Student ID: _____

CS 151
Quiz 5

Name : _____ , _____
(Last Name) (First Name)

Student ID : _____

Signature : _____

Instructions:

1. Please verify that your paper contains **7 pages** including this cover.
2. Write down your Student-Id on the top of each page of this quiz.
3. This exam is **closed book**. No notes or other materials are permitted.
4. Total credits of this quiz are **45 points.**
5. To receive credit and for possible re-grade request you must show your work clearly.
6. **For possible re-grade request make sure that your write clearly.**
7. Calculators are **NOT** allowed.

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Question 1 [State minimization] **[15 points]**

a. Reduce the number of states in the following state table using the implication table method. (**10 points**)

Present state	Next State		Output
	X=0	X=1	
A	F	C	0
B	C	E	1
C	A	E	1
D	A	C	0
E	B	G	0
F	D	C	0
G	B	C	1

Notice that this state table is for a **Moore** machine.

A = D = F

A						
B	X					
C	X	(A,C) (E,E)				
D	(A,F) (C,C)	X	X			
E	(B,F) (G,C)	X	X	(C,A) (G,C)		
F	(D,F) (C,C)	X	X	(D,A) (C,C)	(D,B) (C,G)	
G	X	(F,C) (C,E)	(F,A) (C,E)	X	X	X
	A	**B**	**C**	**D**	**E**	**F**	**G**

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b. Tabulate the reduced state table using the table provided below. **(5 points)**

Present state	Next State		Output
	X=0	X=1	
ADF	ADF	C	0
B	C	E	1
C	ADF	E	1
E	B	G	0
G	B	C	1

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Question 2 [Function Minimization] [20 points]

Consider function F with the following equation:

F(a,b,c,d) = ac'd' + abcd' + bc'd + a'b'cd'

Assuming that abcd = 0000 and abcd = 1010 never happen in the input (so you can regard them as don't care situations),

1. Fill the following K-map table (5 points)

ab \ cd				
	X m_0	**0** m_1	**0** m_3	**1** m_2
	0 m_4	**1** m_5	**0** m_7	**0** m_6
	1 m_{12}	**1** m_{13}	**0** m_{15}	**1** m_{14}
	1 m_8	**0** m_9	**0** m_{11}	**X** m_{10}

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2. Identify Prime Implicants and Essential Prime Implicants. (10 points)

Prime Implicants:

$m_0 + m_2 + m_8 + m_{10} = b'd'$

$m_8 + m_{12} = ac'd'$, $m_{12} + m_{13} = abc'$, $m_5 + m_{13} = bc'd$

$m_{12} + m_{14} = abd'$

Essential Prime Implicants:

$m_0 + m_2 + m_8 + m_{10} = b'd'$

$m_5 + m_{13} = bc'd$

$m_{12} + m_{14} = abd'$

3. Using the K-map table in 1(a), write the minimized equation for function F. (5 points)

F= b'd' + bc'd + abd'

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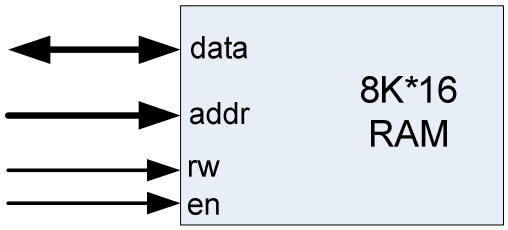
Question 3 [Memory Design] [10 points]

Design a 32K*32-bit RAM using 8K*16-bit RAM modules shown below.



8K*16-bit RAM Module

Use a minimum number of the following logic components in your design (***no other components may be used for this design***):

1) Priority Encoder
2) Decoder
3) Multiplexer

NOTE: All the 8K*16 modules share the same line for rw, so that input is not shown in the solution.

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