# Requirements for device A to drive device B:

| A's output provides | ≤ / ≥ ? | B's input requires |
|---|---|---|
| $V_{OH}(min)$ | ≥ | $V_{IH}(min)$ |
| $I_{OH}(max)$ | ≥ | $I_{IH}(max)$ |
| $V_{OL}(max)$ | ≤ | $V_{IL}(max)$ |
| $I_{OL}(max)$ | ≥ | $I_{IL}(max)$ |

**DC noise margin = min(**Difference in input/output voltages)

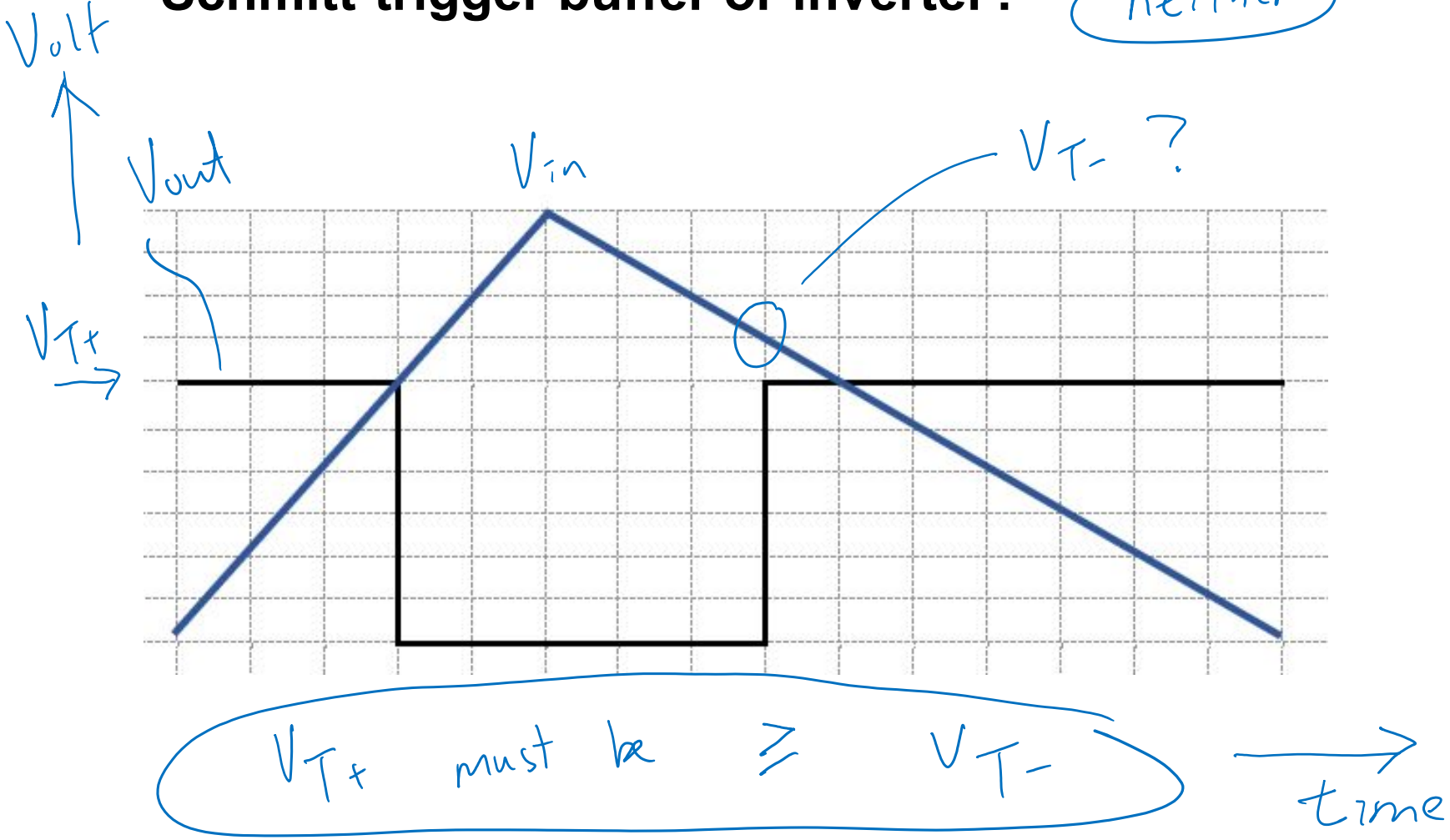
**DC fan-out = min(**Ratio of output/input currents)

# Tristate vs Open-drain

| Tristate device | Open-drain device |
|---|---|
| Outputs can be connected together | |
| Does not require external pull-up resistor | Requires external pull-up resistor |
| Has enable input | Does not have enable input |
| At most one individual output can produce High or Low (i.e. enabled) at any time. The rest must be Hi-Z. | Each individual output can produce High or Low at any time. |
| Common output follows enabled output; Hi-Z when all outputs are disabled | Common output is wire-AND of individual outputs |

**Are these input/output waveforms of a Schmitt-trigger buffer or inverter?**

answer: neither



# What circuit is implemented?

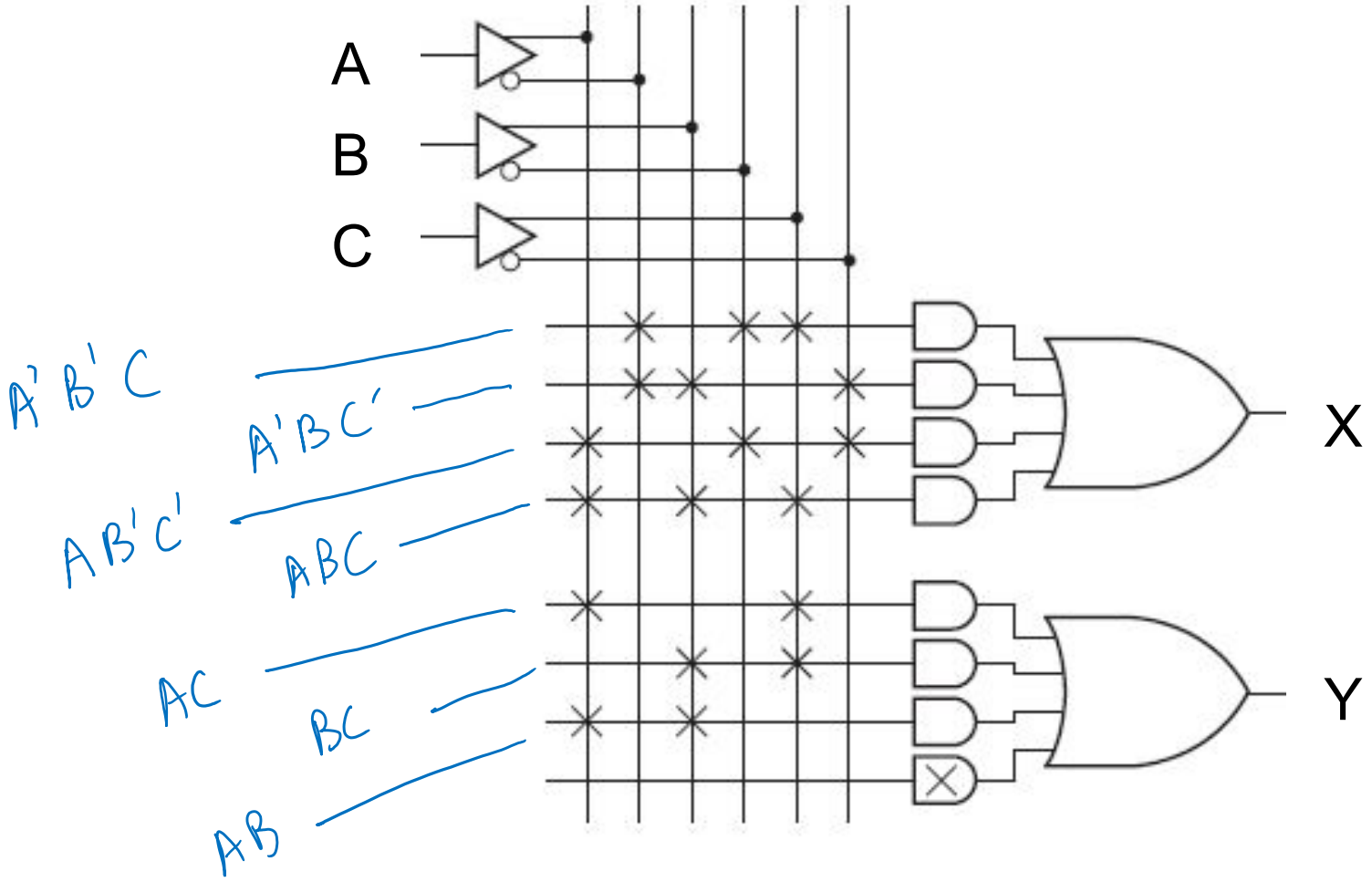



Fig. 9.33 from Fundamentals of Logic Design by Roth and Kinney

# Fill up the truth table

| inputs | | | outputs | |
|---|---|---|---|---|
| A | B | C | X | Y |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 |

**It is a full adder circuit (Y=carry, X=sum)**