

Last Name (Print): _____

First Name (Print): _____

ID number (Last 4 digits): _____

Section: _____

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

Problem	Weight	Score
1	25	
2	25	
3	25	
4	25	
Total	100	

INSTRUCTIONS

1. You have 2 hours to complete this exam.
2. This is a closed book exam. You may use one $8.5'' \times 11''$ note sheet.
3. Calculators are allowed.
4. Solve each part of the problem in the space following the question. If you need more space, continue your solution on the reverse side labeling the page with the question number; for example, **Problem 1.2 Continued**. **NO** credit will be given to solutions that do not meet this requirement.
5. **DO NOT REMOVE ANY PAGES FROM THIS EXAM.** Loose papers will not be accepted and a grade of **ZERO** will be assigned.
6. The quality of your analysis and evaluation is as important as your answers. Your reasoning must be precise and clear; your complete sentences should convey what you are doing. **To receive credit, you must show your work.**
7. Any student caught cheating on an exam will receive a grade of zero for the exam. Additional sanctions, including assigning an **XF** grade, will be pursued following university guidelines.

Problem 1: (25 Points)

1. (8 points) Consider a Moore finite state machine with two inputs, w and x , and a single output y .
 - (a) (6 points) Using the state diagram in Figure 1, complete the state table in Table 1. Where appropriate, mark don't care conditions for the inputs using the symbol \times .

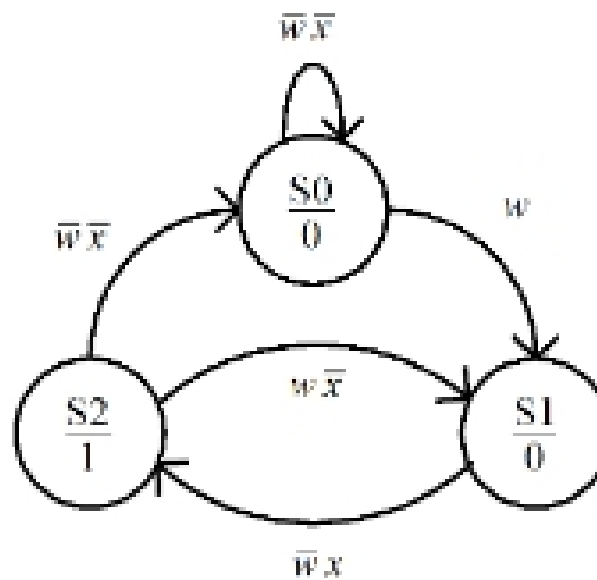


Figure 1: State diagram for a Moore finite state machine with inputs w and x , and output y .

Present State	Inputs		Next State		Output
	Q_A	Q_B	w	x	
S0	0	0			
S0	0	0			
S1	0	1			
S2	1	0			
S2	1	0			

Table 1: State table for the Moore finite state machine in Figure 1.

- (b) (2 points) How many D-type flip-flops are required to realize the finite state machine in part 1? To receive credit, you must justify your answer using one or two short sentences.

2. (8 points) Consider another Moore finite state machine, where the three-variable Karnaugh map in Figure 2 corresponds to the D-type flip-flop input D_A .

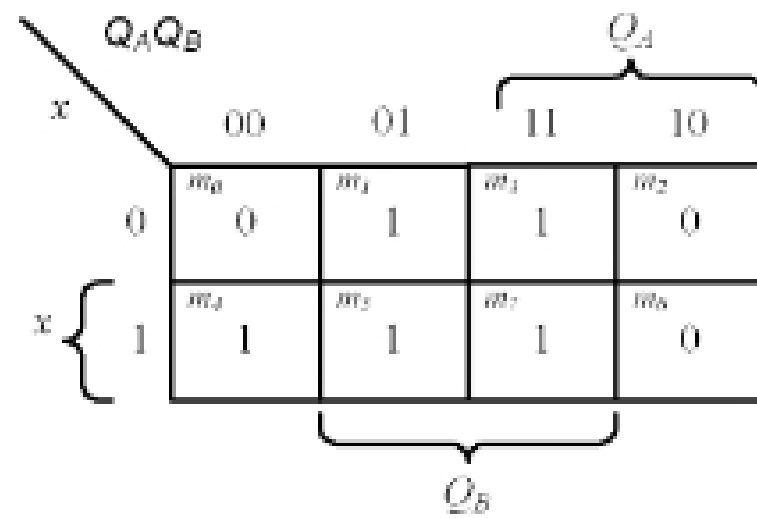


Figure 2: Three-variable Karnaugh map for determining D_A .

- (a) (4 points) Using the three-variable Karnaugh map in Figure 2, determine a simplified expression for D_A . To receive partial credit, you must circle the minterms that you grouped together in the Karnaugh map shown in Figure 2.

- (b) (4 points) Assuming that the expression for D_B is

$$D_B = \bar{x}Q_B + Q_B,$$

and that the signals x , Q_B , and \bar{Q}_B are available, realize the signal D_B using 2-input NAND gates and neatly sketch your circuit below.