Recitation 1

1) Binary to Decimal

$$1001_2 = 9$$
$$1100_2 = 12$$
$$00101101_2 = 45$$
$$10110100_2 = 180$$

$(a_{n-1}a_{n-2}a_{n-3}...a_1a_0)_2 = a_{n-1}*2^{n-1} + a_{n-2}*2^{n-2} + a_{n-3}*2^{n-3} + ...+ a_1*2^1 + a_0*2^0$

$$1001.101_2 = 9.625$$
$$0.5 \quad 0.125$$

2) Binary to Octal

$$\underline{101}\ \underline{110}_2 = 56_8$$

$$\underline{001}\ \underline{101}\ \underline{110}_2 = 156_8$$

octal digit	equivalent 3-bit binary string
0	000
1	001
2	010
3	011
⋮	⋮
7	111

$$111.010_2 = 7.2_8$$

$$\underset{\uparrow}{0}10111.010_2 = 27.2_8$$

$$\underset{\uparrow}{0}10111.0101\underset{\uparrow\ \uparrow}{00}_2 = 27.24_8$$

Octal to Binary

$$2\,6_8 = \cancel{0}10\;110_2$$

$$2.6_8 = \cancel{0}10.11\cancel{0}_2$$

3) Binary to Hexadecimal

$$\overbrace{0101}\overbrace{1010}_2 = 5A_{16}$$

$$\overbrace{0001}0100 . 1101_2 = 14.D_{16}$$

Hexadecimal to Binary

0	0000	4	0100	8	1000	c	1100
1	0001	5	0101	9	1001	d	1101
2	0010	6	0110	a	1010	e	1110
3	0011	7	0111	b	1011	f	1111

$$AB3D_{16} = 1010101100111101_2$$

$$1010 - 1011 - 0011 - 1101$$

$$15C.38_{16} = 0001\;0101\;1100 . 0011\;1000$$

$$40 \neq 400$$
$$40 = 040$$

4) Mixed Exercises

✳ $1023_{16} = (\cdots)_8$ hex to octal

$$\underbrace{\overset{1}{0001}}_{1}\ \underbrace{\overset{0}{0000}}_{0}\ \underbrace{\overset{2}{0010}}_{0\ \ 4}\ \underbrace{\overset{3}{0011}}_{3} \longrightarrow \boxed{(10043)_8}$$

✳ $9E36.7A_{16} = (\cdots)_8$

0	0000	4	0100	8	1000	c	1100
1	0001	5	0101	9	1001	d	1101
2	0010	6	0110	a	1010	e	1110
3	0011	7	0111	b	1011	f	1111

$$\underbrace{00\underset{1}{1}\overset{9}{001}}\ \underbrace{\overset{E}{1110}}_{\ \ 1\ \ 7}\ \underbrace{\overset{3}{0011}}_{0}\ \underbrace{\overset{6}{0110}}_{6\ \ 6} . \underbrace{\overset{7}{0111}}_{3}\ \underbrace{\overset{A}{10100}}_{6\ \ 4}$$

$$\boxed{117066.364_8}$$

Question   Find the base ?

$$302_x / 20_x = 12.1_x$$

> $(a_{n-1}a_{n-2}a_{n-3}\ldots a_1a_0)_2 = a_{n-1}*2^{n-1} + a_{n-2}*2^{n-2} + a_{n-3}*2^{n-3} + \ldots + a_1*2^1 + a_0*2^0$

Sol:

$$302_x = 20_x \times 12.1_x$$

$$3x^2 + 0\cdot x + 2 = (2x + 0)(1\cdot x + 2 + 1\cdot x^{-1})$$

$$3x^2 + 2 = 2x^2 + 4x + 2$$

$$x^2 = 4x$$

$$x^2 - 4x = 0$$

$$x(x-4) = 0$$

$$x = 0 \quad \leftarrow \text{ cannot be}$$

$$\boxed{x = 4}$$

$$\sqrt{41_y} = 5_y \qquad y = ?$$

$$41_y = 5_y \cdot 5_y$$

$$4 \cdot y^1 + 1 \cdot y^0 = 5 \cdot y^0 \cdot 5 \cdot y^0$$

$$4y + 1 = 25$$

$$4y = 24$$

$$y = 6$$

6) Decimal to Base-r

$\circledast$ $12.3 = (?)_2$

firstly (sequential divisions)

$$12 = (\ldots)_2$$

divider = base number
that you need
(r)

```
 12 | 2
 =  |‾6 | 2
LSB  0  =  | 3 | 2
        0  = |‾1 | 2
              1 ① MSB
```

$\boxed{(1100)_2}$

<u>Secondly</u> (sequential multiplications)

$$0.3 = (\cdots)_2$$

$\times 2 \Big($ 0.3

$\times 2 \Big($ 0.6 $\longrightarrow$ 0

1.2 $\longrightarrow$ 1

-1

$\times 2 \Big($ 0.4 $\longrightarrow$ 0

$\times 2 \Big($ 0.8 $\longrightarrow$ 0

$\times 2 \Big($ 1.6 $\longrightarrow$ 1

-1

$\times 2 \Big($ ⬭1.2 $\longrightarrow$ 1

repeating from now

equal

$0.3_{10} = 0.0\overline{1001}_2$

$0.010011001\ldots$

So,

$$12.3 = 1100.0\overline{1001}$$

$$\boxed{\text{Logic Gates}}$$

<u>Question</u>

$X\,Z'$

$Y\,Z$
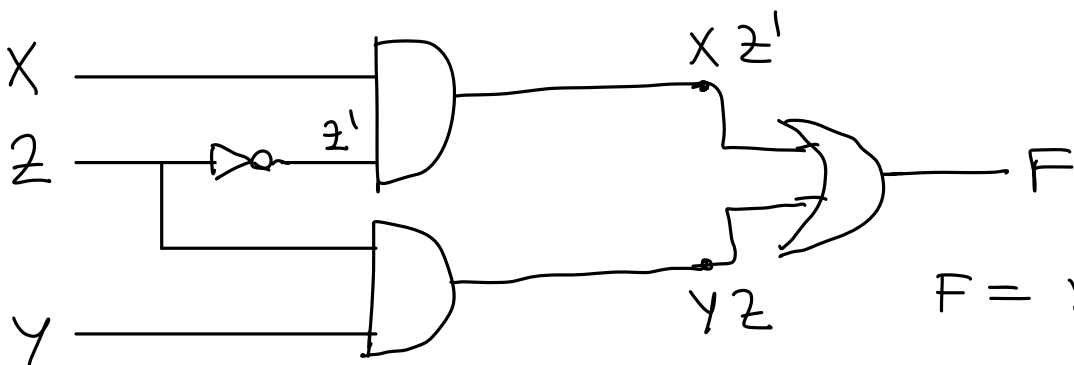
$F = X\,Z' + Y\,Z$

time diagram of Z given. $(X = Y = 1)$

Z	Y	X	Z'	YZ	XZ'	F
0	1	1	1	0	1	1
1	1	1	0	1	0	1

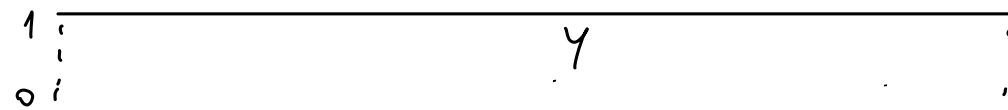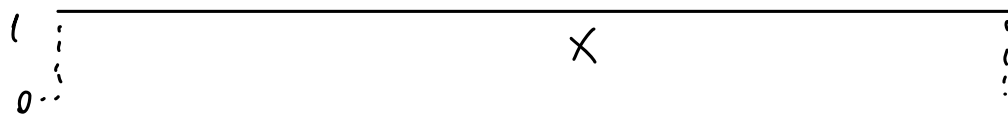$$F = XZ' + YZ = 1 \cdot Z' + 1 \cdot Z = Z' + Z = 1$$

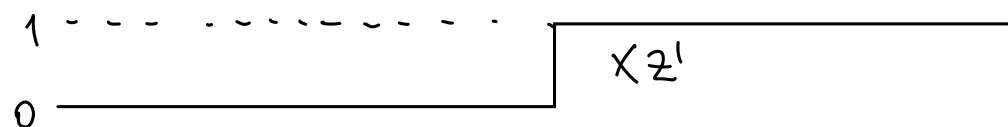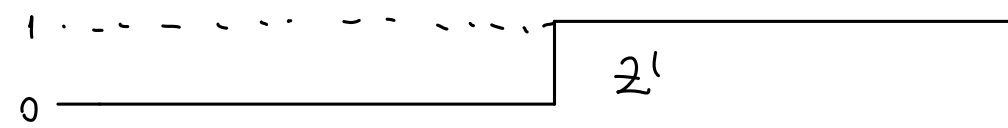Time Diagram Part:
(not solved in recitation)

Z   (time diagram of Z given in the question)

} and

X

Y   } and

Z'

XZ'   } or

YZ

F