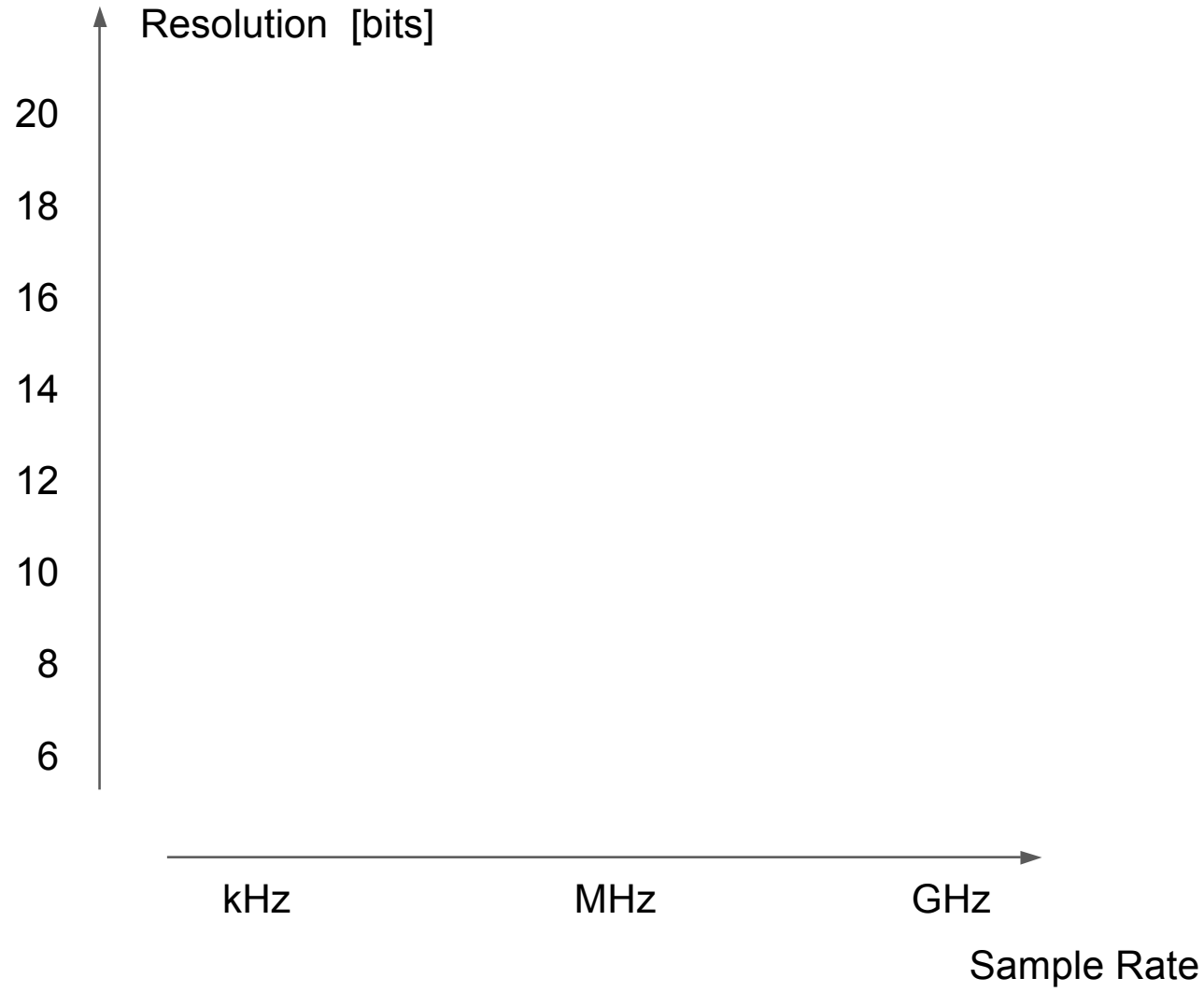
ECE3204 Lecture 25

A/D Converters

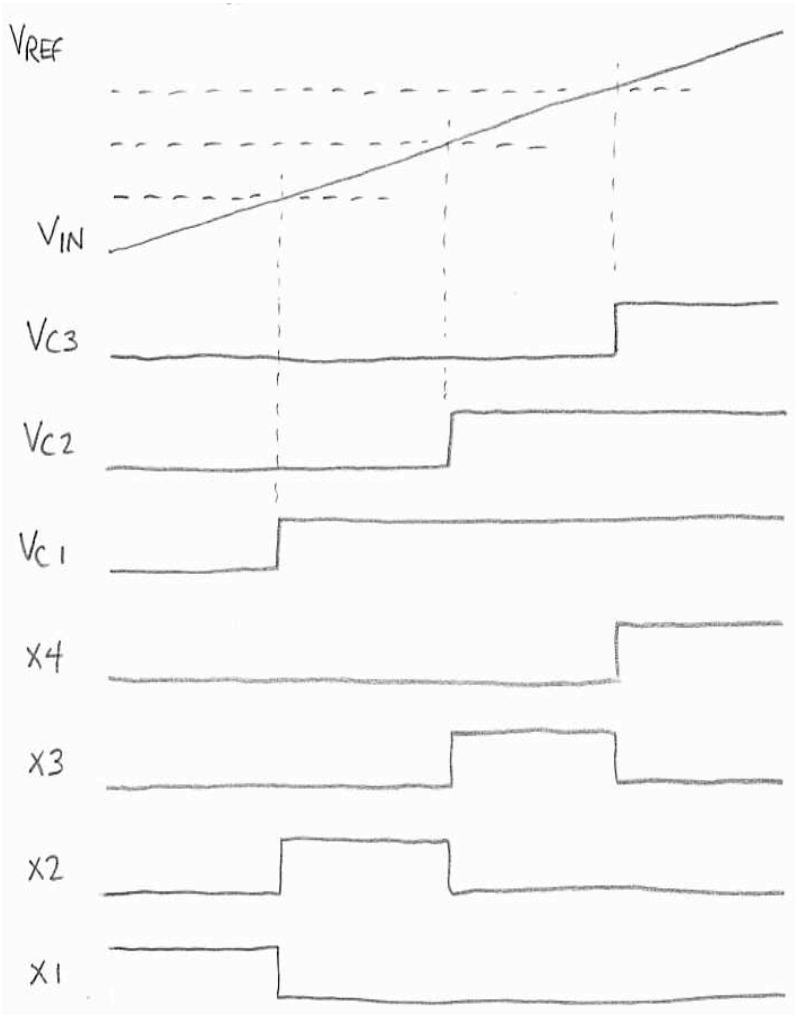
Exam 3 Preview

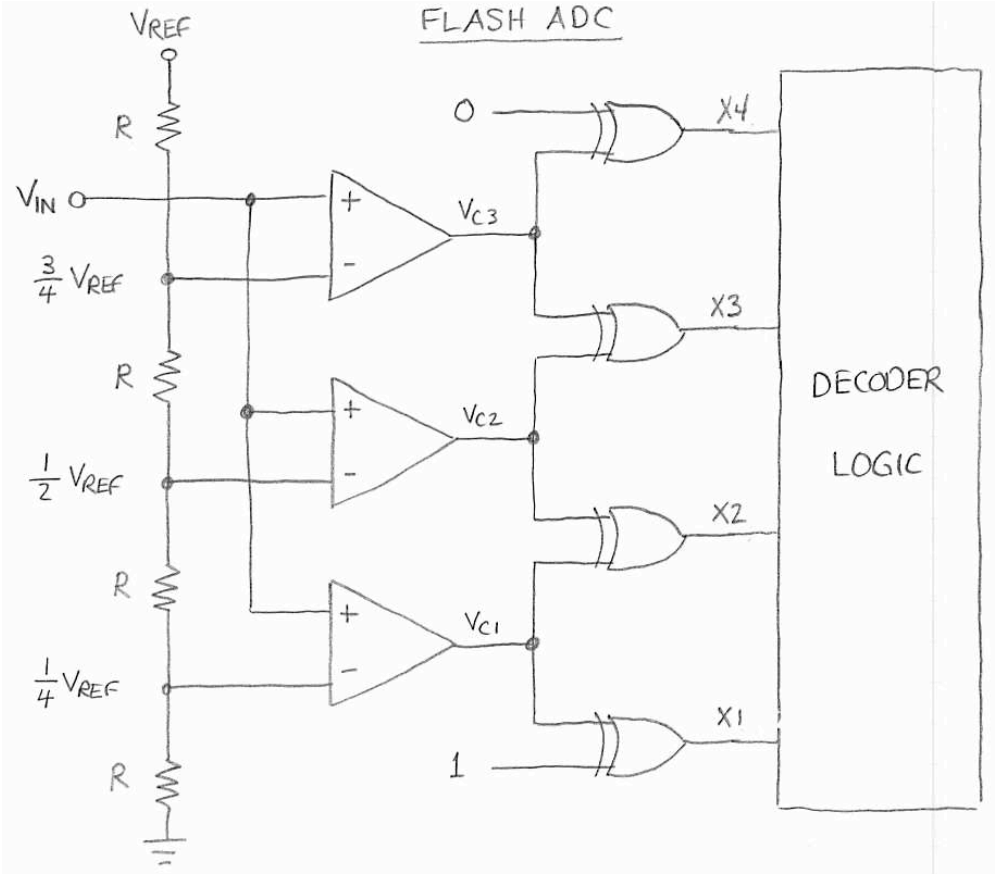
Tomorrow:
Exam 3
Hand in all late HW/Lab

ADC Architecture Tradeoff: Sample Rate vs. Resolution

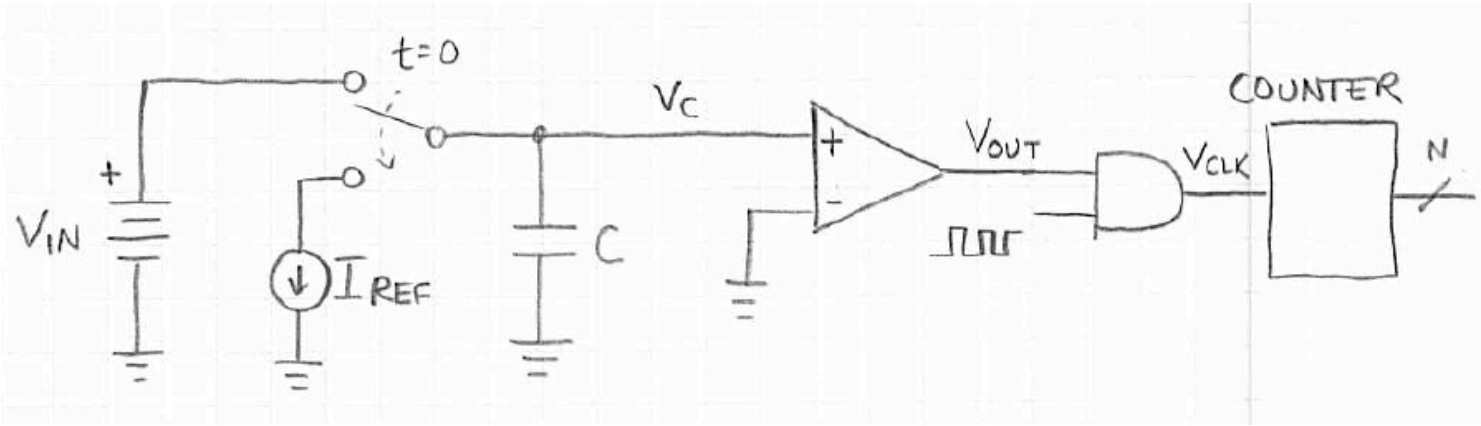


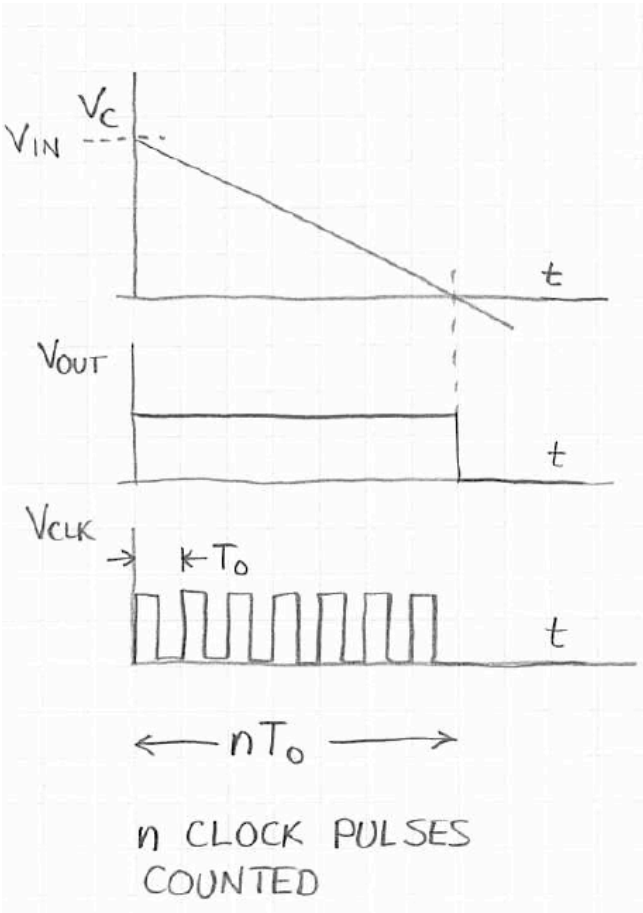
Flash ADC


VREF
VIN
VC3
VC2
VC1
X4
X3
X2
X1


FLASH ADC
VREF
R
R
R
R
VIN
3/4 VREF
1/2 VREF
1/4 VREF
VC3
VC2
VC1
0
1
X4
X3
X2
X1
DECODER
LOGIC

Ramp ADC





FOR CAPACITOR

$$\frac{I}{C} = \frac{dV}{dt}$$

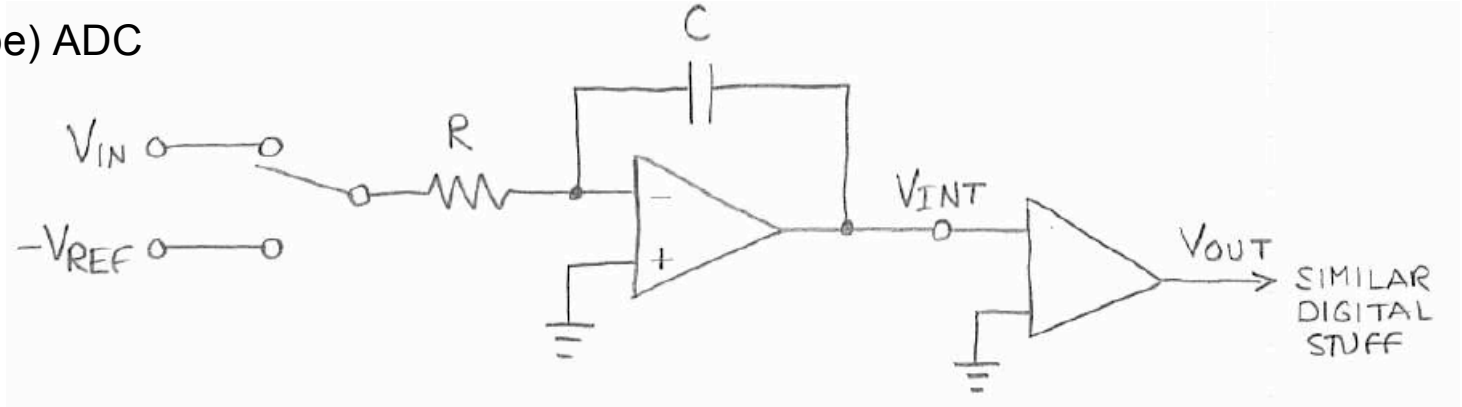
$$\frac{I_{REF}}{C} = \frac{V_{IN}}{nT_0}$$

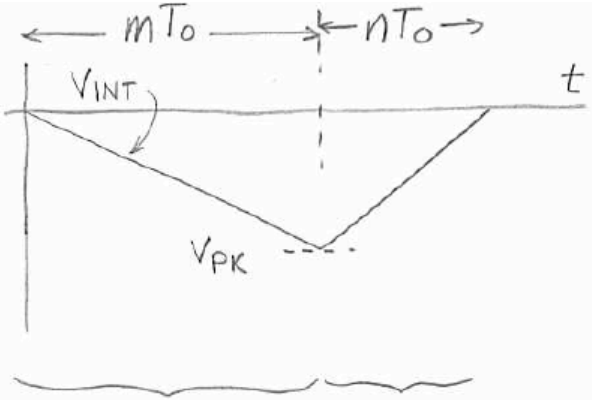
$$n = V_{IN}\left[\frac{C}{I_{REF}\,T_0}\right]$$

GOOD: $n \propto V_{IN}$

BAD: PROPORTIONALITY FACTOR DEPENDS ON I_{REF}, T_0, C

Integrating (Dual-Slope) ADC





INTEGRATE V_{IN} FOR mT_o

$m = 2^N$

N-BIT ADC

INTEGRATE $-V_{REF}$ UNTIL $V_{INT} = 0$ AFTER TIME nT_o

FOR INTEGRATOR

$$V_{PK} = -RC\, V_{IN}\, m T_o$$

ALSO

$$-V_{PK} = -RC(-V_{REF})\, n T_o$$

SOLVE FOR n

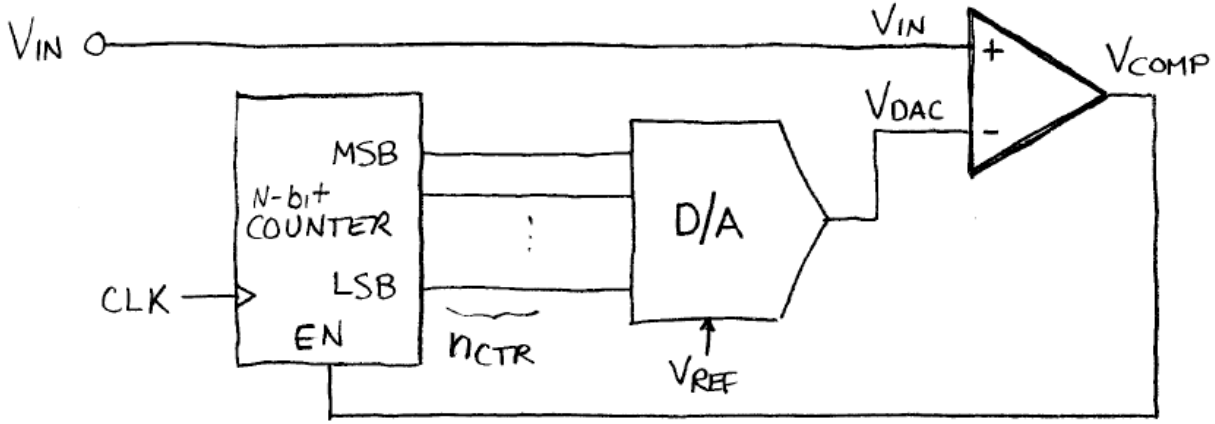
$$-RC\, V_{IN}\, m T_o = -RC\, V_{REF}\, n T_o$$

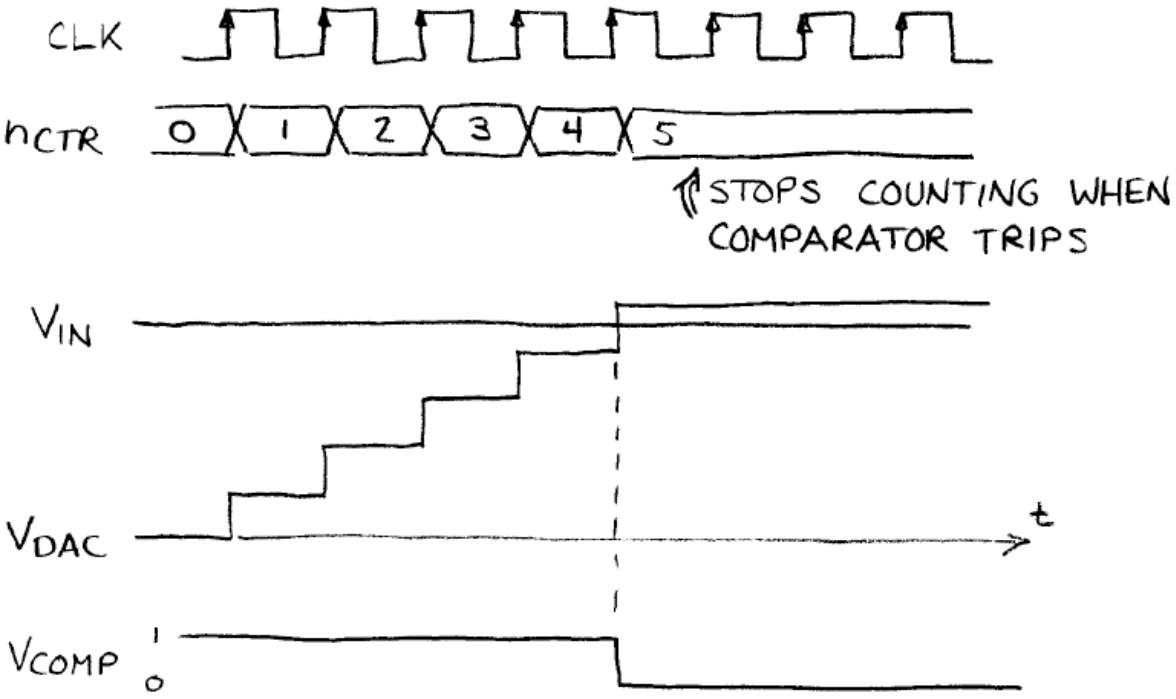
$$n = V_{IN}\left[\frac{m}{V_{REF}}\right]$$

NICE: NOW PROPORTIONALITY FACTOR DEPENDS ONLY ON V_{REF}

VALUES OF R, C, T_o UNIMPORTANT (AS LONG AS THEY ARE STABLE DURING THE CONVERSION TIME)

Counter (Feedback) ADC





Successive Approximation ADC