

EE 360 D

Implementations
Difference Eqns!

Wednesday, Sept. 15th, 2021

$$x[n] = \begin{bmatrix} A & B & C \end{bmatrix}$$

position 1 2 3

n =

$$\begin{bmatrix} -2 & -1 & 0 & -1 & -2 \\ 1 & 2 & 3 & 4 & 5 \end{bmatrix}$$

for n = -2: 2

$$x[n+3] = n$$

$$\begin{aligned} -2+3 \\ = 1! \end{aligned}$$

make
Array position
1!

Analog - Differential Eqns!

$$\dot{y} + y = x$$

$$\frac{dy}{dt}$$

Digital - Difference Eqn!

$$y[n] + y[n-1] = x[n]$$

MATLAB!

DFI



Direct!

DFII



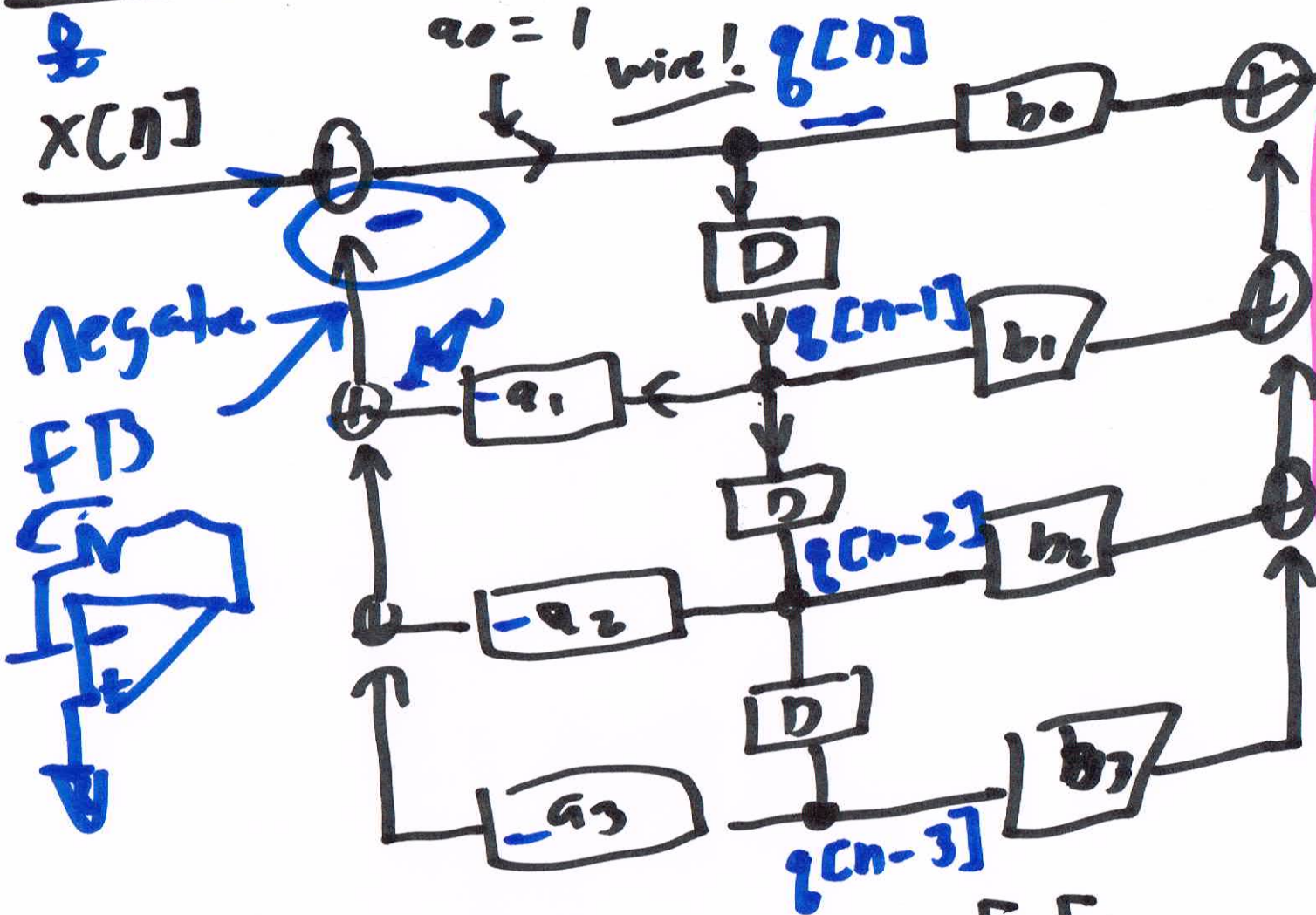
SAVE MONEY
& LAYOUT!

Canonical!

TDFFII



Direct Form II Block (Digital!)



$$y[n] = b_0 q[n] + b_1 q[n-1] + b_2 q[n-2] + b_3 q[n-3]$$



FB

FF

$$q[n] = x[n] - a_1 q[n-1] - a_2 q[n-2] - a_3 q[n-3]$$

$n = 0:50$ $\text{length}(n) = 51$

~~$x(i)$~~ for $i = 0:50$

BAD!

$x(i-3) - \underline{x(i-3)}$

Array!



Force to 1!

~~$x(i)$~~
 $g(i) = g(i-2) + g(i-3)$

$g(i+3) = g(i+1)$ $g(i)$ + 3!

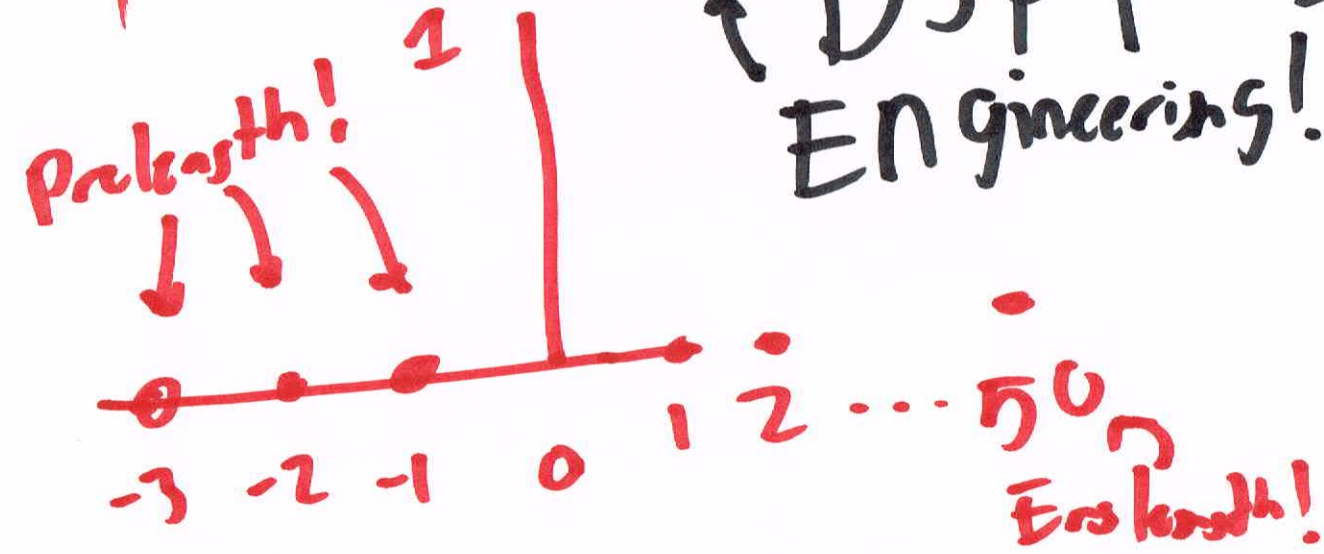
Controls Engineering!

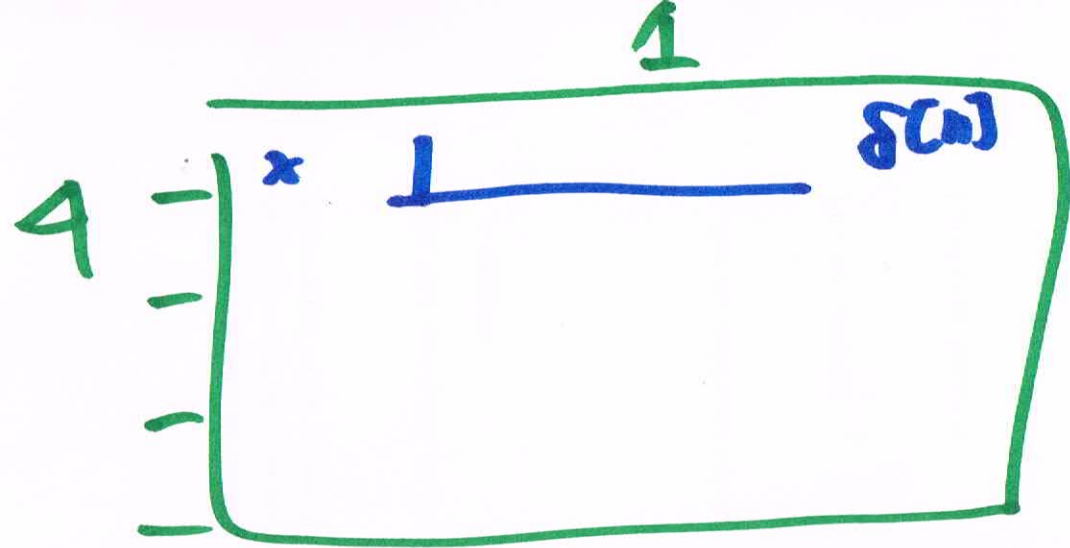
Option
1!

$n = 50$ *endkast!* $\text{prekast} + 1$
 $\text{prekast} = -3$
 for $i = 0$ $+4$ $: 50$ $+9$ *Array!*

$$f(i) = f(i-1) + f(i-2)$$

\uparrow DSP ENGINEERING!
 \uparrow worst case!





$$\begin{aligned}
 & (a_0 y[n] + a_1 y[n-1] + a_2 y[n-2] + a_3 y[n-3]) \\
 & = b_0 x[n] + b_1 x[n-1] + b_2 x[n-2] + b_3 x[n-3]
 \end{aligned}$$

$$y[n] = \frac{b_0 x[n] + b_1 x[n-1] + b_2 x[n-2] + b_3 x[n-3]}{1 - a_1 y[n-1] - a_2 y[n-2] - a_3 y[n-3]}$$

FB

$$\underline{a_0 = 1}$$

6)