Diode + Transisters → Descrete components
54000 1000
Putting few diode + transisters - small scall intergration
53000

6 introduction to micro-computer and micro-computer organisation.

Types of logic circuits
1. Combinational logic circuits.
2. Sequential logic circuits.

Combinational logic circuits <memoryless>

- Depends on input only <No memory>
  ex > output depend on input only >
  Adders, encorders, decorders, multiplexers, demultiplexers comparators ---.

Sequential logic circuits

- circuits which have input set, logic network, output and memory - Main point

// Given input, it looks on input and checks previous output and decide the current output //

> Present output depends not only present input but also the previous output.

example of S.L.C
1. Latchers
2. Flip flops (basic building block of all memory devices)

Unit 4

$1+1=2$
$~~1+1=10~~$
$~~5+5=10~~$

Combinational logic circuits

Types.

1. Binary adder.

- Most basic arithmetic operation is addition of 2 binary digits

- It consist of 4 elementary operations

$0+0=0$

$0+1=1$

$1+0=1$

$1+1=10$

carry

Half-adder.

- It performs addition of 2 bits. which can be arranged in a ~~temp~~ table.

A	B	C	S
0	0	0	0
0	1	0	1 - $\bar{A}B$
1	0	0	1 - $A\bar{B}$
1	1	1	0

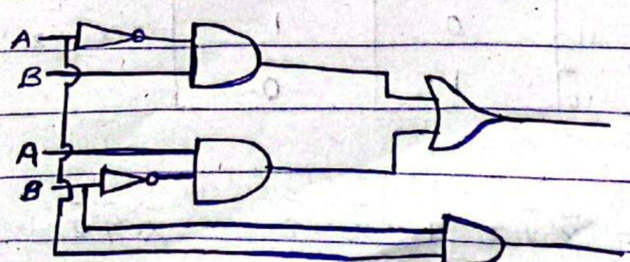
C = carry

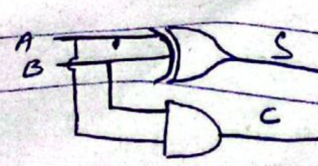
S = sum

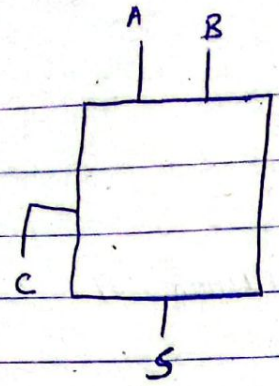
Bolean expression for sum and ~~carry~~ carry.

Sum = $\bar{A}B + A\bar{B}$ // $S = \bar{A}B + A\bar{B}$

Carry = AB // $C = AB$







x	y	z	carry	Sum
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

// when you hv more than one ~~ad~~ binary numbers, half adder sees it dificult

use K-map of Sum.

3 inputs = 2^3 = 8 cells.

	xy \ z	0	1	
$\bar{x}y\bar{z}$	00	0	1	$\bar{x}\bar{y}z$
	01	1	0	
$x\bar{y}\bar{z}$	11	0	1	xyz
	10	1	0	

$$S = \bar{x}\bar{y}z + \bar{x}y\bar{z} + x\bar{y}\bar{z} + xyz$$

K-map for Carry.

xy \ z	0	1
00	0	0
01	0	1
11	1	1
10	0	1

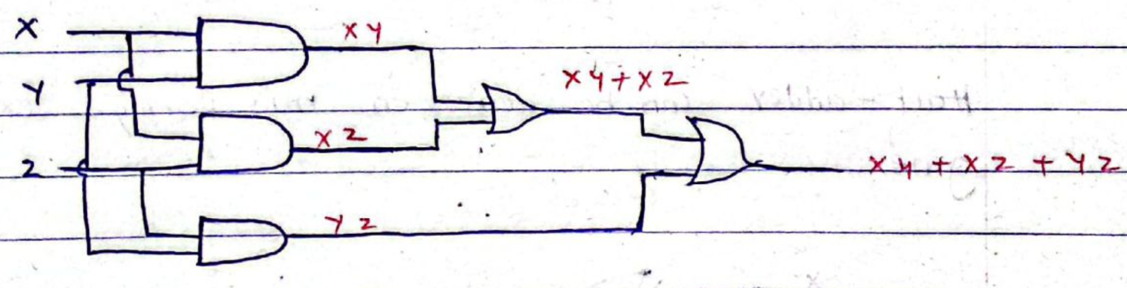
~~x~~ y z

~~xy~~ x z

x y

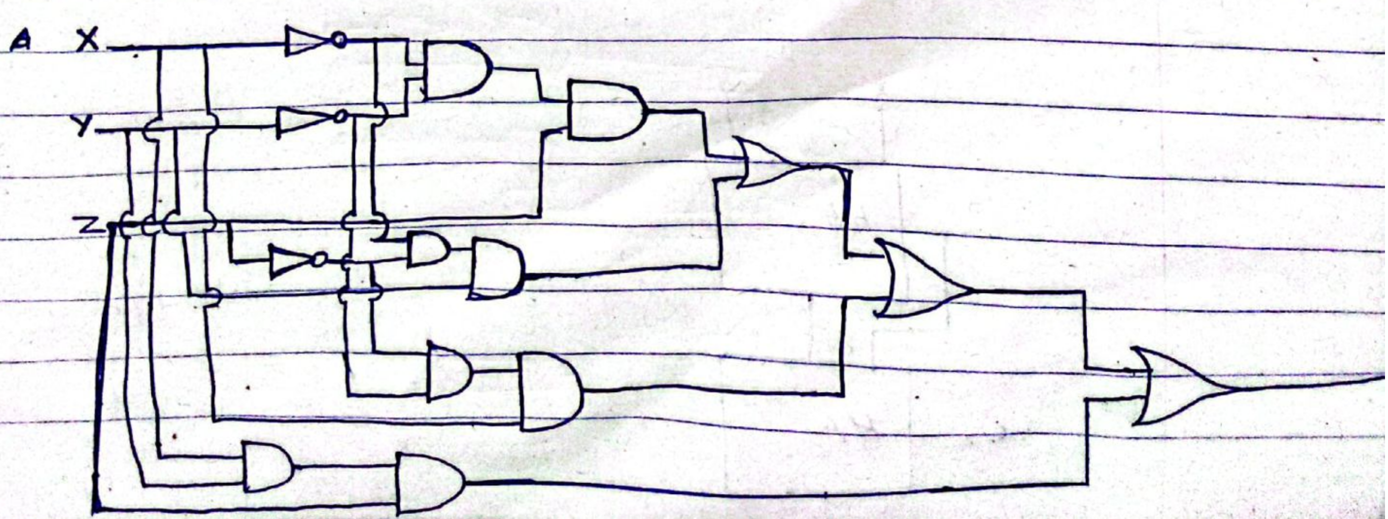
$$C = yz + xz + xy$$

logic circuit for carry.

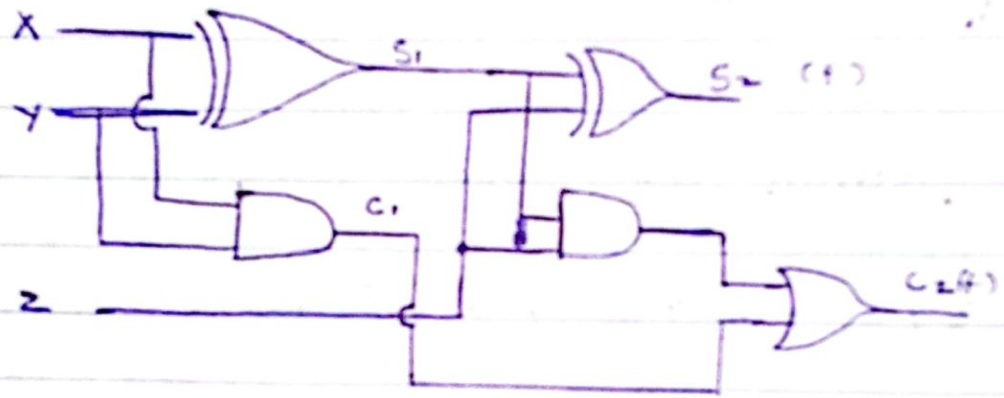


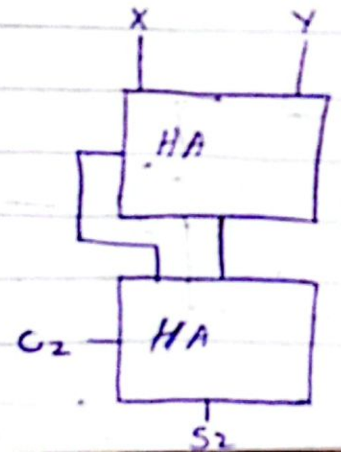
logic circuit for Sum.

$$S = \bar{x}\bar{y}z + \bar{x}y\bar{z} + x\bar{y}\bar{z} + xyz$$



Half - adder can be done in this using exclusive or gate.





Digital circuits to implement

$21_{10} + 11_{10} =$

$$
\begin{array}{r|l}
2 & 21 \\
2 & 10 - 1 \\
2 & 5 - 0 \\
2 & 2 - 1 \\
2 & 1 - 0 \\
 & 0 - 1
\end{array}
= 10101
$$

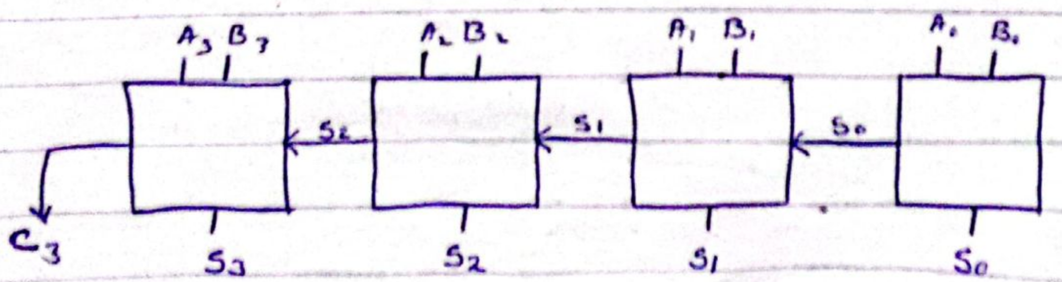
$$
\begin{array}{r|l}
2 & 11 \\
2 & 5 - 1 \\
2 & 2 - 1 \\
2 & 1 - 0 \\
 & 1
\end{array}
$$

$= 1011$ making each of 5 bit add 0 01011

Using four bit

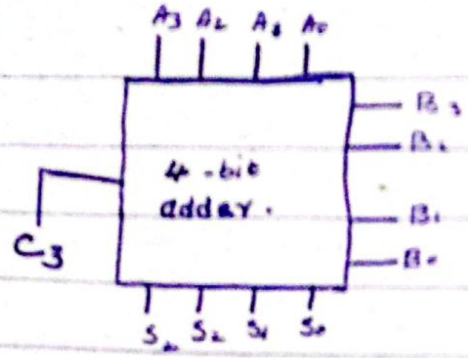
$$
\left.\begin{array}{l} A = A_3 A_2 A_1 A_0 \\ B = B_3 B_2 B_2 B_0 \end{array}\right\} A + B
$$

$$A + B = \overset{\checkmark 1}{(A_0 + B_0)} \; \overset{\checkmark 2}{(A_1 + B_1)} \; \overset{\checkmark 3}{(A_2 + B_2)} \; \overset{\checkmark 4}{(A_3 + B_3)}$$



ALU

BCD



- An n-bit full adder requires n full adders with each output carry connected to input carry of next higher-order full adder.