Lecture 27

CpE 100

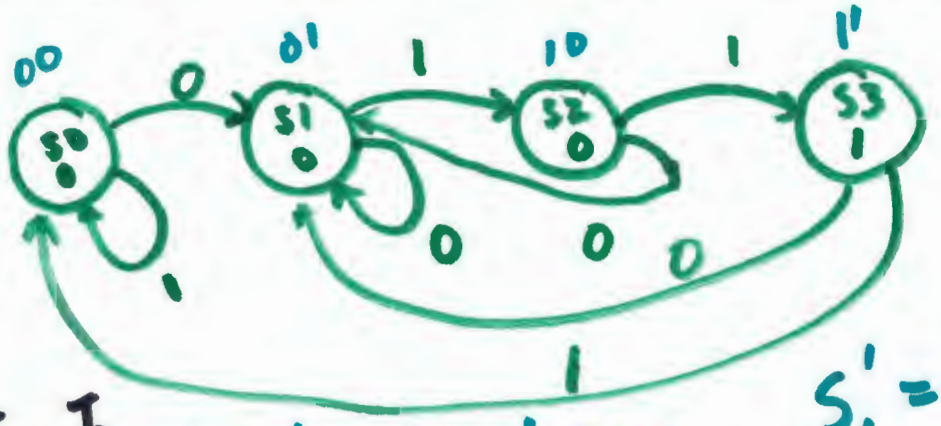
MAY 5, 2021

Practice Final Exam – CpE 100
University of Nevada, Las Vegas

NAME: _____

Open book and closed notes. No extra paper, do your work on this exam, use the back if needed. When possible put a box around your answers.
Show your work for credit and be neat!

1. Sketch the state diagram, and hardware implementation for a state machine that can detect the sequence 011. Use the back of this sheet of paper if needed. (20 points)



$S_1 S_0$	C1	C2	S_1'	S_0'	S_1'	S_0'	Y
0 0	0	1	0	1	0	0	0
0 1	0	1	0	1	1	0	0
1 0	0	1	0	1	1	1	0
1 1	0	1	0	1	0	0	1

$S_1' = \bar{S}_1 S_0 C_2 + S_1 \bar{S}_0 C_2$

512 Bytes

1 byte

4-bit words

4 x 1024.
4 Kbits

2. If a memory uses 10-bits for addressing 8-bit words then how many memory elements are in the memory? What is the capacity of the memory in bits? In Bytes? (10 points)

1) 4 2) 4
3) 4 4) 4
5) 4 6) 4

2^{10} - Addresses, 1024 addresses

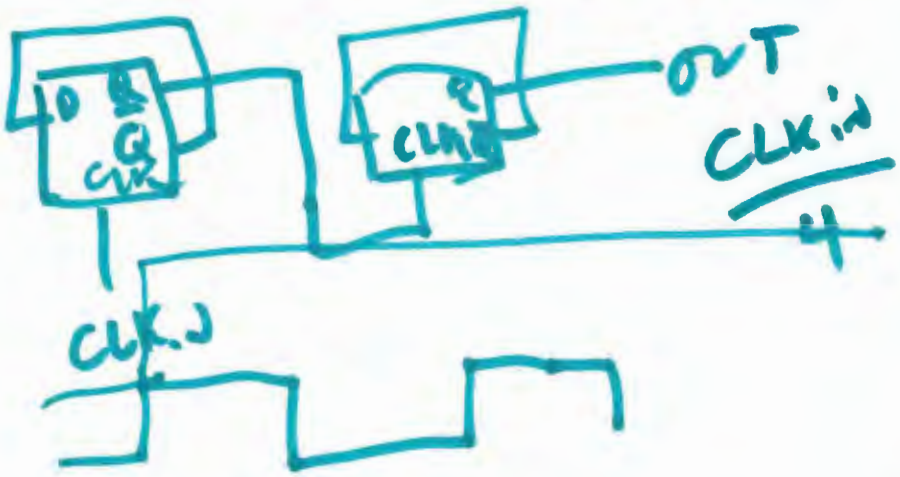
0 → 1023

xxxx xxxx
xxxx xxxx

1024 bytes

bits = 8 x 1024
= 8K bits

3. Sketch the design of a digital circuit that will divide a clock signal by 4. (5 points)



4. How would you implement a comparator for comparing two 4-bit digital words to determine which one is larger using adders? (10 points)

"="

2)

5. What is the following hexadecimal number in binary, decimal, and octal: 0xF9CD. (5 points)

13 D x 16^0
12 C x 16^1
9 9 x 16^2
15 F x 16^3

Binary → 1111 1001 1100 1101

1 111 100 111 001 101

OCTAL → 1 7 4 7 1 5

6. Show how to 10 from 22 using two's complement numbers. (10 points)

22
-10
12

22 010110
-10 110110
* 001100 → 12

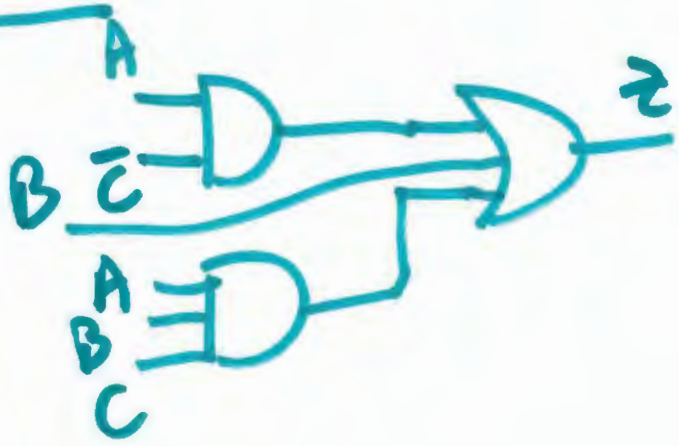
010110 (22)

001010

110101
+ 1
= 110110 (-10)

7. Write the truth table for $A\bar{C} + B + \bar{A}BC$ and sketch the logic gate implementation. (5 points)

A	B	C	Z
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1



2)

-1 - 1 = 0

8. Design a digital logic circuit that takes a 3-bit input code that corresponds to the days of the week, that is, 001 is Sunday, 010 is Monday, 011 is Tuesday, etc. and generates an output high, Y (= 1), when it's either a Monday or Friday. Show both your Boolean expression for the design and the logic gate implementation. (15 points)

$B_2 B_1 B_0$

010 → 2

116 → 6

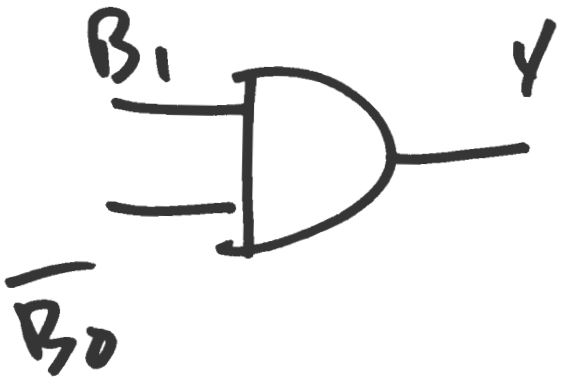
111 → 7

000 → X

$B_2 B_1$

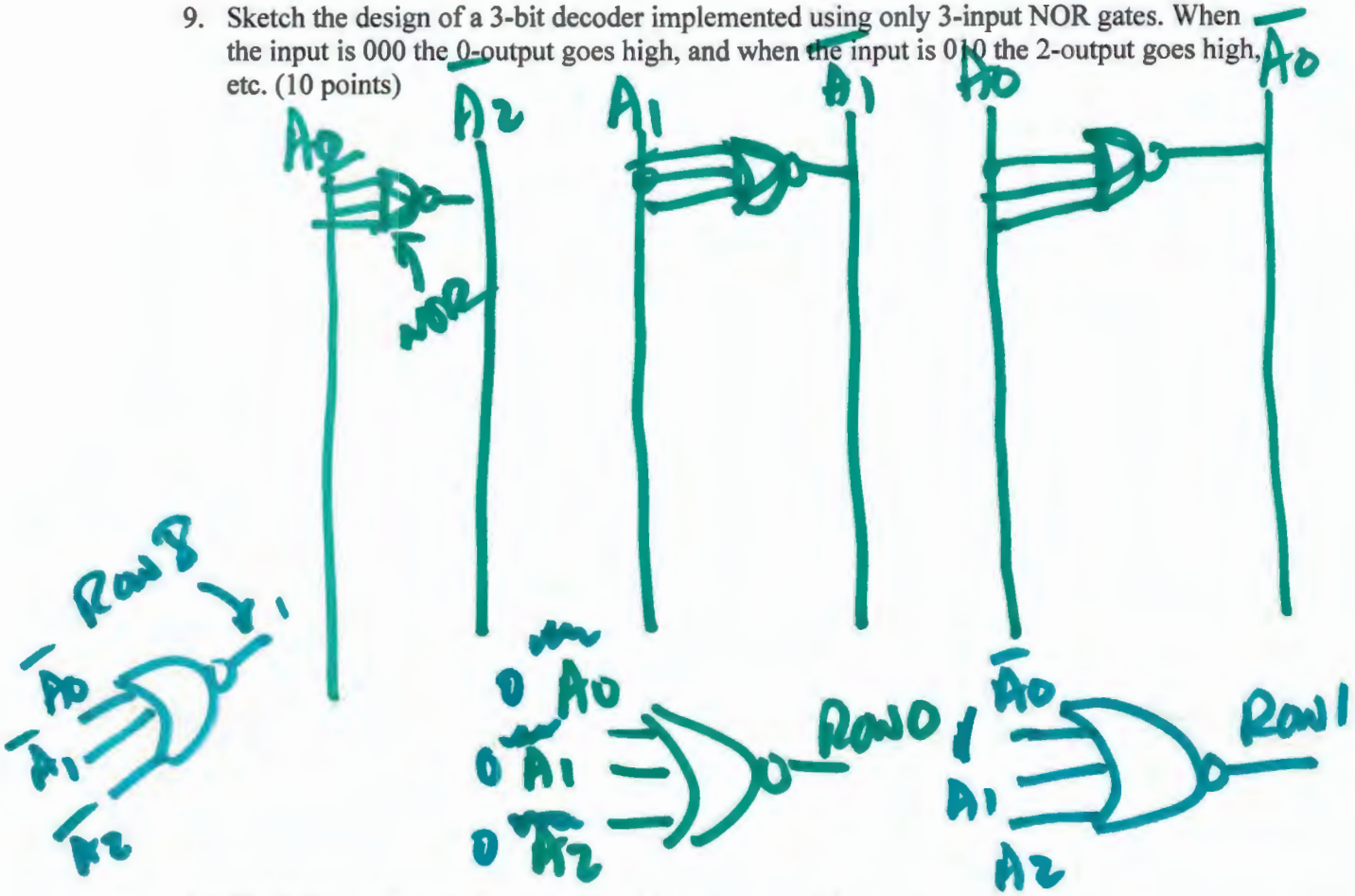
B_0	00	01	11	10
0	X	1	1	0
1	0	0	0	0

$Y = B_1 \overline{B_0}$



4)

9. Sketch the design of a 3-bit decoder implemented using only 3-input NOR gates. When the input is 000 the 0-output goes high, and when the input is 010 the 2-output goes high, etc. (10 points)



10. Work Exercise 2.24 on page 100 of the textbook. (10 points)

$$Z = BD + A\bar{C}D$$

$$Y = \bar{A}D + A\bar{C}D + A\bar{B}C + ABCD$$