TOTAL: _____/10

ECE 543: Introduction to Digital Systems

Homework #1

Due: Friday, September 17th, 2021 (6 P.M.)

Student Name: _____

Note:
- **Please use this sheet as a cover page.**
- **Your work must be hand-written (no typing please).**
- **Homework must be submitted electronically through Canvas in a PDF format.**

Do the following problems from "Fundamentals of Digital Logic with Verilog Design" by Brown & Vranesic (3rd Edition)

Solve the following problems:

Problems from Chapter 2:
2.12, 2.13, 2.20, 2.21, 2.31, 2.33

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12. $f = x_1x_3 + x_1\bar{x}_2 + \bar{x}_1x_2x_3 + \bar{x}_1\bar{x}_2\bar{x}_3$

$X + X = X \quad X + \bar{X} = 1$

$f(x_1x_2x_3) = x_1x_3(x_2+\bar{x}_2) + x_1\bar{x}_2(x_3+\bar{x}_3) + \bar{x}_1x_2x_3 + \bar{x}_1\bar{x}_2\bar{x}_3$

$x_1x_2x_3 + x_1\bar{x}_2x_3 + x_1\bar{x}_2x_3 + x_1\bar{x}_2\bar{x}_3 + \bar{x}_1x_2x_3 + \bar{x}_1\bar{x}_2\bar{x}_3 + x_1x_2x_3$

$x_2x_3(x_1+\bar{x}_1) + \bar{x}_2\bar{x}_3(x_1+\bar{x}_1) + x_1\bar{x}_2x_3 + x_1x_2x_3$

$x_2x_3 + \bar{x}_2\bar{x}_3 + x_1\bar{x}_2x_3 + x_1x_2x_3 \rightarrow x_2x_3 + \bar{x}_2\bar{x}_3 + x_1x_3$

13. $f = x_1\bar{x}_2\bar{x}_3(x_4+\bar{x}_4) + x_1x_2x_4 + x_2x_3x_4$

$x_1(\bar{x}_2\bar{x}_3(x_4+\bar{x}_4) + x_2x_4 + x_2x_3x_4)$

$x_1(\bar{x}_2\bar{x}_3\bar{x}_4 + \bar{x}_2\bar{x}_3x_4 + x_2x_4 + x_2x_3x_4)$

$x_1(\bar{x}_2 + \bar{x}_3 + x_2x_4 + x_2x_3x_4)$

$(x_2 + x_4 + x_3 + x_2x_4)x_1$

20.

x_1	x_2	x_3	f
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

$\bar{x}_1x_2x_3 + x_1\bar{x}_2\bar{x}_3 + x_1\bar{x}_2x_3 + x_1x_2x_3 = f$

$(\bar{x}_1+x_1)x_2x_3 + (\bar{x}_2+x_2)x_1\bar{x}_3$

$x_2x_3 + x_1\bar{x}_3$

21,

x_1	x_2	x_3	f
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

$\bar{x}_1\bar{x}_2x_3 + \bar{x}_1x_2x_3 + x_1\bar{x}_2\bar{x}_3 + x_1x_2\bar{x}_3 + x_1x_2x_3 = f$

$\bar{x}_1x_3 + x_1\bar{x}_3 + x_1x_2x_3$

1

$\bar{x}_1x_3 + x_1\bar{x}_2\bar{x}_3 + x_1x_2$

$\bar{x}_1x_3 + x_1\bar{x}_2 + x_1\bar{x}_3 + x_1x_2$

$\bar{x}_1x_3 + x_1 + x_1\bar{x}_3$

$x_3 + x_1$

31.

x_1	x_2	x_3	f
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

$\bar{x}_1\bar{x}_2\bar{x}_3 + \bar{x}_1x_2x_3 + x_1\bar{x}_2x_3 + x_1x_2\bar{x}_3 = f$

$\bar{x}_1 + x_1\bar{x}_2x_3 + x_1x_2\bar{x}_3$

$\bar{x}_1\bar{x}_2\bar{x}_3 + \bar{x}_1x_2x_3 + x_1\bar{x}_2x_3 + x_1x_2\bar{x}_3 = f$

$\bar{x}_1 + \bar{x}_2 + \bar{x}_3 + x_1\bar{x}_2x_3 + x_1x_2\bar{x}_3$

$\bar{x}_1 + \bar{x}_2 + \bar{x}_3 + x_1x_2\bar{x}_3$

$\bar{x}_1 + \bar{x}_2 + \bar{x}_3$

33.

x_1	x_2	x_3	f
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

$\bar{x}_1\bar{x}_2\bar{x}_3 + \bar{x}_1x_2\bar{x}_3 + \bar{x}_1x_2x_3 + x_1\bar{x}_2\bar{x}_3 + x_1x_2\bar{x}_3 = f$

$\bar{x}_1x_3 + \bar{x}_1x_2\bar{x}_3 + x_1\bar{x}_2\bar{x}_3 + x_1x_2x_3$

$\bar{x}_1x_3 + \bar{x}_1x_2\bar{x}_3 + \bar{x}_2 + x_1x_2x_3$

$\bar{x}_1x_3 + \bar{x}_1\bar{x}_3 + \bar{x}_2 + x_1x_2x_3$

$\bar{x}_1(x_3 + \bar{x}_3)' + \bar{x}_2 + x_1x_2x_3$

$\bar{x}_1 + \bar{x}_2 + x_1x_3$

$\bar{x}_1 + \bar{x}_2 + x_3$