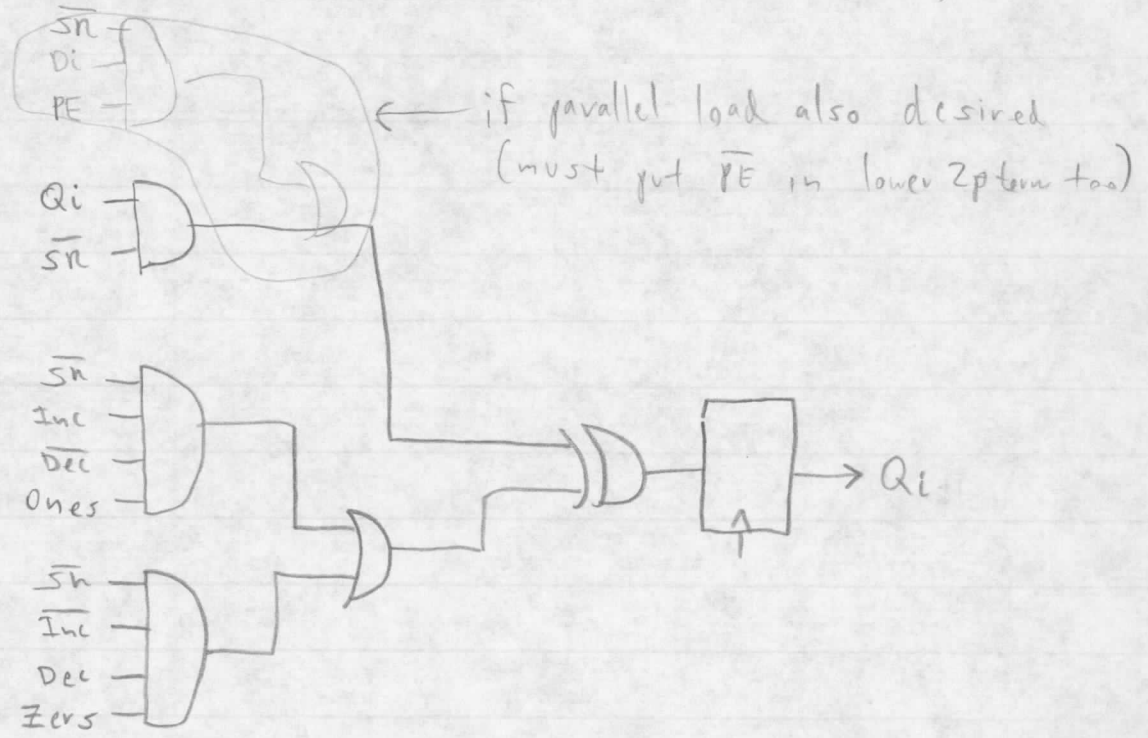


Semaphore Counter 20X10 (see sema.ab1)



SN is reset to \emptyset , overrides Inc + Dec
 Inc + Dec may both be asserted, cancelling out
 $Ones = Q_{i-1} \cdot \dots \cdot Q_0$ (lower bits all 1's)
 $Zeros = !Q_{i-1} \cdot \dots \cdot !Q_0$ (lower bits all 0's)

For 20X10, reg. is followed by inverter, so must de-morganize top \bar{p} -term, so it becomes $SN + !Q_i$ (can't do this if PE is added, so outputs have to be active-low)

$$Overflow := (Count == \text{all } 1\text{'s}) \cdot Inc \cdot \overline{Dec} \cdot \overline{SN}$$

$$\begin{aligned}
 NZ := & SN + ((Count == \emptyset) \cdot \overline{Inc} \cdot \overline{Dec} \cdot \overline{SN}) \\
 & + ((Count == \emptyset) \cdot Inc \cdot Dec \cdot \overline{SN}) \\
 & + ((Count == 1) \cdot \overline{Inc} \cdot Dec \cdot \overline{SN})
 \end{aligned}$$

Note: NZ is increment overflow cycle (all 1's \rightarrow all 0's)