

Midterm-F-2021

PROBLEM 1; GENERAL UNDERSTANDING

1

```
library ieee;
use ieee.std_logic_1164.all;
use ieee.numeric_std.all;
```

entity circuit is
port(

A : in std_logic;

B : in std_logic;

Q : out std_logic;

P : out std_logic);

end circuit;

architecture circuit_arch of circuit is

begin

$Q \leftarrow \text{NOT}(P \text{ AND } \text{NOT}(A \text{ AND } B));$

$P \leftarrow \text{NOT}(Q \text{ AND } B);$

end circuit_arch;

2. $(\bar{A} + \bar{B})C + A(B + \bar{C})$

3. as complement $18 - 25 = 18 + (-25)$

a. $18 = 010010$ ————— $\rightarrow 010010$
 $(-25) = 111001 = 100110 + 1 = 100111 \rightarrow 100111$

$$\boxed{111001 = -7}$$

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3.

b. $56 = 32 + 16 + 8 \Rightarrow 111000$

$.89 \times 2 = 1.68$

$.68 \times 2 = 1.36$

$.36 \times 2 = 0.72$

$.72 \times 2 = 1.44$

$10 = 8 + 2 = 001010$

$.77 \times 2 = 1.54$

$.54 \times 2 = 1.08$

$.08 \times 2 = 0.16$

$.16 \times 2 = 0$

$111000.1101 \quad 001010.1100$

\downarrow

$1000011.1001 \Rightarrow 67.5675$

4. 177_9 to XXX_7

$$(1 \times 9^2) + (7 \times 9) + 7 = 81 + 63 + 7 = 81 + 70 = 151$$

$$151 / 7 = 21 \text{ r } 4$$
$$21 / 7 = 3 \text{ r } 0 \Rightarrow 177_9 = 304_7$$
$$3 / 7 = 0 \text{ r } 3$$

PROBLEM 2: COUNTERS

out/state: $2 \rightarrow 0 \rightarrow 1 \rightarrow 6 \rightarrow 7$

	$Q_2\ Q_1\ Q_0$	$Q_2^+\ Q_1^+\ Q_0^+$	$D_3\ D_2\ SR_0$	$Y_2\ Y_1\ Y_0$
0	0 0 0	0 0 1	0 0 10	0 0 0
1	0 0 1	1 1 0	1 1 01	0 0 1
2	0 1 0	0 0 0	0 0 0X	0 1 0
3	0 1 1	X X X	X X XX	X X X
4	1 0 0	X X X	X X XX	X X X
5	1 0 1	X X X	X X XX	X X X
6	1 1 0	1 1 1	1 1 10	1 1 0
7	1 1 1	0 1 0	0 1 01	1 1 1

$$D_2 = Q_2 \overline{Q}_0 + \overline{Q}_1 Q_0$$

$Q_2\ Q_1$	Q_0	D_2
00	0	1
01	0	X
10	1	X
11	0	0

$$D = Q_0 + Q_2$$

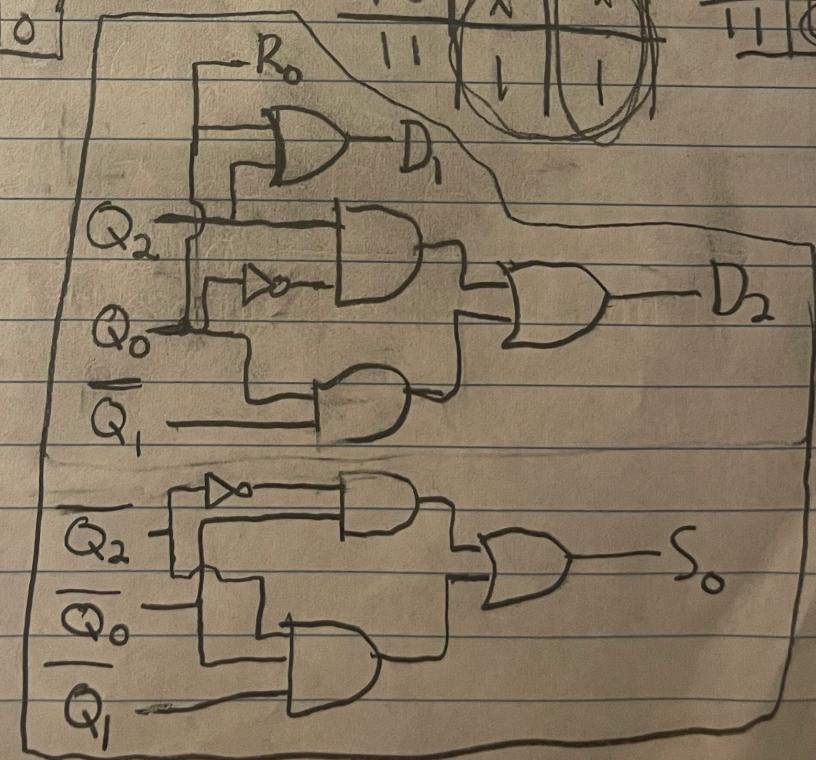
$Q_2\ Q_1$	Q_0	D
00	0	1
01	0	X
10	1	X
11	1	1

$$S_0 = \overline{Q}_2 Q_1 Q_0 + Q_2 \overline{Q}_0$$

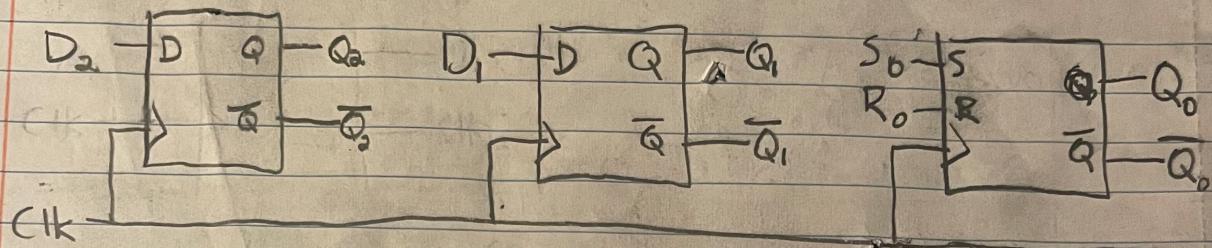
$Q_2\ Q_1$	Q_0	S_0
00	0	0
01	0	X
10	1	X
11	1	0

$$R_0 = Q_0$$

$Q_2\ Q_1$	Q_0	R_0
00	0	1
01	X	X
10	X	X
11	0	1



PROBLEM 2: COUNTERS (CONTINUED)

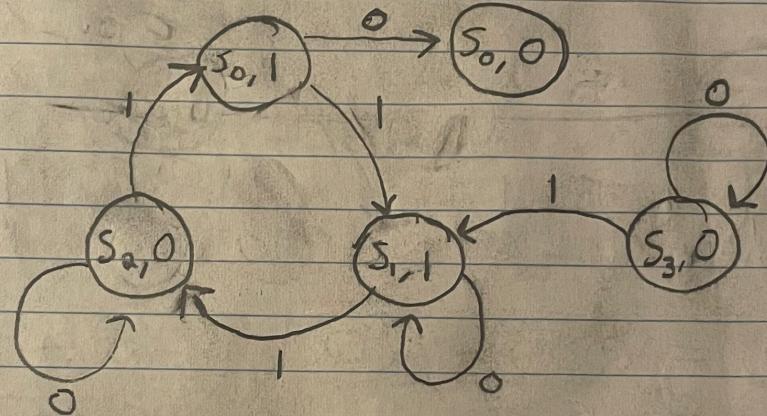


PROBLEM 3 (AUTONOMA + CONTROL)

$$\Sigma = \{0, 1\}$$

$$\Delta = \{0, 1\}$$

$$a_0 \Rightarrow$$



b.	Present State	Next State $x=0$	Present output $x=1$
	S_0	S_0	0 1 1
	S_1	S_1	1
	S_2	S_2	0
	S_3	S_3	0