Impulse Response of Nonrecursive Difference Equation.

First causal one:

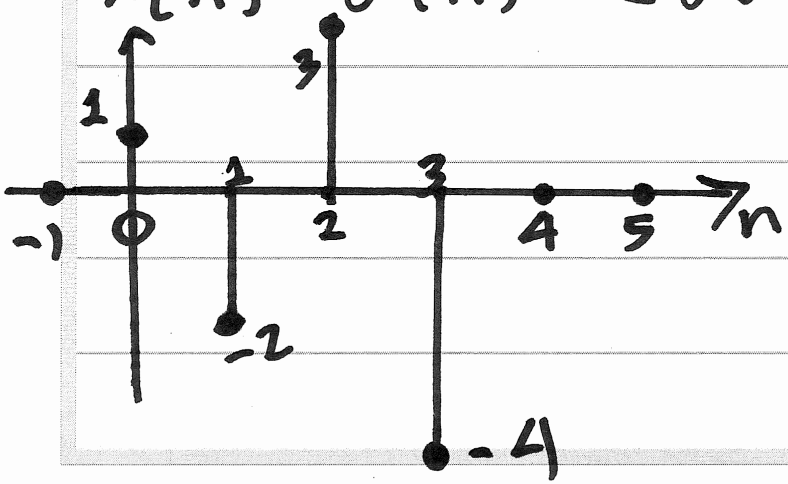
$$y[n] = \sum_{k=0}^{M} b_k \, x[n-k]$$

$$= b_0 x[n] + b_1 x[n-1] + b_2 x[n-2] + \ldots + b_M x[n-M]$$

Nonrecursive: means does <u>not</u> depend on $y[n-1]$, $y[n-2]$, etc.

<u>First, sidenote</u>: reminder example

$$x[n] = \delta[n] - 2\delta[n-1] + 3\delta[n-2] - 4\delta[n-3]$$



$$x[n] = \{\underset{\substack{\uparrow \\ n=0}}{1}, -2, 3, -4\}$$

$\Rightarrow$ 3 representations of the <u>same</u> DT sequence

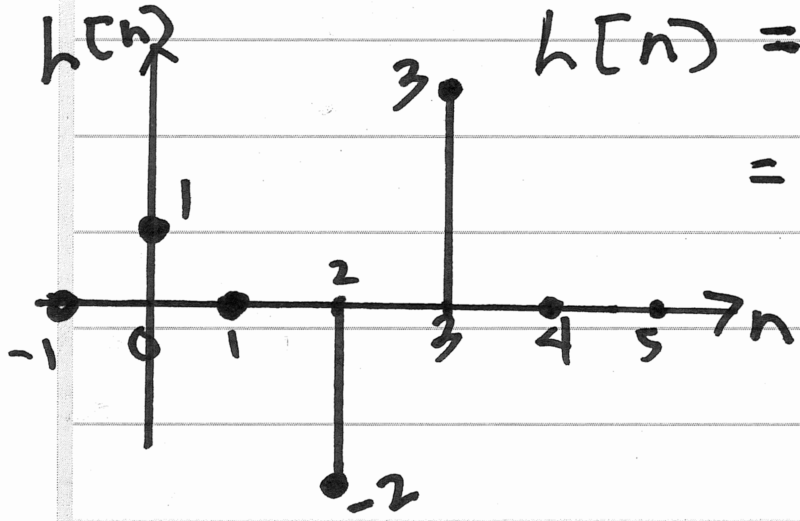
To find $h[n]$, let $x[n] = \delta[n]$:

$$h[n] = b_0 \delta[n] + b_1 \delta[n-1] + b_2 \delta[n-2] + \dots + b_M \delta[n-M]$$

$$= \{\underset{\substack{\uparrow \\ n=0}}{b_0}, b_1, b_2, \dots, b_M\}$$

$\Rightarrow$ The values of b_k's are the impulse response!

<u>Example:</u> $y[n] = x[n] - 2x[n-2] + 3x[n-3]$



$$h[n] = \delta[n] - 2\delta[n-2] + 3\delta[n-3]$$

$$= \{\underset{\uparrow}{1}, 0, -2, 3\}$$

no $x[n-1]$ term

- If the Difference Eqn is recursive, i.e., depends on past values of the output $y[n-1]$, $y[n-2]$, etc. generally use the Z-Transform in Chap. 10 to solve for impulse response $h[n]$

- For exam 1, you only have to Know impulse response for 2 simple recursive difference eqns.

$$y[n] = a\,y[n-1] + x[n] \implies h[n] = a^n u[n]$$

$$y[n] = a\,y[n-1] + x[n] - a^D x[n-D]$$

$$\implies h[n] = a^n \{u[n] - u[n-D]\}$$

where: $D = \text{integer} > 1$