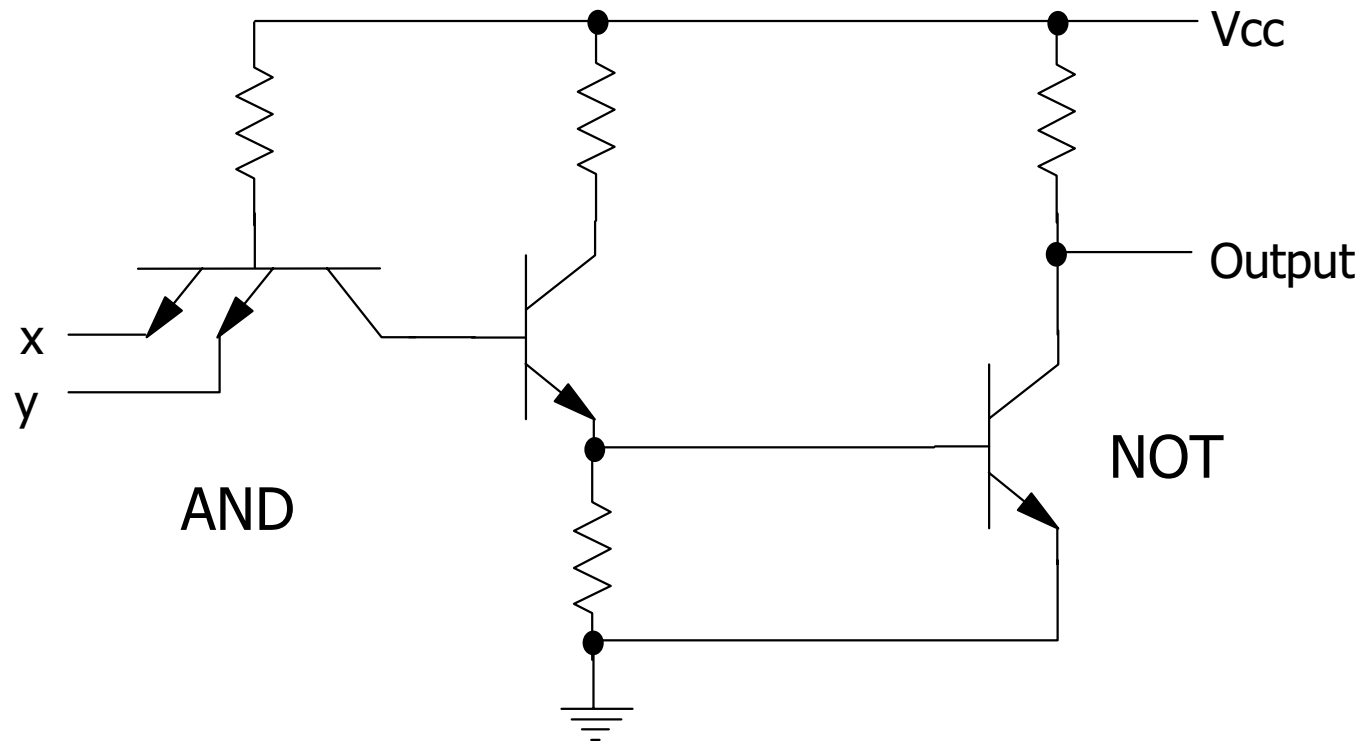# Designs for Bipolar Logic Families

Somchai Prasitjutrakul

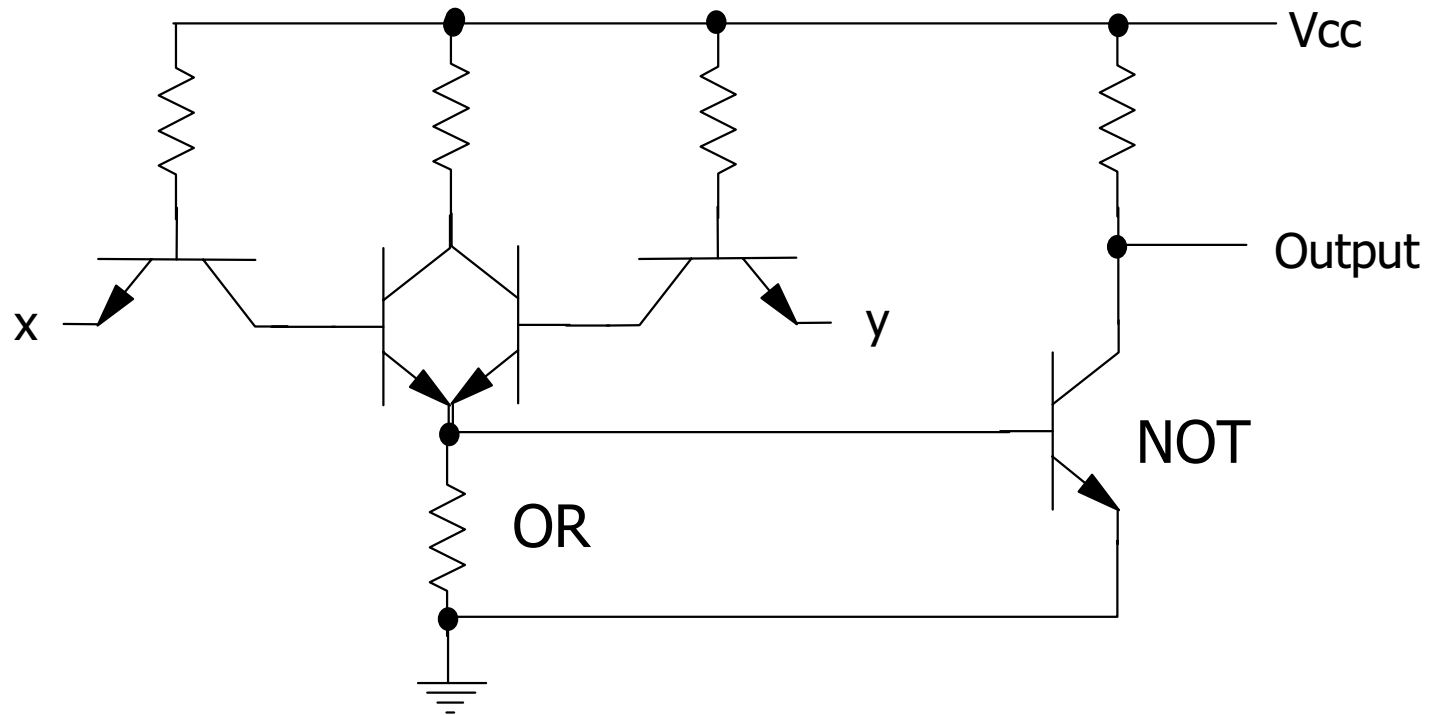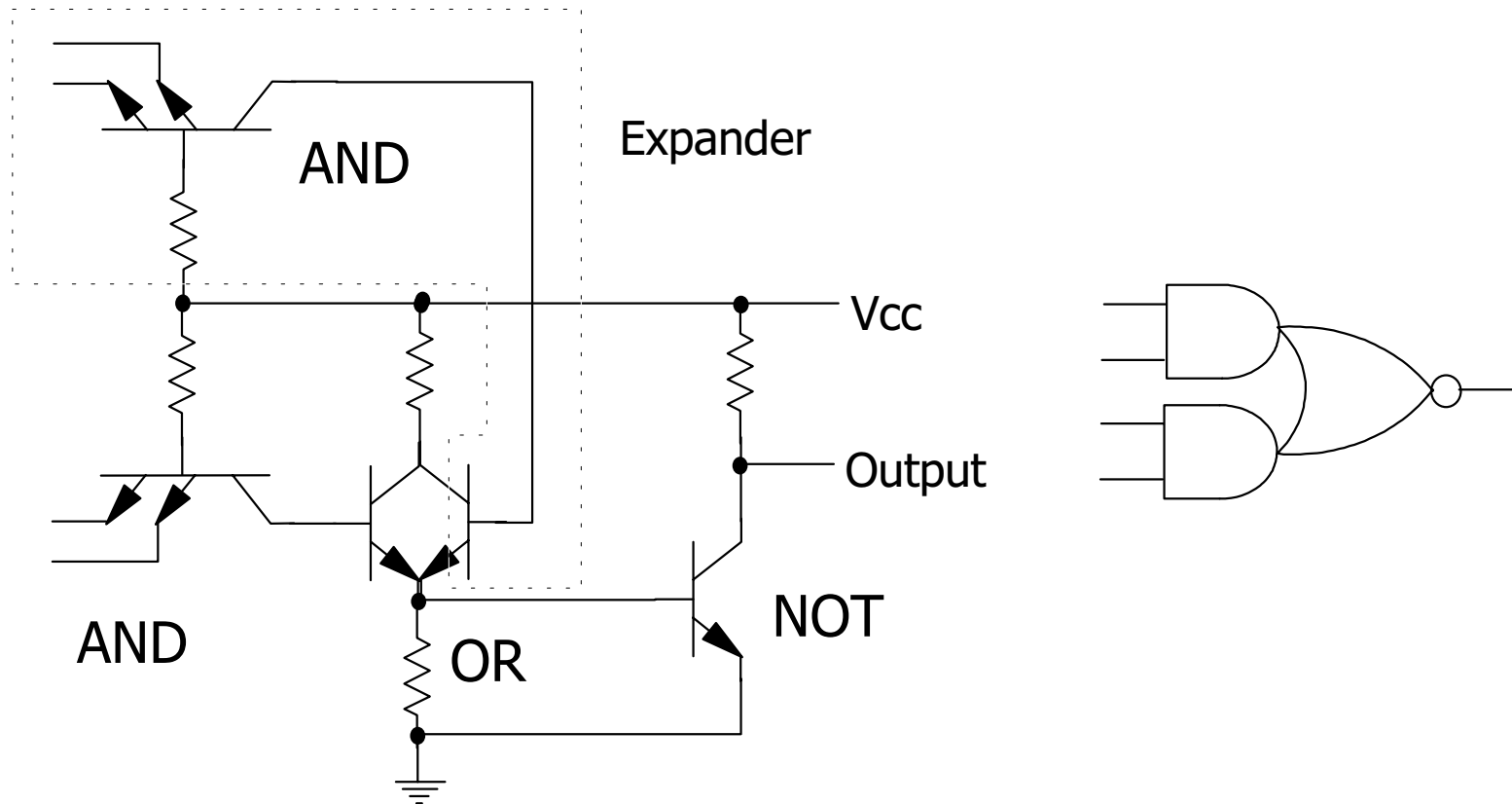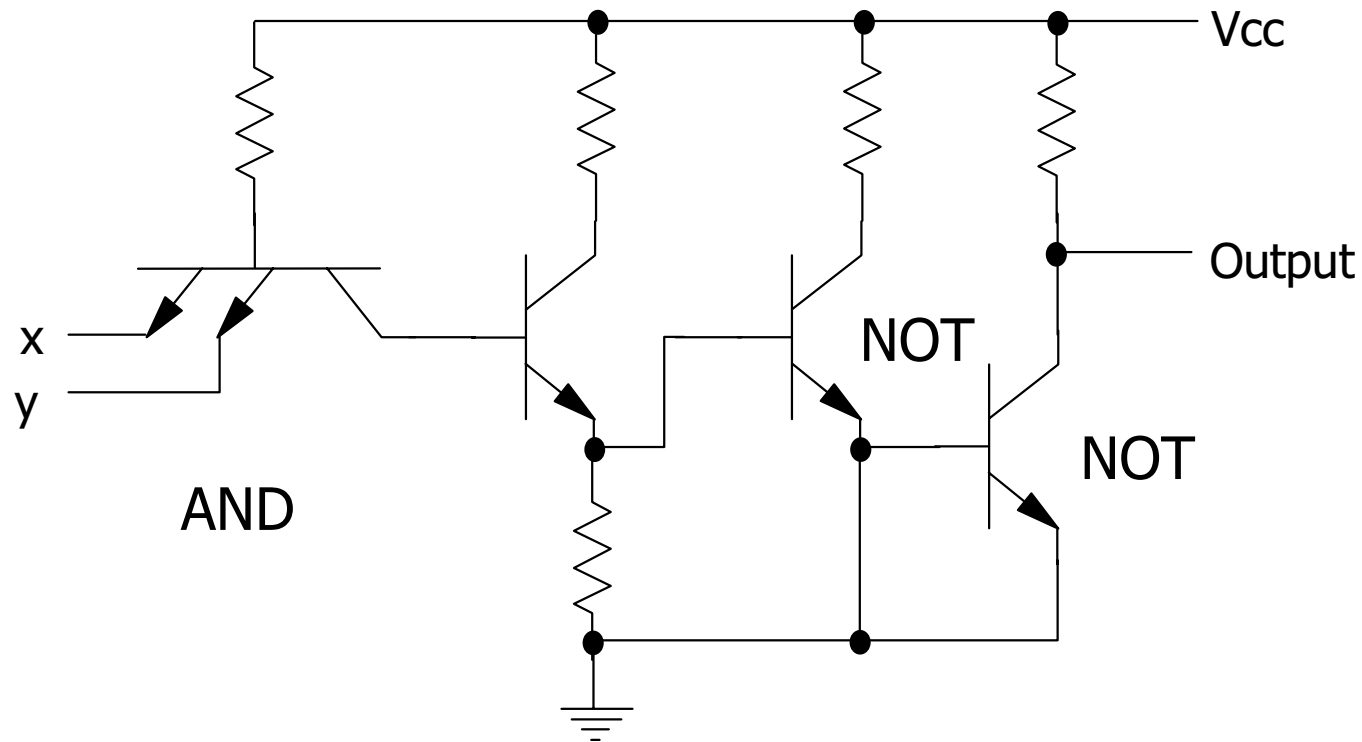# TTL : NAND Gates

Vcc

Output

NOT

AND

x

y

TTL : NOR Gates

TTL : AND-OR-INVERTER

AND

Expander

Vcc

Output
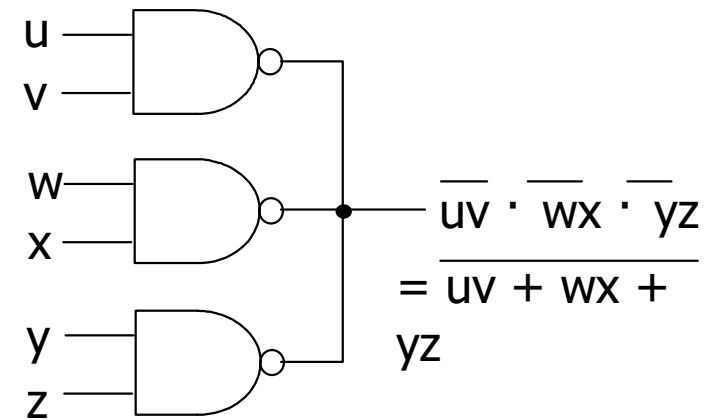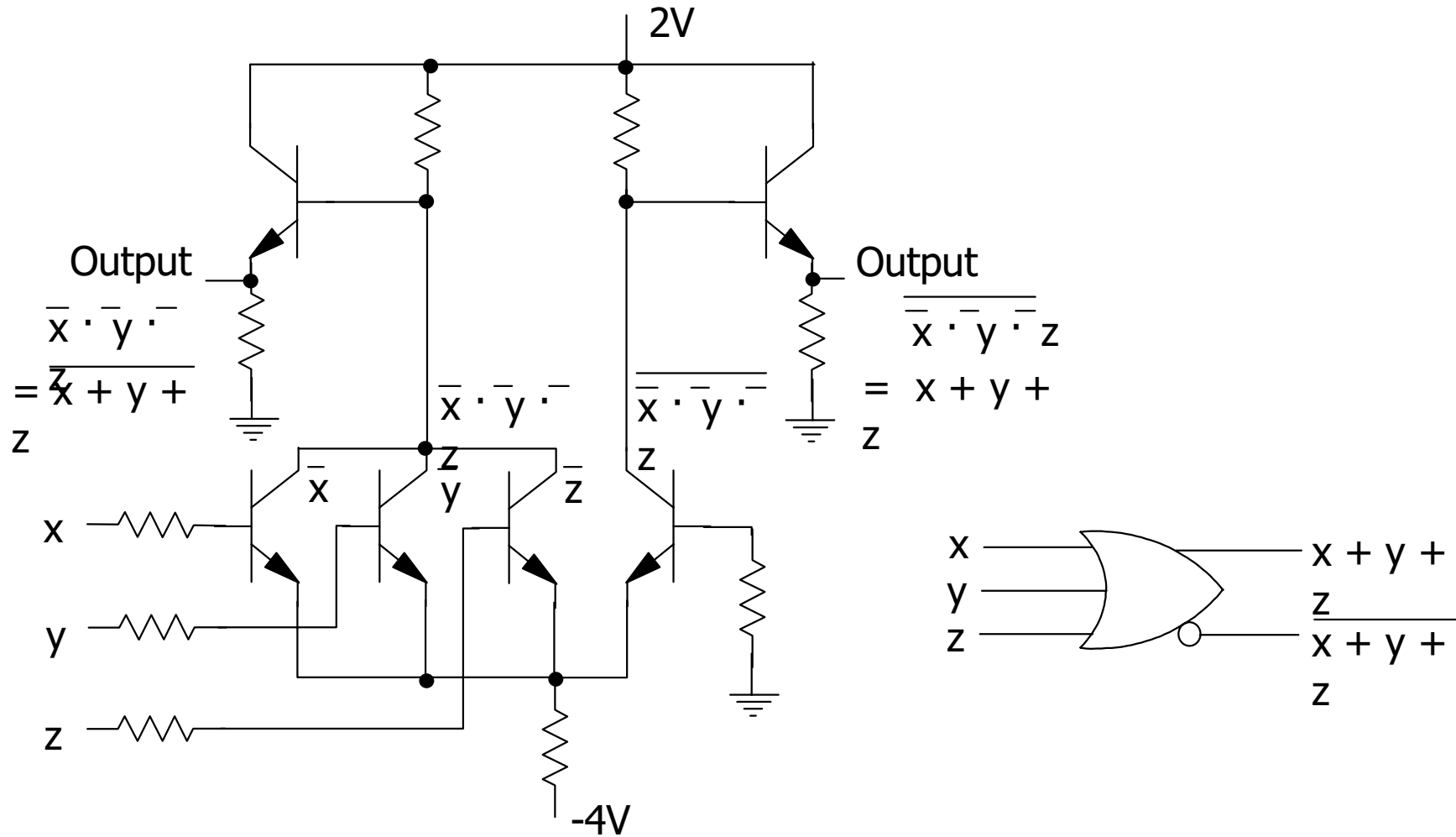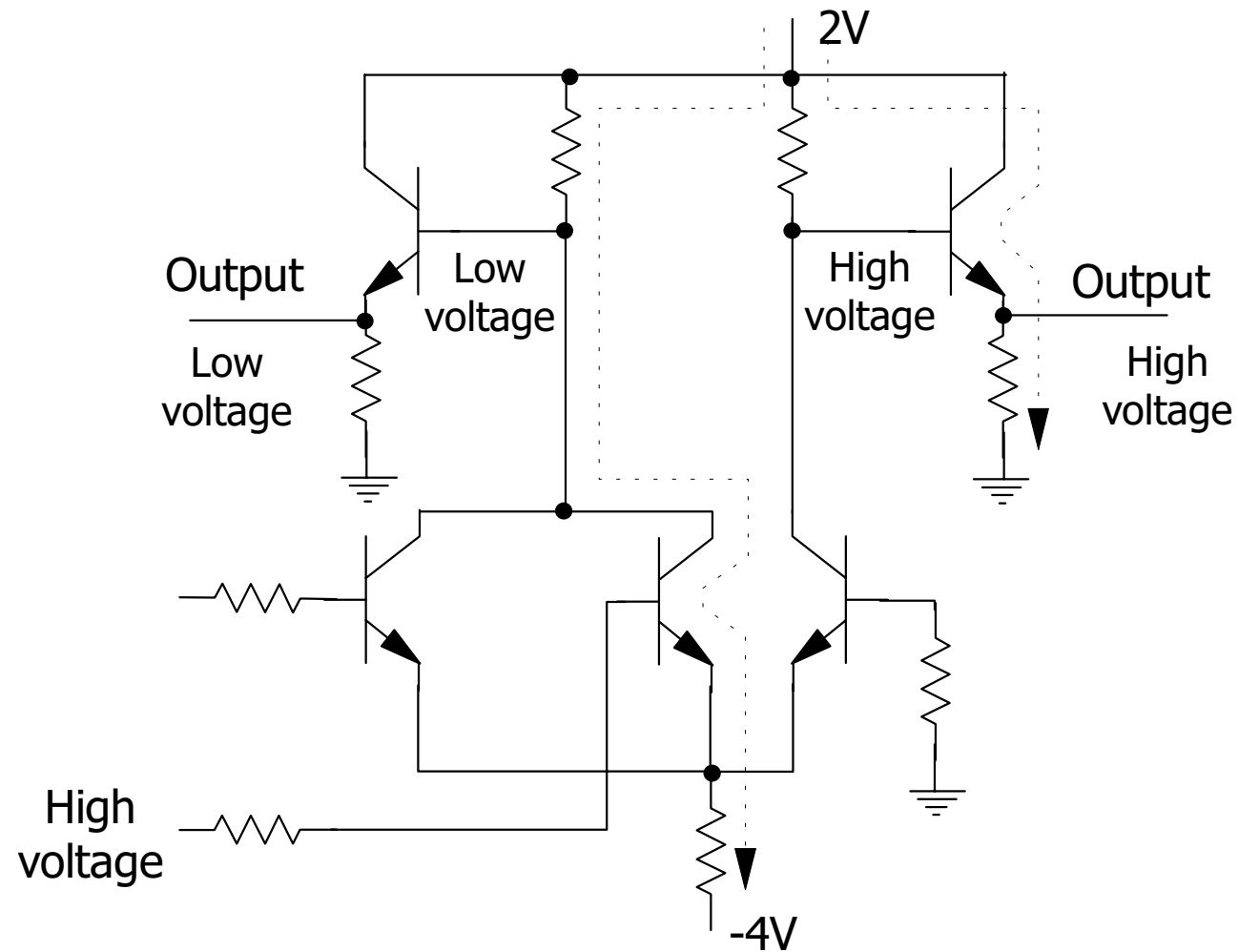
AND

OR

NOT

TTL : AND Gates

Wired-AND of TTL Gates

$$\overline{uv} \cdot \overline{wx} \cdot \overline{yz}$$
$$= \overline{uv + wx + yz}$$

Basic ECL Gates

2V

Output

$$\overline{x} \cdot \overline{y} \cdot \overline{z}$$
$$= \overline{x + y + z}$$

$$\overline{x} \cdot \overline{y} \cdot \overline{z}$$

$$\overline{x} \cdot \overline{y} \cdot \overline{z}$$

$$\overline{x}$$

x

y

z

-4V

Output

$$\overline{\overline{x} \cdot \overline{y} \cdot z}$$
$$= x + y + z$$

$$\overline{x}$$ $$\overline{y}$$ $$\overline{z}$$

x
y
z

x + y + z

$$\overline{x + y + z}$$
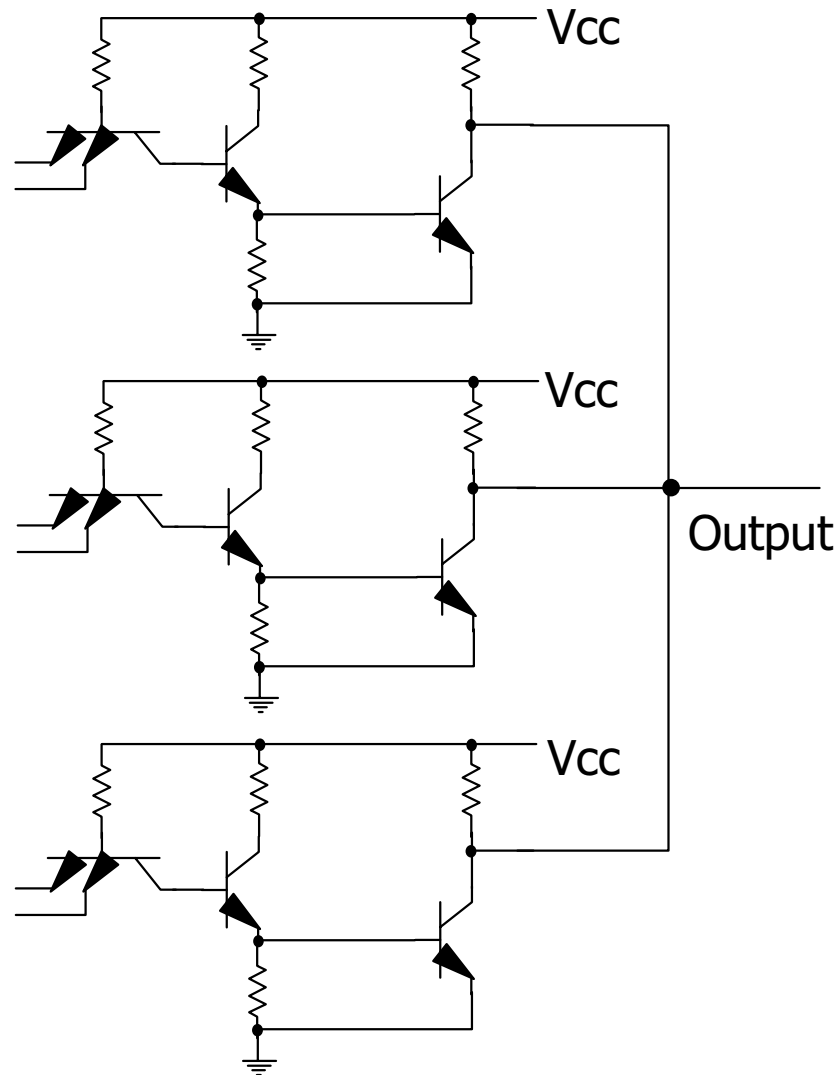
Logic Operation of ECL gates

Logic Operation of ECL gates
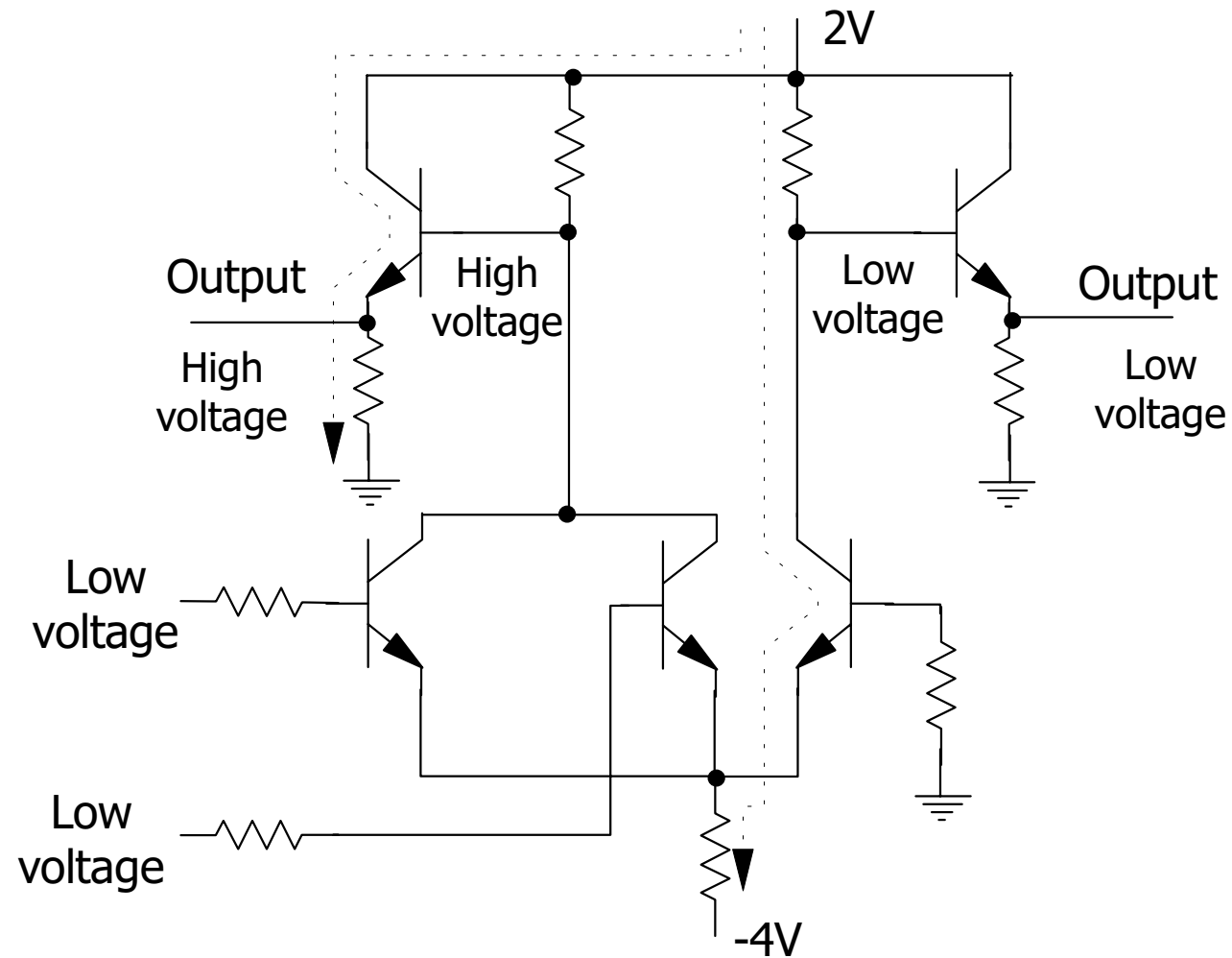
Wired-OR of ECL Gates

$$\overline{x + y + z}$$

$$x + y + z + \overline{(u + v)} \; \overline{\overline{+} \; (\overline{w} + s)}$$
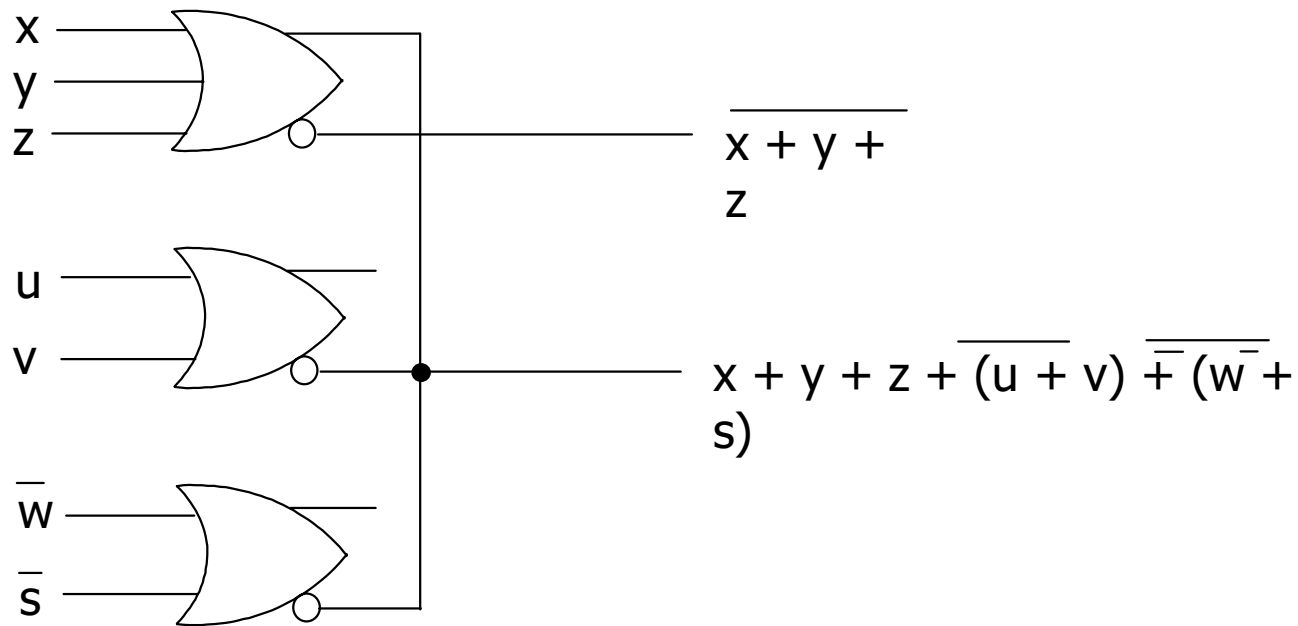
Multiple-Output ECL gates

Examples