Dean Gadberry
NCTC COSC 2425 S23
3/25/23

Exam 1 - Chapters 1 - 4 & Notes

1. What is 23(base6) minus 23(base4)? Express the answer in base 10.

$23_6 = 3(6^0) + 2(6^1) = 3 + 12 = 15_{10}$

$23_4 = 3(4^0) + 2(4^1) = 3 + 8 = 11_{10}$

$15 + 11 = 26$

2. Find the value of the following 8-bit two's complement binary number: 11001010

```
        11001010 − 1 = 11001001
            Inversion  00110110
        00110110 = 2^1 + 2^2 + 2^4 + 2^5 = 2+4+16+32 = 54

        11001010 = −54
```

11001010 = -54

3. Using the Hamming Algorthm with EVEN parity, find the position of the error and the corrected data string.

```
1001 0001 0010

        100100010010
p1 = ? 0 0 0 0 1   = 1
p2 =   ?0   00   01   = 1
p3 =      ?000       0 = 0
p4 =             ?0010 = 1
        12 4    8
        100100010010
        11 0    1
        *X X    *       = 6

bit 6 incorrect

               _
        100101010010
p1 = ? 0 0 0 0 1   = 1
p2 =   ?0   10   01   = 0
p3 =      ?010       0 = 1
p4 =             ?0010 = 1

        12 4 _ 8
        100101010010
        10 1    1
```

Position of error: 6

Corrected Data String: 1001 0101 0010

4. Simplify (minimize) the expression below using Boolean Algebra:

$$(A \quad \overline{B}) * \overline{(A + B)}$$

$$((\overline{A} * B) + (A * \overline{B})) * \overline{(A + B)} \qquad Exclusive\ OR$$

5. List all the ordered pairs that make the following expression true:

¬(¬A + ¬B)

¬¬A * ¬¬B DeMorgan's

A * B Double Negation

A	B	Value
0	0	0
1	0	0
0	1	0
1	1	1

Ordered Pair: (1,1)

6. Write the Boolean expression in Sum of Product (SOP) form represented by the truth table below

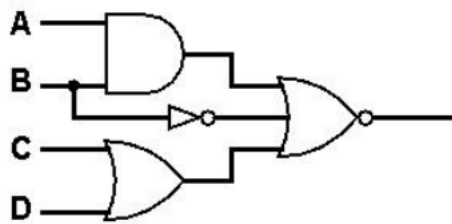| A	B	C	Output
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

A'C+BC+AC'

7. Write the simplified (minimized) expression for the boolean function defined by the following Karnaugh Map (KMap) in Sum of Product (SOP) form.

wx \ yz	00	01	11	10
00	0	1	0	1
01	0	1	1	1
11	1	1	0	0
10	1	1	0	1

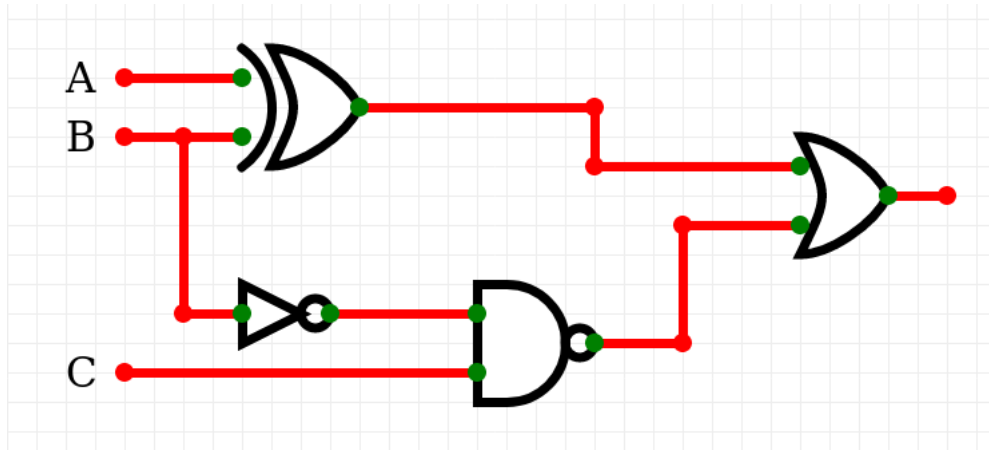| yz / wx	00	01	11	10
00	0	1	0	1
01	0	1	1	1
11	1	1	0	0
10	1	1	0	1

y'+w'x'+w'y'+w'+x'z'

8. What is the Boolean Expression represented by the digital circuit?

$$\neg[(A * B) + \neg B + (C + D)]$$

9. Draw the circuit diagram for the following expression:

$(A \oplus B) + \neg(\neg B * C)$

(Drawn with circuitverse.org/simulator)

10. What is the final value of C when the program is run?

```
A    DC      4       # label A defined as 4
B    DC      120     # label B defined as 120
C    DC      0       # label C defined as 0
TOP  LOAD    C       # C in the accumulator
     ADD     =1      # ACC += 1
     STORE   C       # C = 1
     LOAD    C       # C in ACC
     SUB     A       # ACC = 1 − 4 = −3
     SUB     A       # ACC = −3 − 4 = −7
```

3

```
SUB      A          # ACC = −7 − 4 = −11
STORE    B          # B = −11
LOAD     B          # ACC = −11
SUB      A          # ACC = −11 − 4 = −15
BG       TOP        # Does not Branch to TOP because !(ACC>0)
END                 # END
```

The final value of C is 1