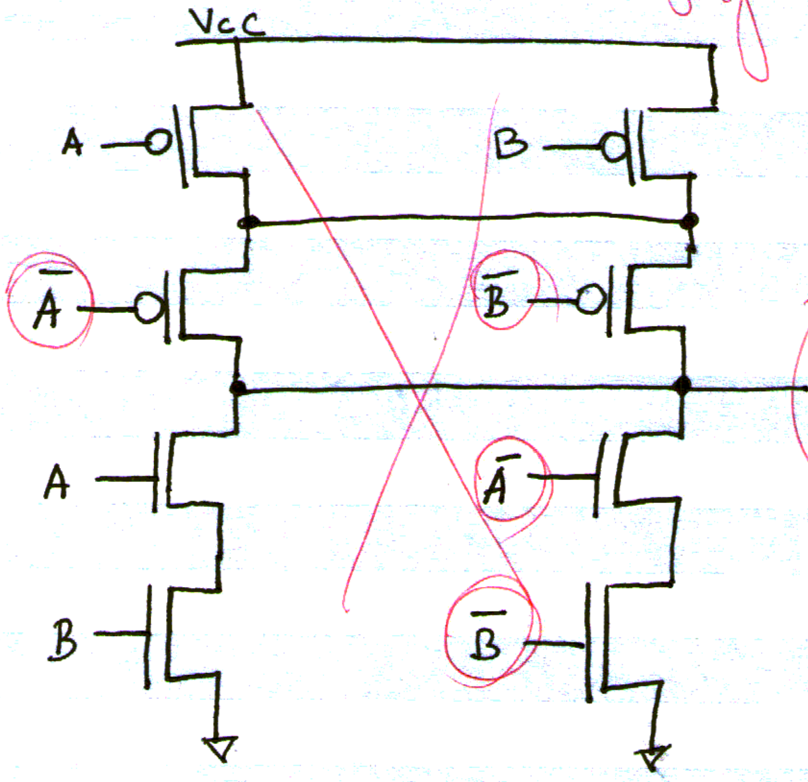
HWK #8

②

XOR gate

A	B	Z
0	0	0
0	1	1
1	0	1
1	1	0

Show how you got from here to here



NO.

$Z = \overline{\bar{A} \cdot \bar{B} + A \cdot B} = A \oplus B$

$Z = \bar{A}B + A\bar{B}$

Way to do this:

① find Z

② Either use NANDs and NORs given in class to implement the circuit, or try the shorthand method discussed in class.

(3)

$$\text{DC Fanout} = \min\left(\left\lfloor \frac{I_{out\ high}}{I_{in\ high}} \right\rfloor, \left\lfloor \frac{I_{out\ low}}{I_{in\ low}} \right\rfloor \right)$$

a) SN7400 drives SN74LS00 ⟷ $\underline{V_{IN} = 2.7V}$

$$\text{Fanout} = \min\left(\left| \frac{I_{out\ high}\ (SN7400)}{I_{in\ high}\ (SN74LS00)} \right|, \left| \frac{I_{out\ low}\ (SN7400)}{I_{in\ low}\ (SN74LS00)} \right| \right)$$

$$= \min\left(\left| \frac{-.4E{-}3A}{20E{-}6A} \right|, \left| \frac{16E{-}3A}{-.4E{-}3A} \right| \right)$$

$$= \min(20, 40)$$

$$= \underline{\underline{20}}$$

✓

b) SN74LS00 drives SN7400

$$\text{Fanout} = \min\left(\left| \frac{I_{out\ high}\ (SN74LS00)}{I_{in\ high}\ (SN7400)} \right|, \left| \frac{I_{out\ low}\ (SN74LS00)}{I_{in\ low}\ (SN7400)} \right| \right)$$

$$= \min\left(\left| \frac{-.4E{-}3A}{40E{-}6A} \right|, \left| \frac{8E{-}3A}{-1.6E{-}3A} \right| \right)$$

$$= \min(10, 5)$$

$$= \underline{\underline{5}}$$

✓

(4)

a) ON Semiconductor 74LS283

Static Power = $P_S = V_{cc} \cdot I_{cc} = 5V \cdot 39E{-3}A = 195E{-3}W$ (Low)

$P_S = V_{cc} \cdot I_{cc} = 5V \cdot 34E{-3}A = 170E{-3}W$ (High)

Dynamic Power is zero on TTL $P_D = 0W$

Total Power Dissipated $= P_S + P_D = P_T$

3/4 of time = High   1/4 of time = Low

$\therefore \quad P_T = \frac{3}{4}(170E{-3}W) + \frac{1}{4}(195E{-3}W) + 0W$

$P_T = .17625W$

b) Philips 74F283

For Low & High $\quad P_S = V_{cc} \cdot I_{cc} = 5V \cdot 55E{-3}A$

$P_S = .275W$

$P_D = 0$ (TTL)

$P_T = \frac{3}{4}(.275W) + \frac{1}{4}(.275W) + 0$

$P_T = .275W$

c) Philips 74HC283

$P_S = V_{cc} \cdot I_{cc} = 5V \cdot 8E{-}6A = \underline{40E{-}6 \text{ Watts}}$
(Low and High)

This IC has dynamic power dissipation

$P_D = (C_{PD} + C_L) \cdot V_{cc}^2 \cdot \text{Frequency}.$

$F = 100E3\ Hz \qquad P_D = (88E{-}12\ F + 15E{-}12\ F)(25V^2)(F)$ (5V · 5V; F = 100E3 H)

$P_D = \underline{.2575E{-}3 \text{ Watts}}$

$F = 1E6\ Hz \qquad P_D = (88E{-}12F + 15E{-}12F)(25V^2)(1E6\ Hz)$

$P_D = \underline{2.575E{-}3 \text{ watts}}$

$f = 10E6\ Hz \qquad P_D = (88E{-}12F + 15E{-}12F)(25V^2)(10E6\ Hz)$

$P_D = \underline{.02575 \text{ watts}}$

$P_T = P_S + P_D = (40E{-}6W) + .2575E{-}3W = \underline{.2975E{-}3W}$
(Frequency 100 kHz)

$P_T = P_S + P_D = (40E{-}6W) + 2.575E{-}3W = \underline{2.615E{-}3W}$
(frequency 1MHz)

$P_T = P_S + P_D = (40E{-}6W) + .02575 \text{ watts} = \underline{\underline{.02579\ W}}$

(5) $C = 150fF$
$V_{cc} = 5v$
$F = 75MHz$

a) Dynamic Power - $P_D = C \cdot V_{DD}^2 \cdot F$

$= (150E{-}15\,F)(5v)^2 \cdot (75E6\,Hz)$

$= .28125\,E{-}3$ Watts

b) Total Power Dissipated = 15% of $450{,}000 \times P_D$

✓

$= (.15)(450{,}000)(.28125E{-}3w)$

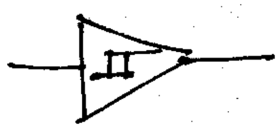
$\approx$ 18.9 watts

Schmitt trigger is a comparator circuit that incorporates positive feedback.

- When input is higher than a certain thershold, the output is high
- When input is lower than a certain threshold, the output is low
- when input is between the two, the output retains value until the inputs changes sufficiently to trigger a change.

- Higher Noise Immunity than circuits with only one input threshold.

Symbol



Schmitt trigger can be found useful for analog/digital systems that ~~requre~~ require signal conditioning and discriminate noisy signals. The way it is used and it's limitation is left to the imagination of the designer.