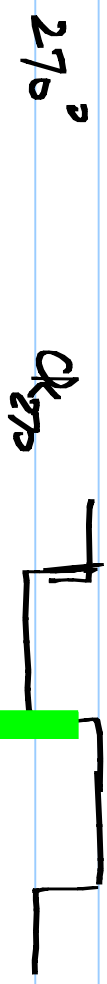
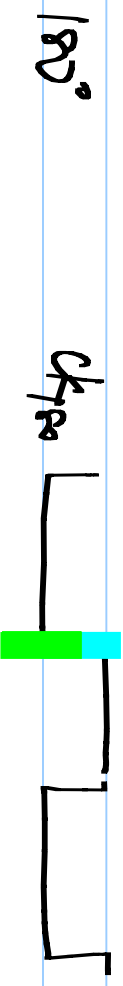
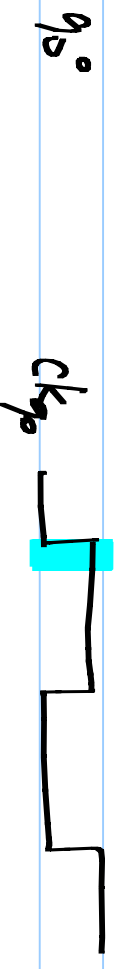
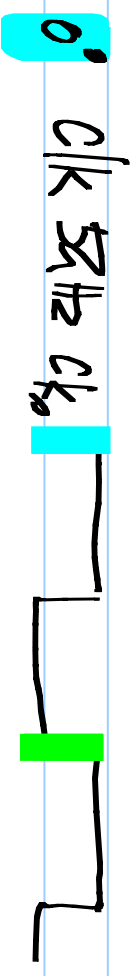
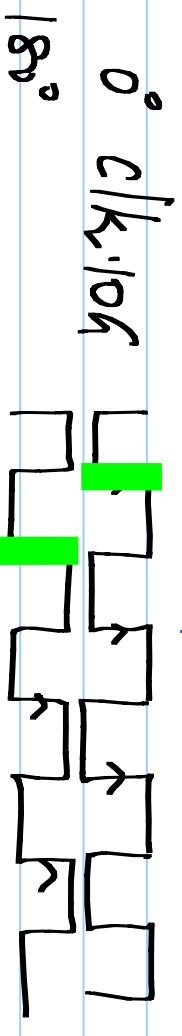
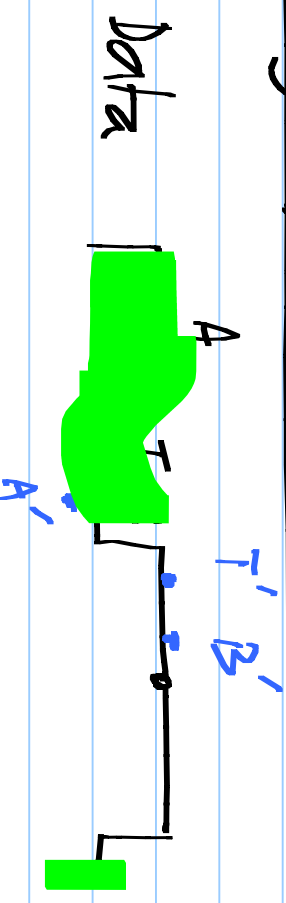
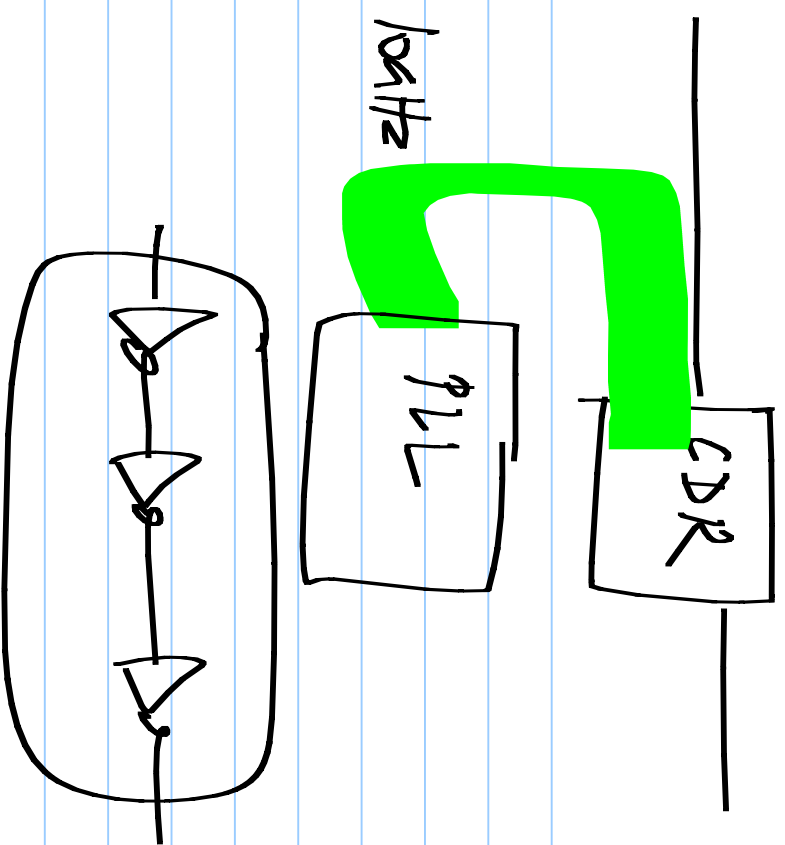
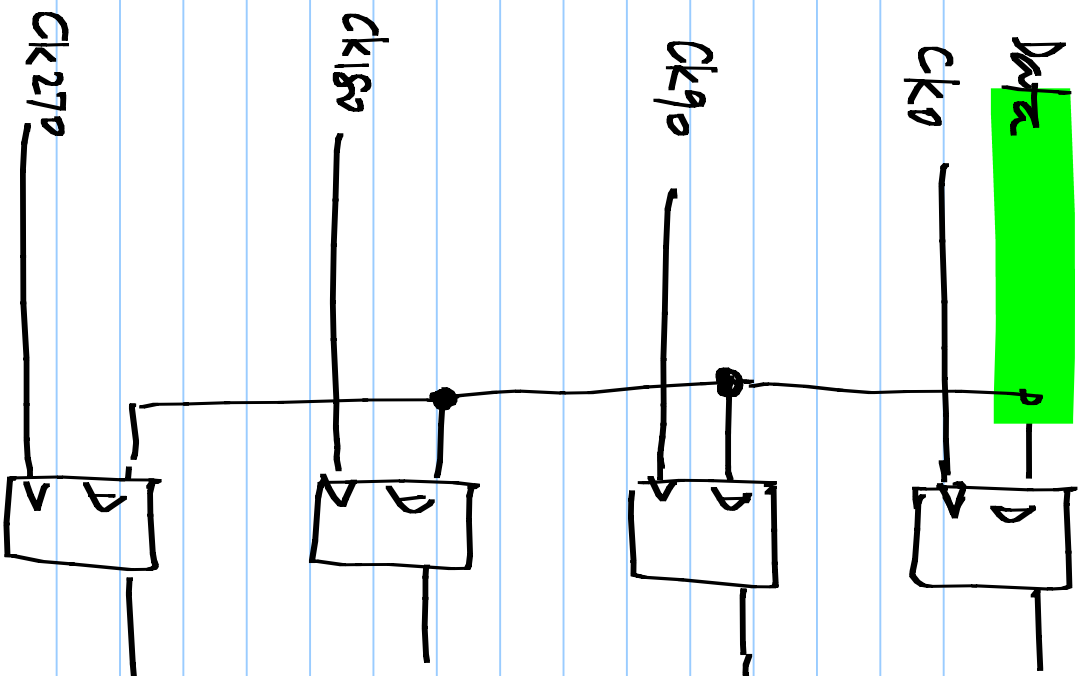


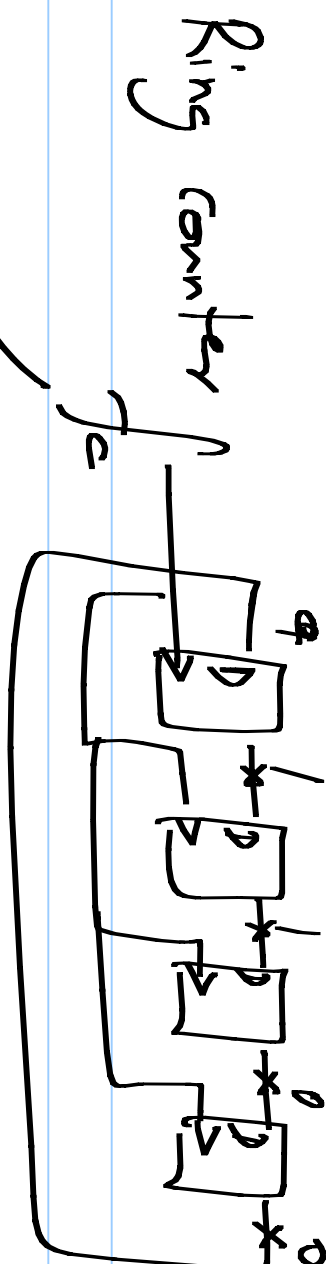
Lecture 9 Half-rate binary phase detector

Data _____
(10k1/s)

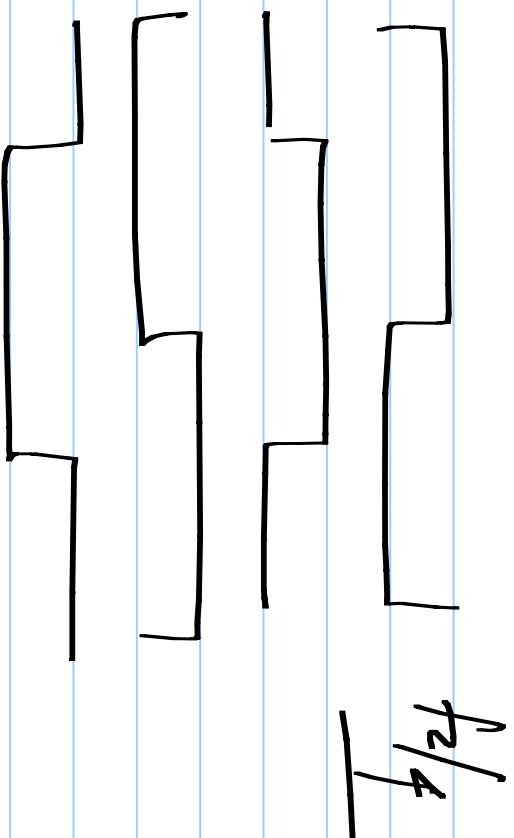
clk _____
(5k1/s)

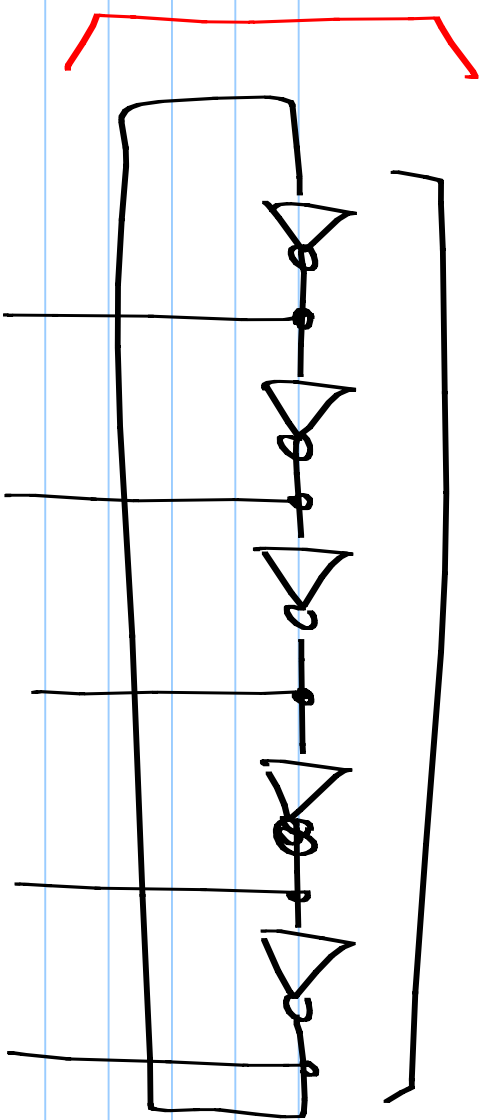






high freq.



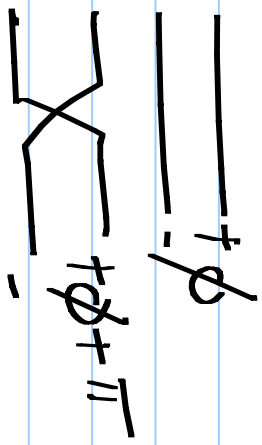


N inv.
 Γ_d

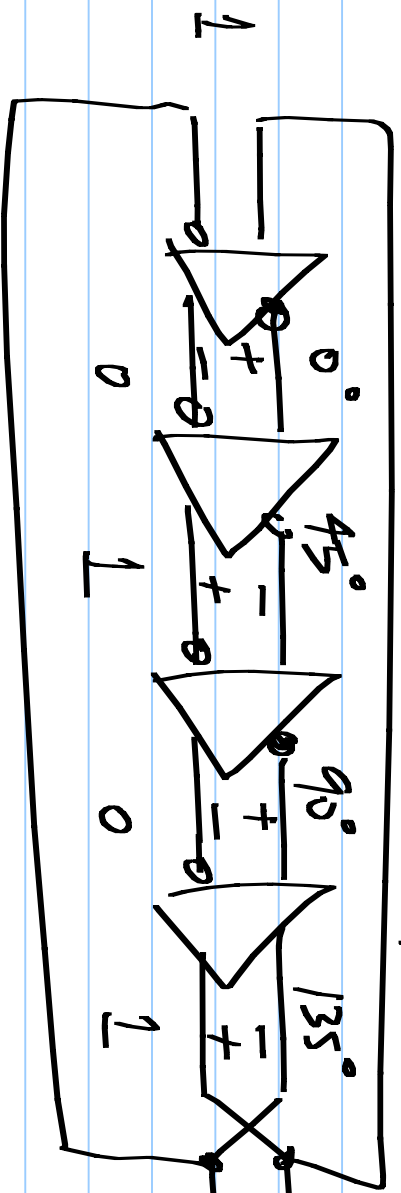
$$\frac{1}{2N\Gamma_d}$$

- ① $\frac{\pi}{5}$ $\frac{2\pi}{5}$ $\frac{3\pi}{5}$ $\frac{4\pi}{5}$

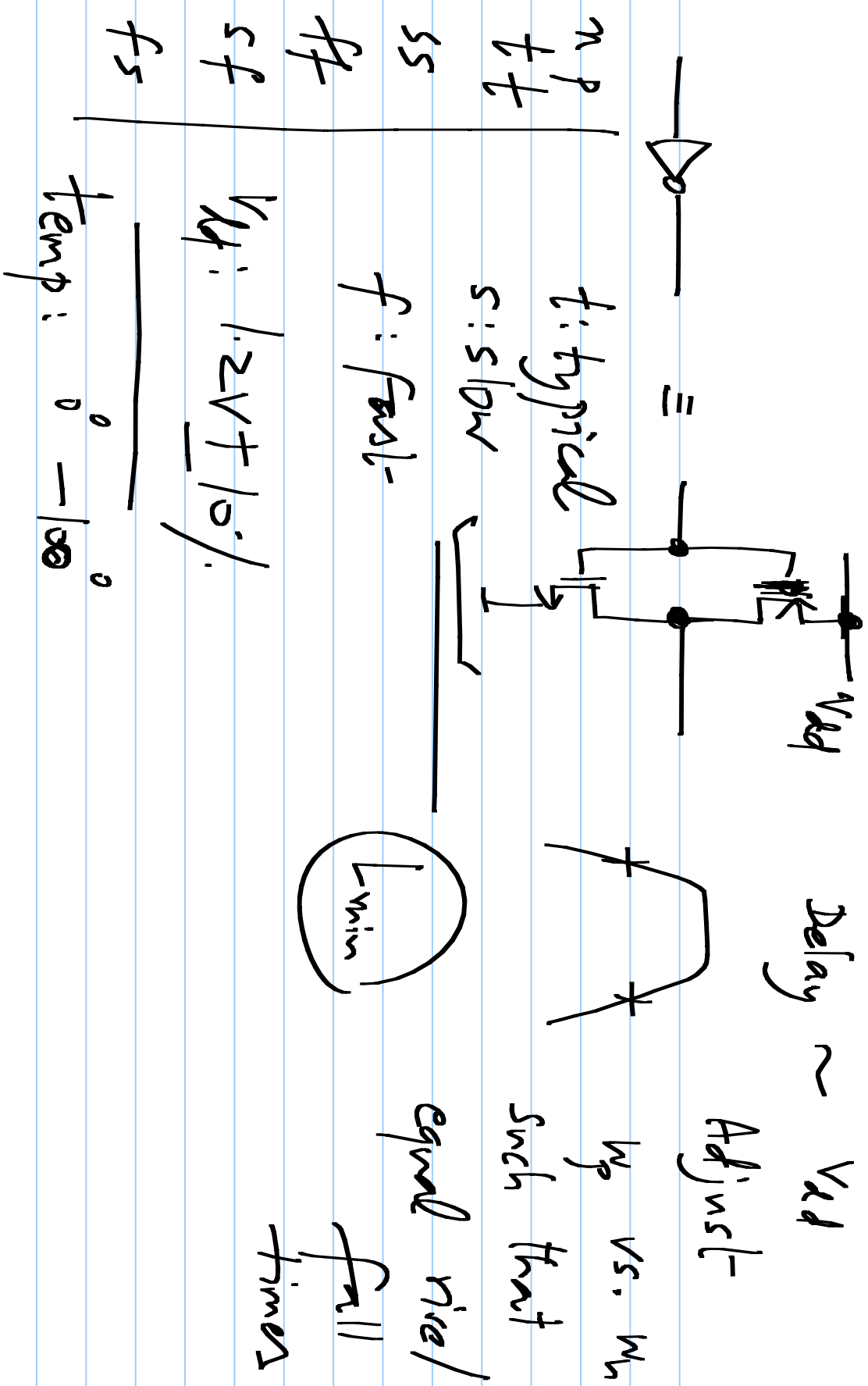
$+\frac{\pi}{11}$ $+\frac{\pi}{11}$



135° 345°

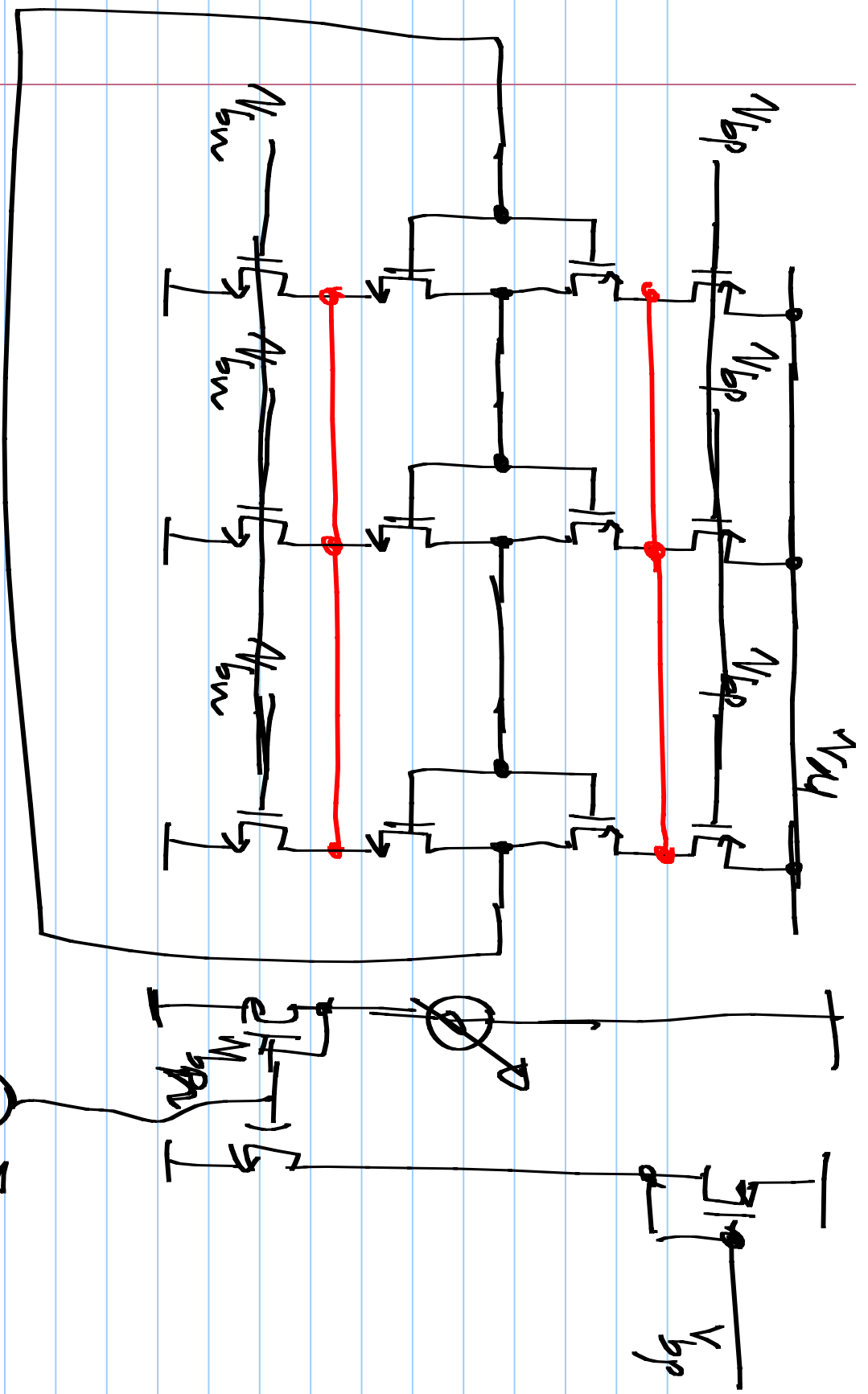


$+$ $-$ $+$

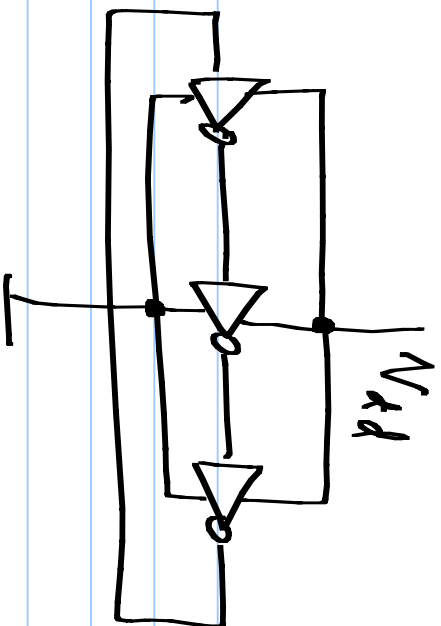


$$V_{th}: 1.2V \pm 10\%$$

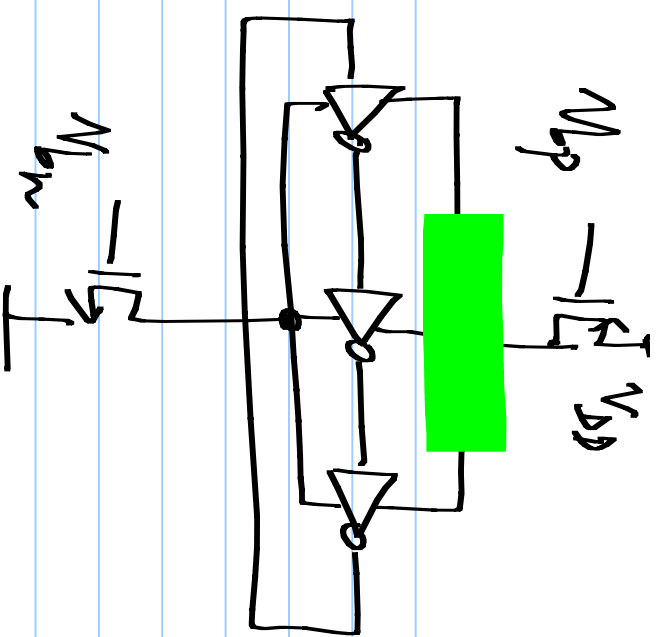
$$Temp: 0^\circ - 100^\circ$$



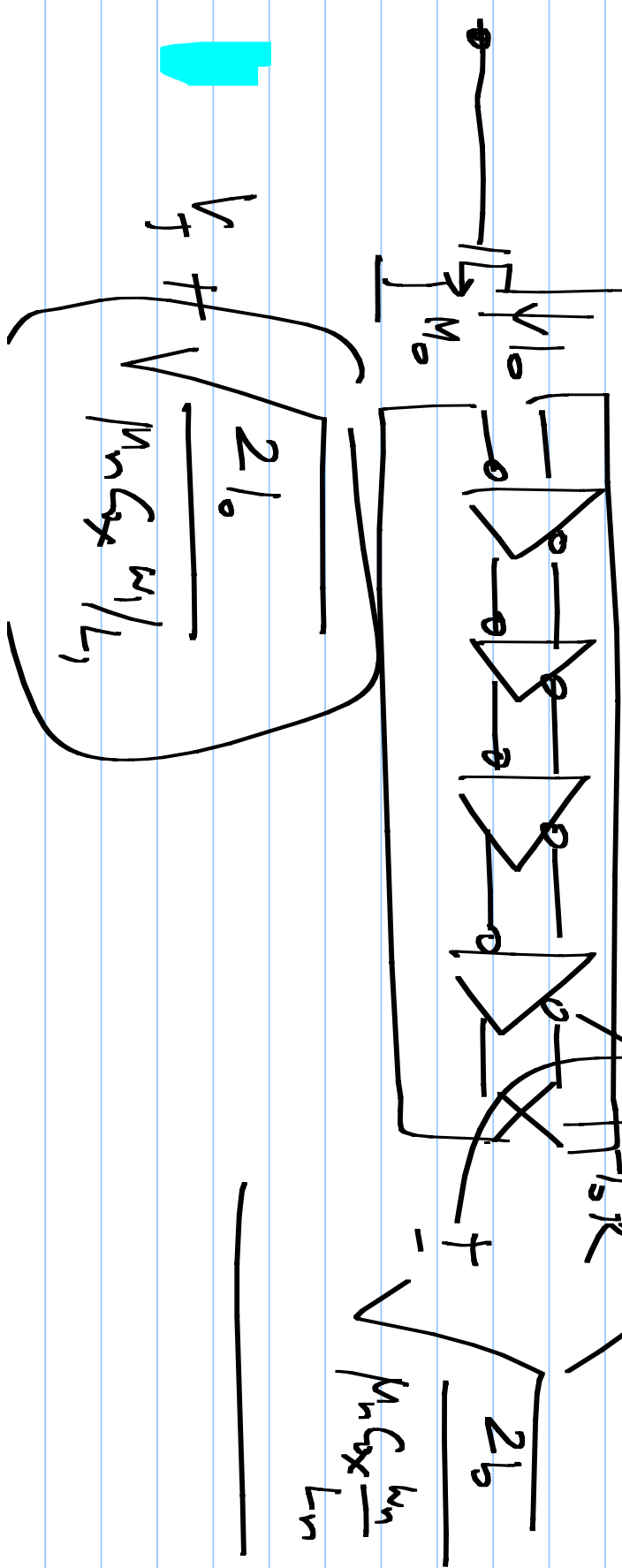
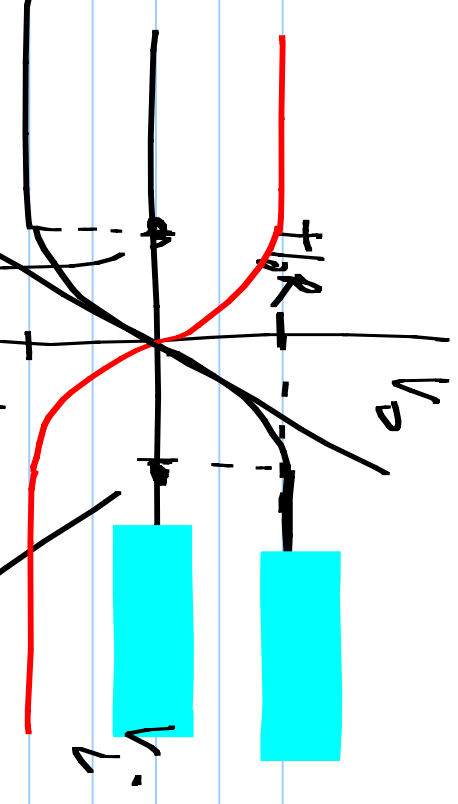
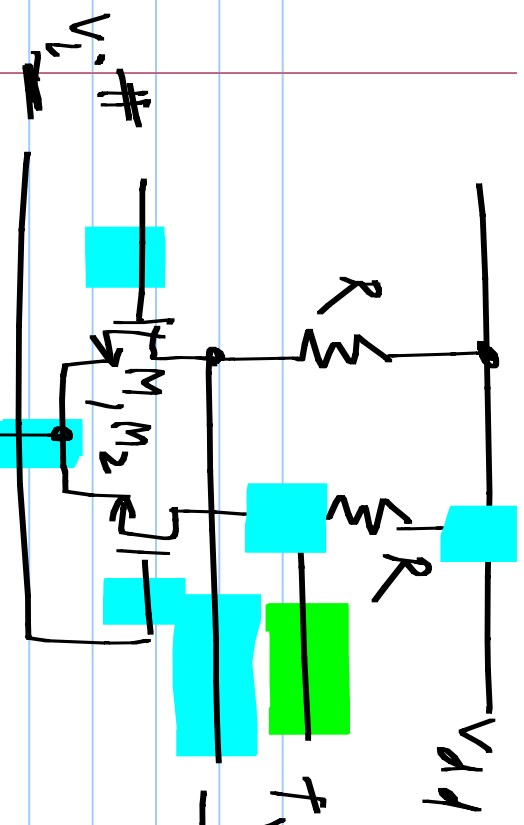
Current mirror and oscillator



change V_{dd} to change f



Current Afraid why osc.



$$V_i \neq \sqrt{\frac{2I_o}{\mu_n C_{ox} W/L_1}}$$

$$\sqrt{\frac{2I_o}{\mu_n C_{ox} W/L_1}}$$