Midterm Exam II PRACTICE EXAM

ECE 2372 | Modern Digital System Design | Texas Tech University

Instructions

You will have 50 minutes to complete the following multiple-choice problems. When you are finished, tear out and complete the answer sheet at the back of the exam packet. Staple the answer sheet to the front of your exam packet and turn it into the instructor. All truth tables referenced in test questions are given at the back of the exam.

Exam Questions

1. Which of the Boolean functions is a valid sum-of-products?
   a. $F(A, B, C) = A'B + A(B' + C)$
   b. $F(A, B, C) = AC' + BC + A'B'C'$
   c. $F(A, B, C) = A(B + C') + A'BC' + ABC$
   d. $F(A, B, C) = (A' + B)(A + B')(A + C)$

2. Which of the Boolean functions is a valid product-of-sums?
   a. $F(A, B, C, D) = A'B + A'CD' + AB'CD'$
   b. $F(A, B, C, D) = (A + B + C')(A + B'C + D)(A' + B + CD')$
   c. $F(A, B, C, D) = (A' + B + C')(A + B' + C + D)(A' + B + C + D')$
   d. $F(A, B, C, D) = A'B(A + B' + C) + A'B + C'D$

3. Which of the Boolean functions is neither sum-of-products nor product-of-sums?
   a. $F(A, B, C) = AB'C + C'(A + B') + AB'(B' + C)$
   b. $F(A, B, C) = A'B + AB'C' + A'BC'$
   c. $F(A, B, C) = (A' + B)(A + B + C')(A' + B + C')$
   d. $F(A, B, C) = A + B + B'C' + C$

4. Which is a sum-of-products equivalent of the Boolean expression $AB + B'(C + D)$?
   a. $AB + B'(C + D)$
   b. $(A + B')(A + C + D)(B + C + D)$
   c. $AB + AB'C + AB'D$
   d. $AB + B'C + B'D$

5. Which is a product-of-sums equivalent of the Boolean expression $AB + B'(C + D)$?
   a. $AB + C'(C + D)$
   b. $(A + B')(A + C + D)(B + C + D)$
   c. $(AB + B')(AB + C + D)$
   d. $(A + B')(B + B')(A + C + D)(B + C + D)$

6. Which Boolean function can be found on Truth Table #2?
   a. $A'BC' + AB'C' + AB'C + ABC$
   b. $A'B'C + A'BC + ABC' + ABC$
   c. $A'B'C' + A'BC' + A'B'C + AB'C$
   d. $AB'C' + A'BC' + AB'C + ABC'$

7. What is the Generalized Minterm Expansion for Output W, on Truth Table #3?
   a. $W(A, B, C, D) = \sum_m(1, 2, 3, 7, 9, 10, 11, 12,15)$
   b. $W(A, B, C, D) = \prod_M(0,4,5,6,8,13,14)$
   c. $W(A, B, C, D) = \prod_M(1,2,3,7,9,10,11,12,15)$
   d. $W(A, B, C, D) = \sum_m(0,4,5,6,8,13,14)$

8. What is the Generalized Maxterm Expansion for Output Y on Truth Table #2?
   a. $Y(A,B,C) = \prod_M(0,4,5,6)$
   b. $Y(A,B,C) = \sum_m(0,4,5,6)$
   c. $Y(A,B,C) = \prod_M(1,2,3,7)$
   d. $Y(A,B,C) = \sum_m(1,2,3,7)$

9. What is the Generalized Minterm Expansion for the function $F(A,B,C) = \prod_M(1,3,6,7)$?
   a. $F(A,B,C) = \sum_m(0,2,4,5)$
   b. $F(A,B,C) = \sum_m(1,3,6,7)$
   c. $F(A,B,C) = \sum_m(0,1,2,5,7)$
   d. $F(A,B,C) = \sum_m(1,2,4,7)$

10. What is the Generalized Maxterm Expansion for the function $F(A,B,C,D) = \sum_m(0,3,4,12,13)$?
   a. $F(A,B,C,D) = \prod_M(1,2,5,11,14,15)$
   b. $F(A,B,C,D) = \prod_M(1,2,5,6,7,8,9,10,11,14,15)$
   c. $F(A,B,C,D) = \prod_M(1,3,5,7,9,10,12,13,14,15)$
   d. $F(A,B,C,D) = \prod_M(0,3,6,7,9,12,13,14,15)$

11. What is the Generalized Minterm Expansion for the function $F(A,B,C) = AB + BC$?
   a. $F(A,B,C) = \sum_m(3,6,7)$
   b. $F(A,B,C) = \sum_m(1,3,6,7)$
   c. $F(A,B,C) = \sum_m(0,1,2,5)$
   d. $F(A,B,C) = \sum_m(1,2,4,6)$

12. What is the Generalized Maxterm Expansion for the function $F(A,B,C) = AB' + ABC'$?
   a. $F(A,B,C) = \prod_M(0,1,3,7)$
   b. $F(A,B,C) = \prod_M(1,4,6,7)$
   c. $F(A,B,C) = \prod_M(0,1,2,3,7)$
   d. $F(A,B,C) = \prod_M(4,5,6)$

13. Which output from Truth Table #1 is shown on the K-Map?

	B'	B
A'	0 0	1 1
A	1 2	0 3

   a. W
   b. X
   c. Y
   d. None

14. What is the optimized sum-of-products from the K-Map given in Problem 13?
    a. $F(A, B) = A'B' + AB$
    b. $F(A, B) = AB' + A'B$
    c. $F(A, B) = AB'$
    d. $F(A, B) = A'B + AB$

15. What is the optimized product-of-sums from the K-Map given in Problem 13?
    a. $F(A, B) = (A + B')(A' + B)$
    b. $F(A, B) = (A' + B')$
    c. $F(A, B) = (A' + B)(A + B)$
    d. $F(A'B) = (A + B)(A' + B')$

16. What is the optimized sum-of-products for Output Y from Truth Table #1?
    a. $F(A, B) = A + B'$
    b. $F(A, B) = A'$
    c. $F(A, B) = A$
    d. $F(A, B) = A' + B$

17. What is the optimized product-of-sums for Output Y from Truth Table #1?
    a. $F(A, B) = A'$
    b. $F(A, B) = A + B$
    c. $F(A, B) = A + B'$
    d. $F(A, B) = A$

18. Which output from Truth Table #2 is shown on the K-Map?

	B'		B	
A'	1 $_0$	0 $_1$	0 $_3$	0 $_2$
A	1 $_4$	1 $_5$	0 $_7$	1 $_6$
	C'	C		C'

    a. W
    b. X
    c. Y
    d. None

19. What is the optimized sum-of-products from the K-Map given in Problem 18?
    a. $F(A, B, C) = A'B'C' + AB' + ABC'$
    b. $F(A, B, C) = B'C' + AB' + AC'$
    c. $F(A, B, C) = A'C + BC$
    d. $F(A, B, C) = A'C + ABC$

20. What is the optimized product-of-sums from the K-Map given in Problem 18?
    a. $F(A, B, C) = (A + C')(A' + B' + C')$
    b. $F(A, B, C) = (A' + B)(B + C)(A' + C)$
    c. $F(A, B, C) = (A + C')(B' + C')$
    d. $F(A, B, C) = (A + C')(B' + C')(A + B')$

21. What is the optimized sum-of-products for Output X from Truth Table #2?
    a. $F(A, B, C) = B + C'$
    b. $F(A, B, C) = B + B'C'$
    c. $F(A, B, C) = B + A'B'C'$
    d. $F(A, B, C) = B' + C$

22. What is the optimized product-of-sums for Output X from Truth Table #2?
    a. $F(A, B, C) = B' + C$
    b. $F(A, B, C) = B + C'$
    c. $F(A, B, C) = (B' + C)(A + B')$
    d. $F(A, B, C) = (B + C')(A' + B)$

23. Which output from Truth Table #3 is shown on the K-Map?

    a. W
    b. X
    c. Y
    d. None

24. What is the optimized sum-of-products from the K-Map given in Problem 23?
   a. $F(A, B, C, D) = C + AC'D + A'B'C' + A'B'CD'$
   b. $F(A, B, C, D) = A'B + AC'D'$
   c. $F(A, B, C, D) = C + D + A'B'D' + A'B'C'$
   d. $F(A, B, C, D) = A'B + A'CD + AC'D'$

25. What is the optimized product-of-sums from the K-Map given in Problem 23?
   a. $F(A, B, C, D) = (A' + B)(A' + C + D)(A + C' + D')$
   b. $F(A, B, C, D) = (A' + D)(A' + C)(A + B')(A' + C + D')$
   c. $F(A, B, C, D) = (A' + B')(C' + D)(A' + B + D')$
   d. $F(A, B, C, D) = (A + B')(A + C' + D')(A' + C + D)$

26. What is the optimized sum-of-products for Output Y from Truth Table #3?
   a. $F(A, B, C, D) = AC' + AB' + B'C$
   b. $F(A, B, C, D) = AB' + ABC' + A'B'C$
   c. $F(A, B, C, D) = BC + A'B + A'C'$
   d. $F(A, B, C, D) = AB' + AB'C' + C'D$

27. What is the optimized product-of-sums for Output Y from Truth Table #3?
   a. $F(A, B, C, D) = (B' + C')(A + B' + D)(A + B + C + D')$
   b. $F(A, B, C, D) = (A' + C)(A' + B)(B + C')$
   c. $F(A, B, C, D) = (A' + C)(A' + B + D')(A + B + C')$
   d. $F(A, B, C, D) = (B' + C')(A + B')(A + C)$

28. Which answer choice best describes a 5-to-32 Line Decoder?
   a. 32 AND-gates driven by two 2-to-4 decoders
   b. 32 AND-gates driven by one 3-to-8 decoder and one 2-to-4 decoder.
   c. 32 AND-gates driven by one 1-to-2 decoder and one 2-to-3 decoder.
   d. 5 AND-gates driven by two 3-to-8 decoders.

29. An 8-to-1 multiplexer is fed a data input, Y, where each value of Y is defined in Truth Table #2 (Ex. $Y_0 = 1, Y_1 = 0, Y_2 = 0$, etc.). If the select input of the MUX is set to 5, what will the output of the multiplexer be?
   a. 0
   b. 1
   c. X
   d. None

30. How many OR-gates will be needed to construct an 8-bit, 4-to-1 MUX?
   a. 4
   b. 1
   c. 8
   d. 12

Truth Tables

Truth Table #1 (Two Variables)

A	B	W	X	Y
0	0	0	1	X
0	1	1	0	0
1	0	1	1	1
1	1	0	0	1

Truth Table #2 (Three Variables)

A	B	C	W	X	Y
0	0	0	0	1	1
0	0	1	0	0	0
0	1	0	1	1	0
0	1	1	0	1	0
1	0	0	1	X	1
1	0	1	1	0	1
1	1	0	0	0	1
1	1	1	1	1	0

Truth Table #3 (Four Variables)

A	B	C	D	W	X	Y
0	0	0	0	1	1	X
0	0	0	1	0	1	0
0	0	1	0	0	1	1
0	0	1	1	0	0	1
0	1	0	0	1	0	0
0	1	0	1	1	0	X
0	1	1	0	1	0	0
0	1	1	1	0	0	0
1	0	0	0	1	0	1
1	0	0	1	0	1	1
1	0	1	0	0	1	X
1	0	1	1	0	1	1
1	1	0	0	0	0	1
1	1	0	1	1	1	1
1	1	1	0	1	1	0
1	1	1	1	0	1	0

Answer Key

1. B
2. C
3. A
4. D
5. B
6. A
7. D
8. C
9. A
10. B
11. A
12. C
13. A
14. B
15. D
16. C
17. A
18. C
19. B
20. D
21. A
22. B
23. B
24. C
25. D
26. A
27. D
28. B
29. B
30. C