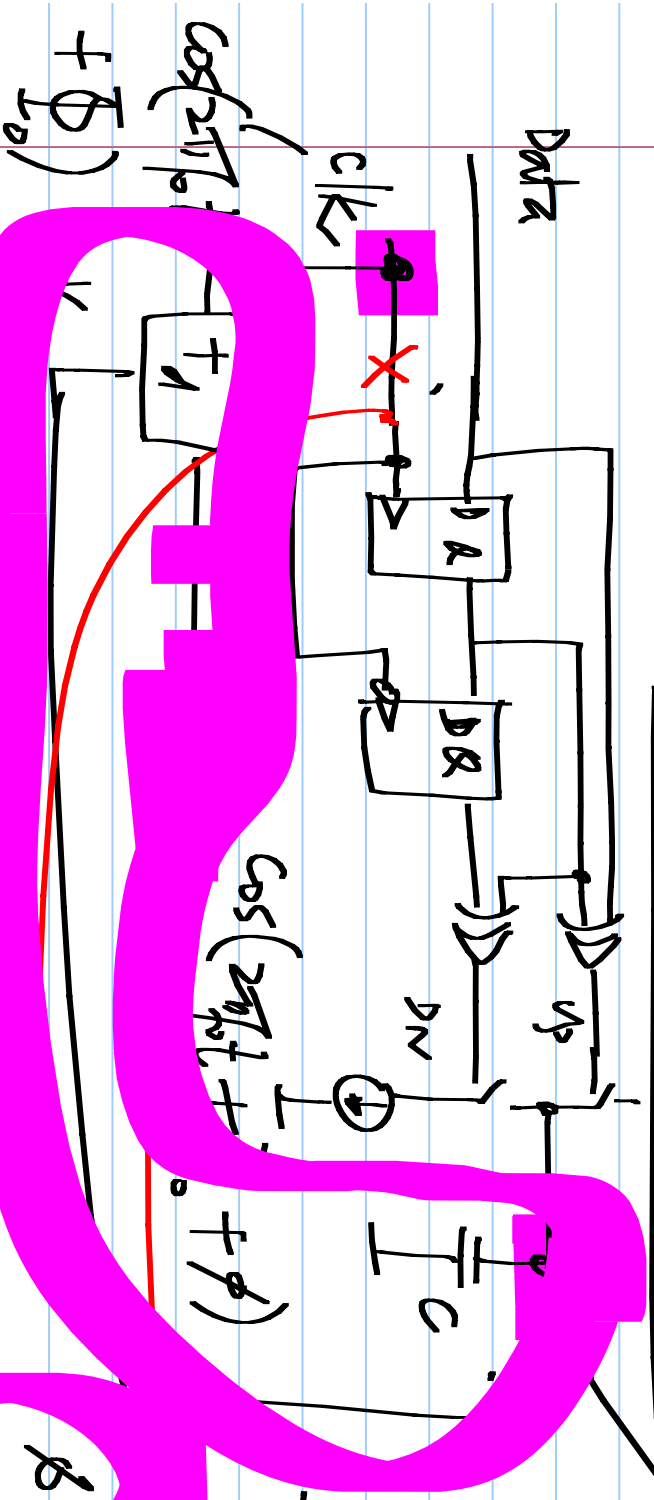


Lecture 15

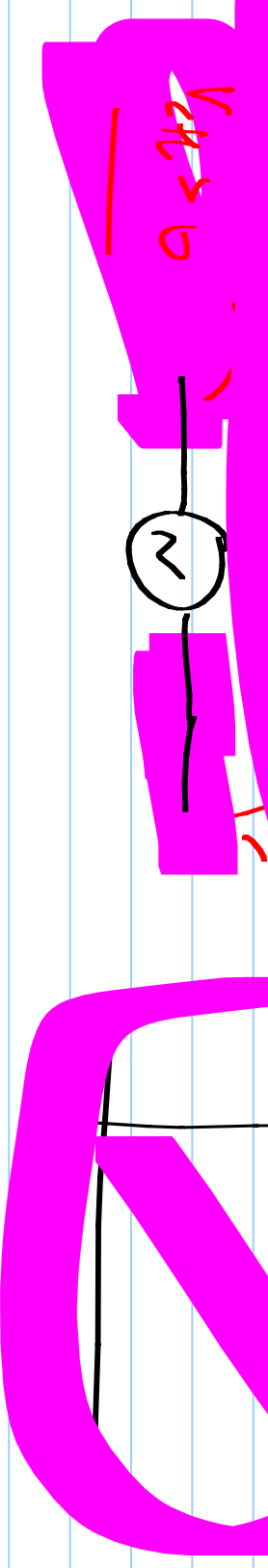
Clock and data recovery

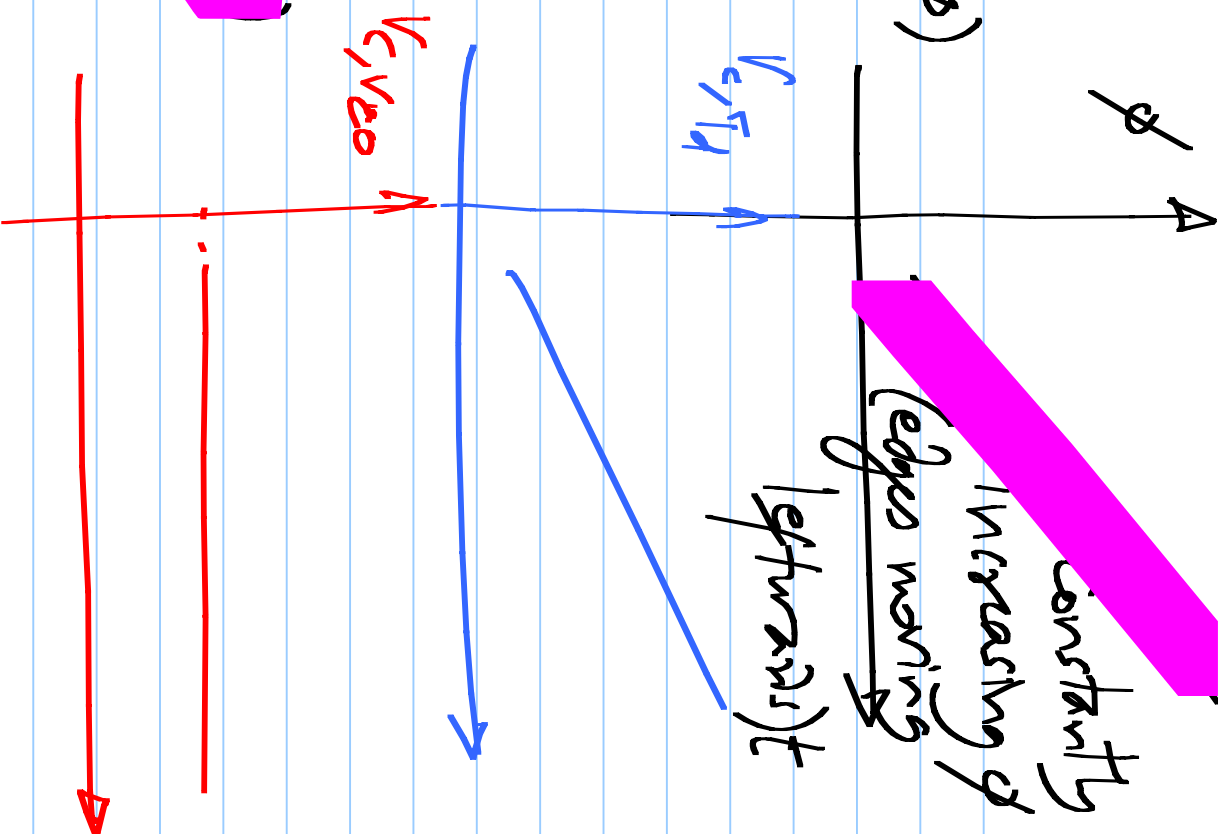
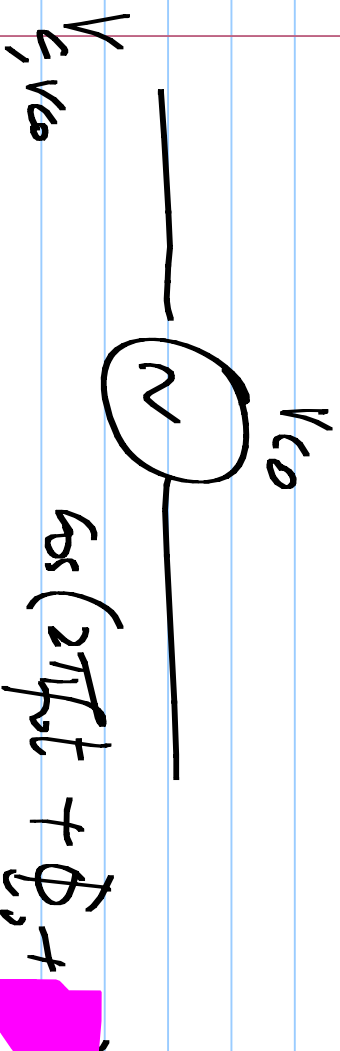
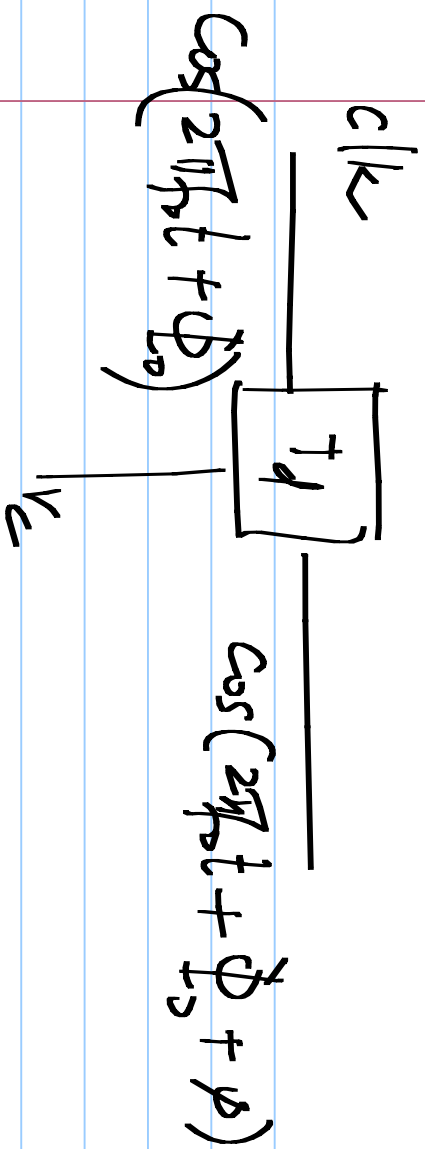
$f_s = \text{Data rate}$

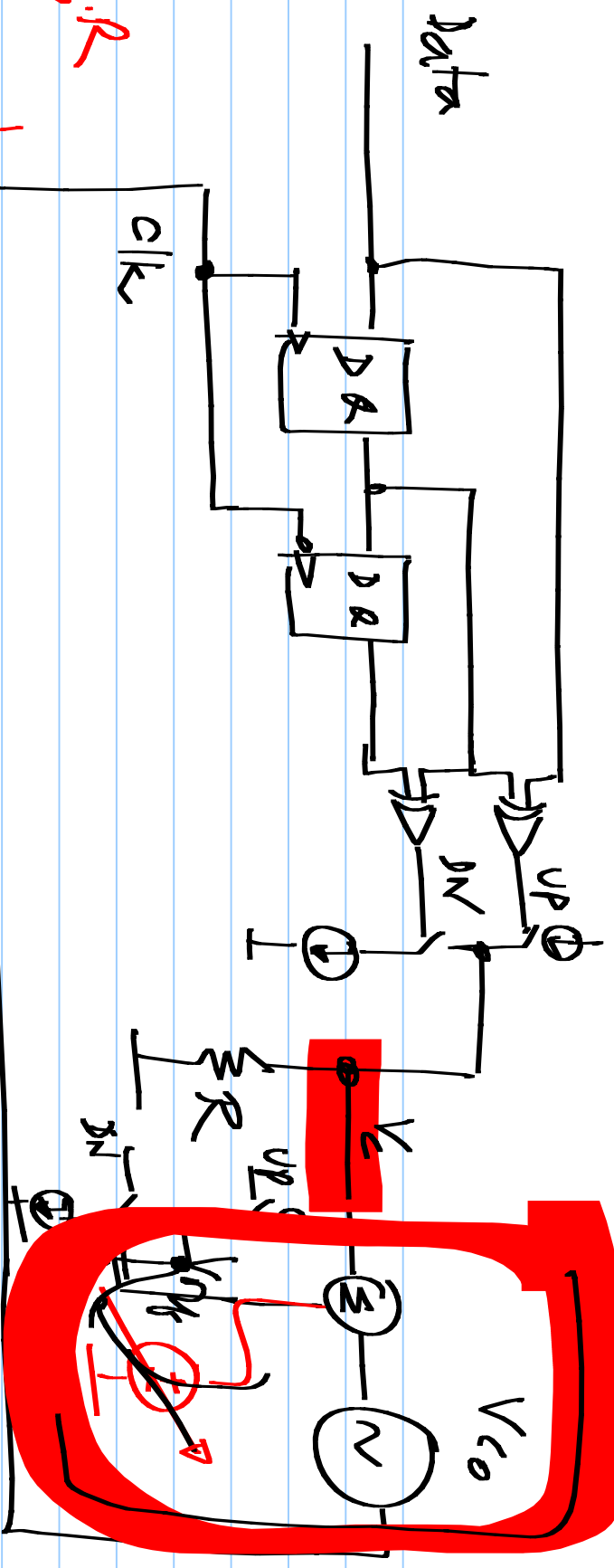


clk lags (midpoint) of data

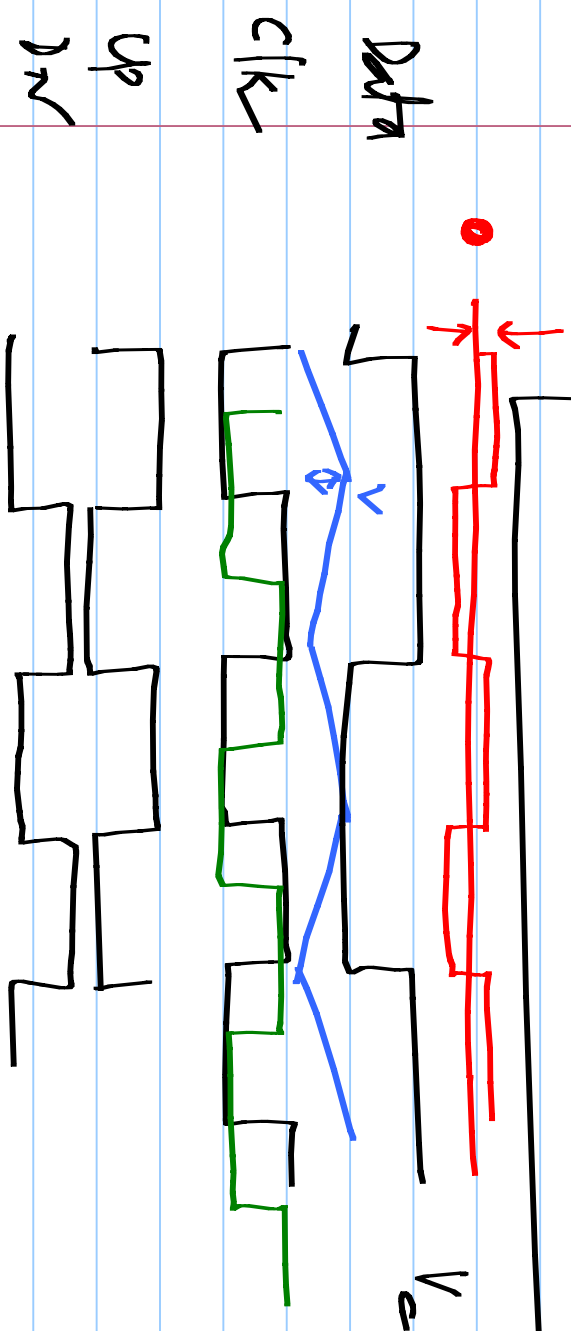
$UP > DN$





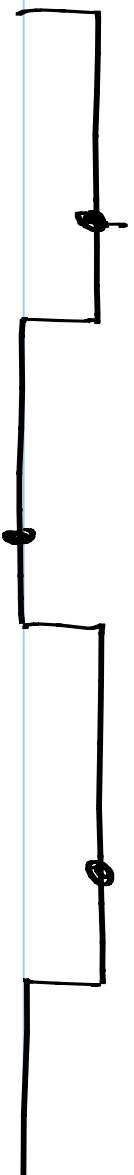


$I_{D,R}$



$f < \text{Data rate}$
 If UP is more than DN
 $\langle I_{cp} \rangle > 0$

Data



$f_0 < \text{Data rate}$

clk

$f_{req} = \text{Data rate}$

rate



UP



DN



free V_c

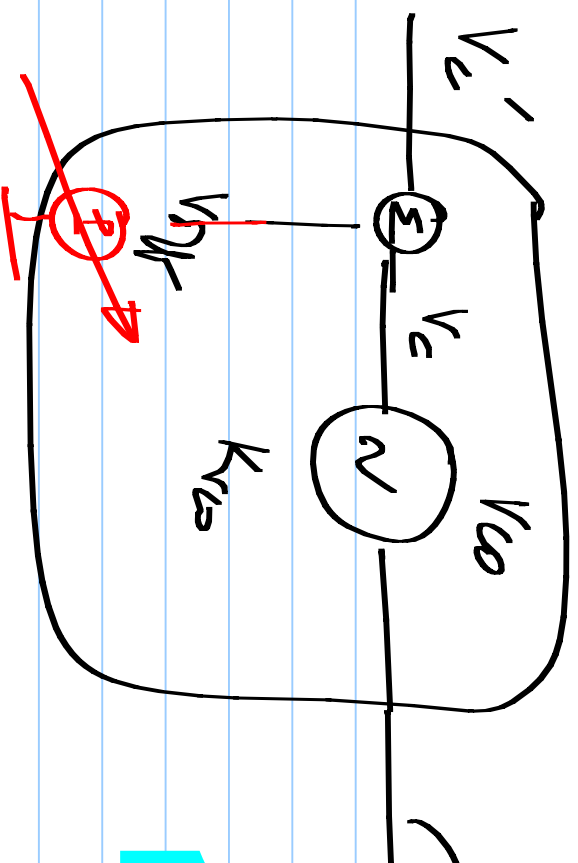
required to

make free

= data rate

UP is more

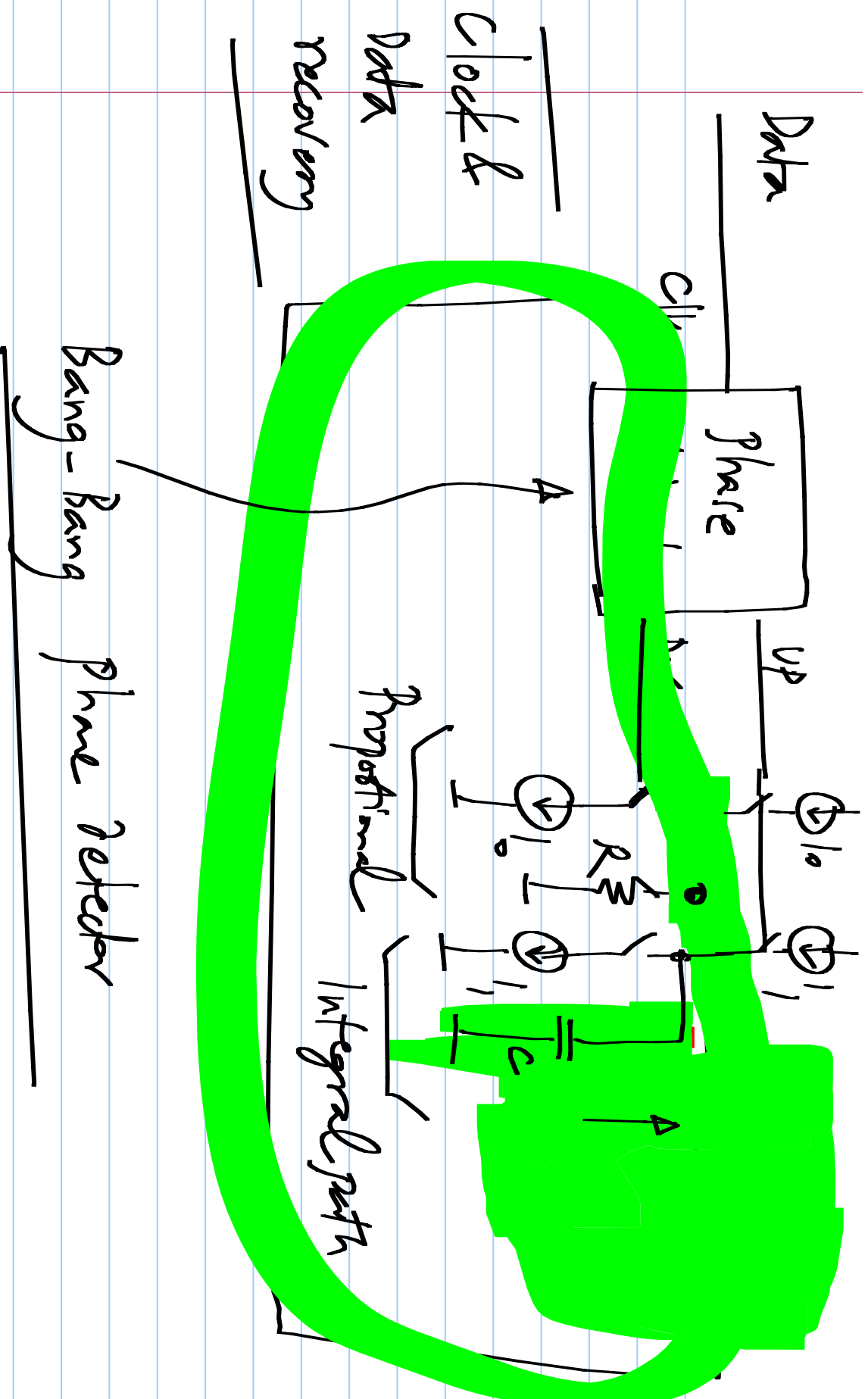
than DN

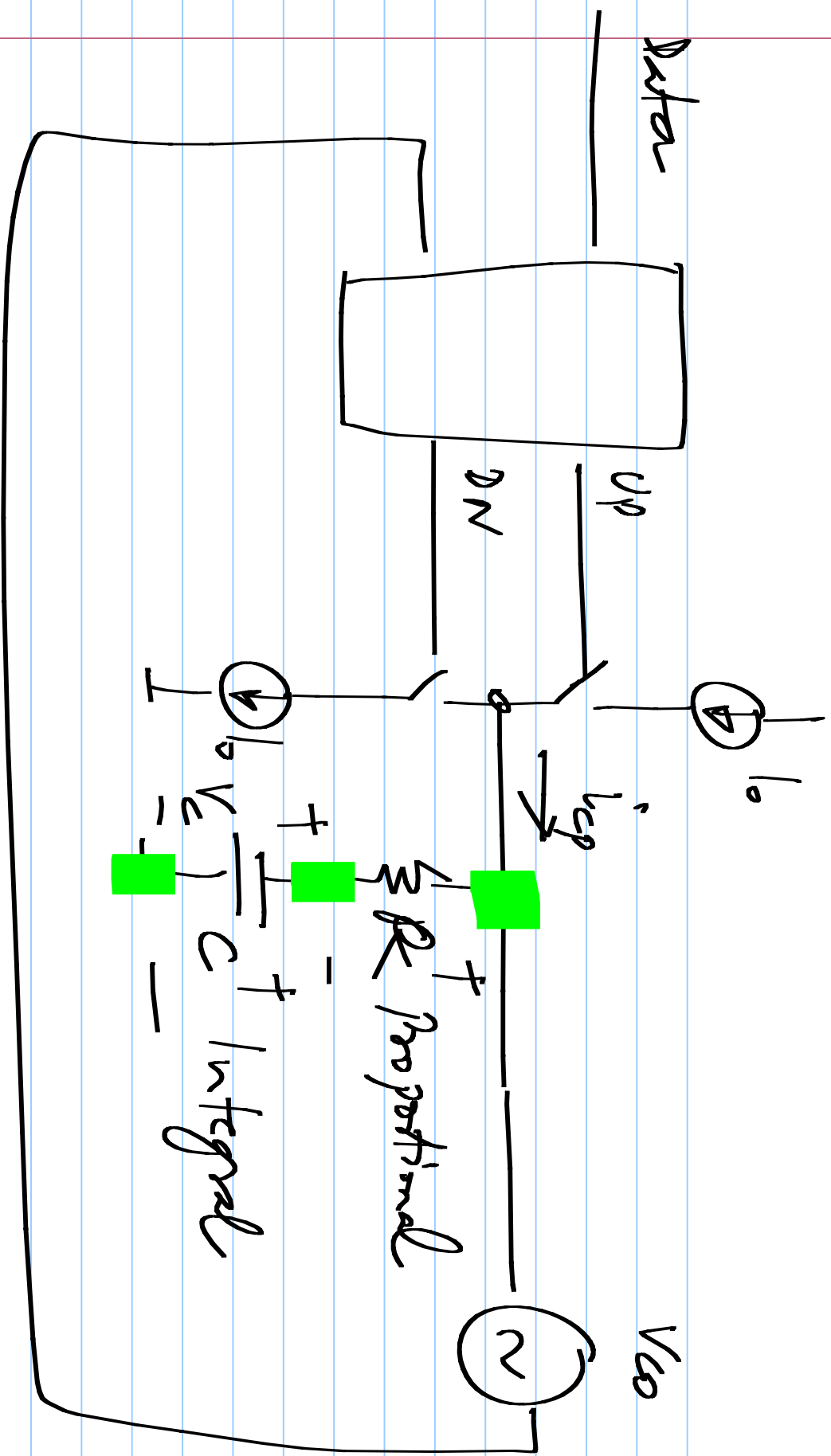


$f_{out} =$

$$(f_0 + K_{vs} \cdot V_{\eta})$$

$$+ K_{vs} \cdot V_c'$$





Draw the steady state waveform
of V_c , V_R , phase of the VCO in
steady state

