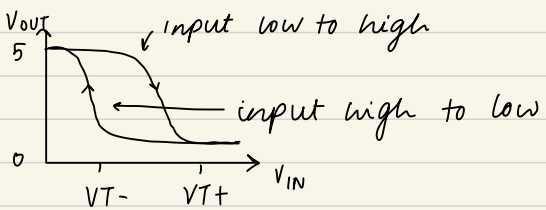
Inverter

Schmitt-Trigger Inputs

- 2 threshold voltages · V_{T-} and V_{T+}
- when $V_{IN} > V_{T+}$, V_{OUT} switches to low
- when $V_{IN} < V_{T-}$, V_{OUT} switches to high
- the non-symmetric is called hysteresis
  - V_{T-} (- V_{T+})



- this one is more stable than a standard inverter when V_{IN} rises slowly / fluctuates around V_T

Combinational PLA

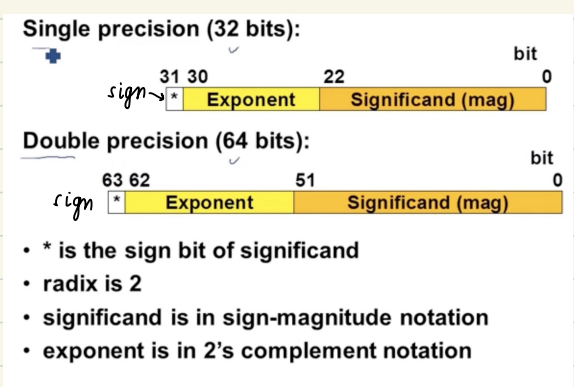
- PLD : programmable logic devices
- PLA, PAL, CPLD, FPGA ← examples
- PLA : prog. logic array } simple
- PAL : prog. array logic
- CPLD : complex PLD } complex
- FPGA : field programmable gate array
- SoM / SOP can be implemented on PLA
- <no of input> x <no of output> PLA

Fixed-point Numbers

- radix point has a fixed position among int and frac
- int only (usually)
- dis-advantages
  - → relatively small range of numbers that can be represent
  - → possible loss of significant digits during computation

Floating-point number

- $S \times R^E$ ← exponent : signed fixed point int
  - ↖ radix : base (2 binary, 8 octal etc)
- significand : signed fractional fixed point no

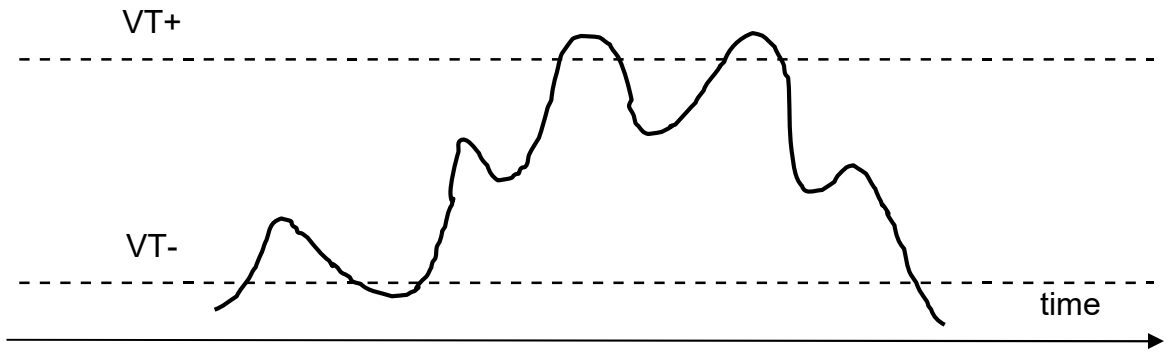


L12 practice problems

1. Given the following input waveform and threshold voltages VT+ and VT-, sketch the output waveforms for each Schmitt-Trigger device below:

   (a) buffer

   (b) inverter



2. Implement the given truth table using the following programmable logic device. Indicate the inputs, outputs and programmed connections clearly on the PLA diagram.

(Hint: use Karnaugh map to first obtain a minimum-cost SOP Boolean expression for x and for y)

Inputs				Outputs	
a	b	c	d	x	y
0	0	0	0	1	1
0	0	0	1	1	0
0	0	1	0	1	1
0	0	1	1	0	1
0	1	0	0	1	0
0	1	0	1	1	0
0	1	1	0	0	1
0	1	1	1	0	1
1	0	0	0	1	1
1	0	0	1	0	1
1	0	1	0	1	1
1	0	1	1	1	0
1	1	0	0	0	1
1	1	0	1	0	1
1	1	1	0	1	0
1	1	1	1	1	0

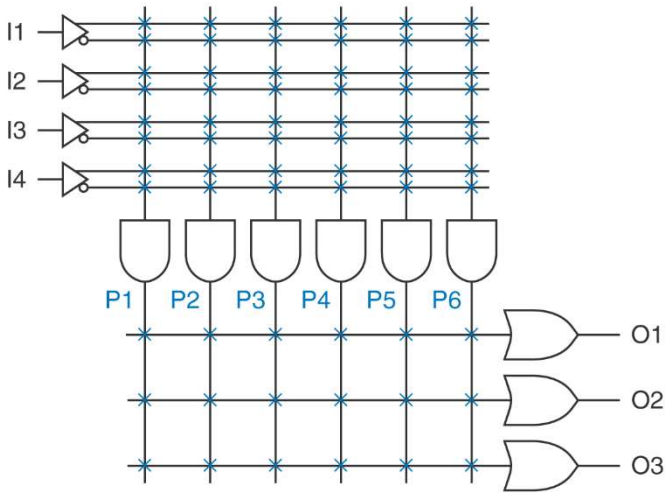


Figure 6-22

Compact representation of a 4 × 3 PLA with six product terms.

3. A digital system uses a 16-bit fixed point representation for unsigned numbers, with 8 bits allocated to the integer portion and 8 bits allocated to the fractional portion.
The 16-bit data format (in 4-bit groups for easy reading) is:
xxxx xxxx yyyy yyyy
where xxxx xxxx is the 8-bit integer portion, and yyyy yyyy is the 8-bit fractional portion.

(a) What is the smallest non-zero binary value that can be represented in this system? What is this value in decimal?

(b) What is the largest binary value that can be represented in this system? What is this value in decimal?

(c) What is the 16-bit representation of the decimal value 8.7? Is this an exact representation?