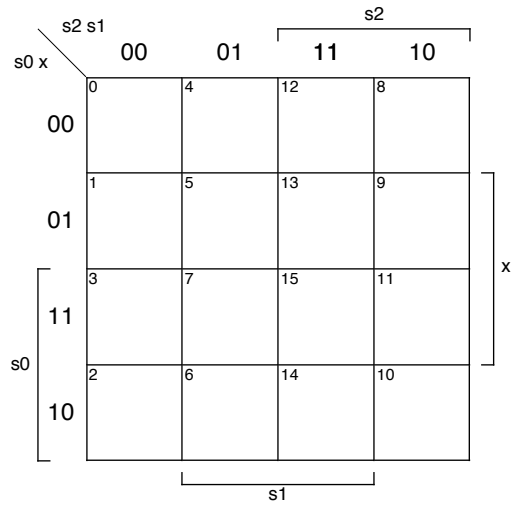
Name: \_\_\_\_\_

Truth table:

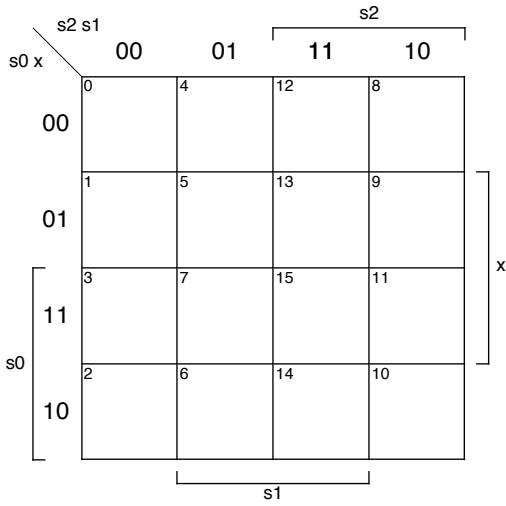
$m$	$s_2$	$s_1$	$s_0$	$x$	$s'_2$	$s'_1$	$s'_0$	$z$
0	0	0	0	0				
1	0	0	0	1				
2	0	0	1	0				
3	0	0	1	1				
4	0	1	0	0				
5	0	1	0	1				
6	0	1	1	0				
7	0	1	1	1				
8	1	0	0	0				
9	1	0	0	1				
10	1	0	1	0	$d$	$d$	$d$	$d$
11	1	0	1	1	$d$	$d$	$d$	$d$
12	1	1	0	0	$d$	$d$	$d$	$d$
13	1	1	0	1	$d$	$d$	$d$	$d$
14	1	1	1	0	$d$	$d$	$d$	$d$
15	1	1	1	1	$d$	$d$	$d$	$d$



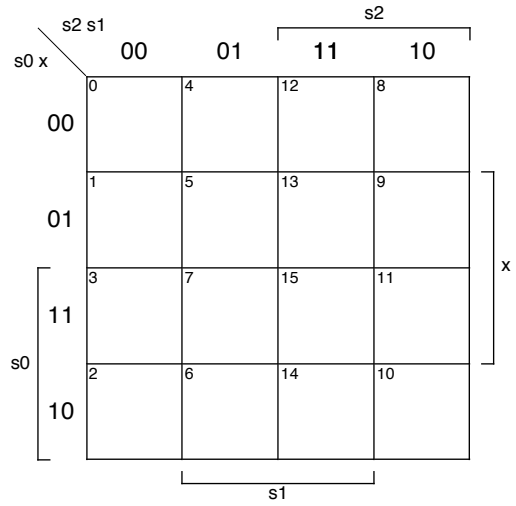
s2' =



s1' =



s0' =



Z =