Working with Difference Equations on the TI-83

Your calculator can help you analyze difference equations by making tables of values and graphing them. First you need to tell the calculator that we're working with discrete functions: hit **MODE**, move to the fourth row, and select **Seq**. You only need to do this once (but you'll want to change it back to **Func** to graph other things).

Entering difference equations. The hardest part here is remembering to use the special keys, **not** the "alpha" keys, for the variable names. Hit the **Y=** button to begin. You can enter up to three difference equations at a time, which the calculator calls u, v, w. The equations will look like this:

$$u(n) = a * u(n-1) + b$$

$$v(n) = a * v(n-1) + b$$

$$w(n) = a * w(n-1) + b$$

where a and b are constants that can be chosen independently for each equation. The left side of each equation is entered for you. Here's how to enter the rest:

Variable	Press
n	x, T, Θ, n
u	2^{nd} 7
v	2^{nd} 8
w	2^{nd} 9

Before the equations you're given a chance to specify the smallest value for n, called nMin. It will usually be $n\text{Min} = 0$ in our examples. Then you're able to input $u(n\text{Min})$. If nMin is 0, this is just $u(0)$. Same goes for $v(n\text{Min})$, $w(n\text{Min})$.

Important notes.

(1) If a is negative, remember to use the negative key (-) rather than the minus sign $-$.

(2) The calculator will allow you to use the alpha keys to put in u, n, etc., without telling you anything's wrong until you try to process the equation.

(3) You must use $*$ for multiplication (the $\times$ button) when putting in $a * u(n-1) + b$. Entering, for example, $7u(n-1)+2$ will throw an error. You have to enter $7 * u(n-1) + 2$.

Selecting which equation(s) to graph or table. By going to the equals sign in any of the equations and pressing **ENTER**, you can select or deselect any equation for inclusion in a graph or table.

Displaying the table or graph. Simply hit **GRAPH** or **TABLE** (both on the far-right button below the screen).

Settings. If you want the calculator to graph a difference equation then you need to specify which part of the graph you want to see. If you want it to give you a table of values, you need to specify which values it should show. The settings are described in the tables below. The best way to familiarize yourself with them is to enter a difference equation and play around with the various settings. Remember, you won't break anything by fiddling with it.

For **graphs**, first press **Window** (under the screen) and enter your desired values for each of the following parameters:

Value	**Enter**	**Usual value**
nMin=	This was discussed above. You can change it here too.	
PlotStart	The smallest value of n to use	0 (1 throws an error!)
PlotStep	The jump in n between points plotted	1
Xmin	The smallest value on the x-axis to plot	$-.5$
Xmax	The largest value of x to plot	
Xscl	The distance between ticks on the x-axis	1
Ymin Ymax Yscl	Same as above, on the y-axis	

For a **table** of values, first press **TBLSET** and enter your desired values for each of the following parameters:

Value	**Enter**	**Usual value**
TblStart	The smallest value of n to use	0
ΔTbl	The jump between values of n to compute $u(n)$ for	
Indput	Highlight **Auto** or **Ask**	Auto
Depend	Highlight **Auto**	Auto