# Sequences

In this document there is for every sequence a short description of the sequence and of the associated tns-file.

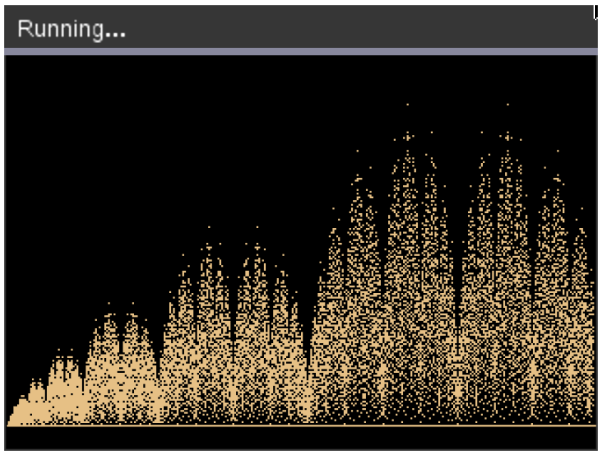
There are two sequences that uses sound.
Connect a TI Innovator Hub to hear the sound.
It is also possible to connect an external speaker for more volume (see below).

## External speaker:

Needed:
Speaker
Grove mosfet
Grove cable

Connect the speaker to the OUT and GND of the mosfet.
Connect the mosfet to the Innovator Hub in port OUT1 using a grove cable.
*(See image below)*

# Stern's diatomic sequence




Construction: see PowerPoint
Interesting property: $\frac{a_{n+1}}{a_n}$ gives all rational numbers

The tns-file “Stern” consists of 4 Python programs
The programs all use the function **stern(n)** wich returns Sterns sequence with n elements.

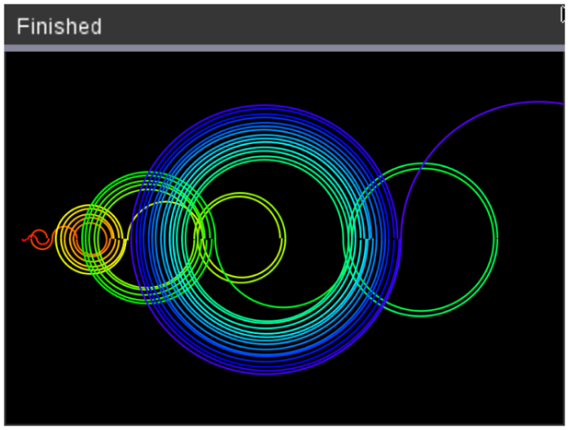
Stern_1.py:
Plots the sequence for n = 8192

Stern_2.py:
Plots the sequence for n = $2^k$.
Use the arrow-keys to change the value of k.
*The esc-key ends the program.*

Stern_3.py:
Plots the sequence for n = $2^k$ and scales the axes.
Use the arrow-keys to change the value of k.
Note that the maximum value of the sequence on the vertical axis is a Fibonacci number.
*The esc-key ends the program.*

Stern_4.py:
Plots the sequence for n = 16000.
Press a key to show or hide the Sagrada Familia.
*The esc-key ends the program.*

# Recamán

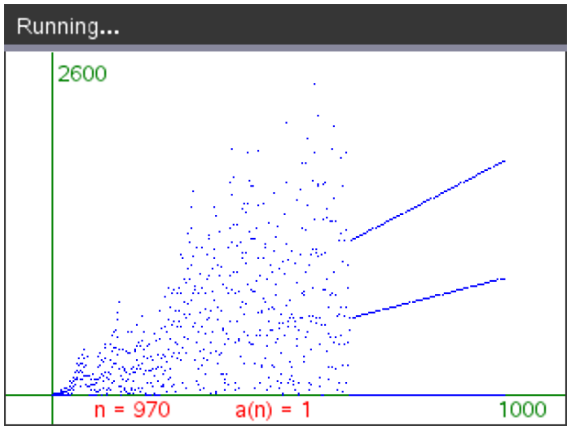



Construction: see PowerPoint
The Recamán sequence is often plotted by connecting subsequent values with semicircles.

The tns-file “Recaman” consists of one Python program.

The program produces the Recamán sequence with 67 terms.
It starts with a black screen.
Press a key to plot the sequence with semicircles in different colors.

# Sloane' sequence




Construction: see PowerPoint.

For values of n greater than 638 the graph shows a regular pattern.
638 is the first even value of n where a(n)=1.
Because n is even it can be written as 2m (a multiple of 2)
Applying the definition of the sequence to 2m, the values of the sequence show a linear pattern.

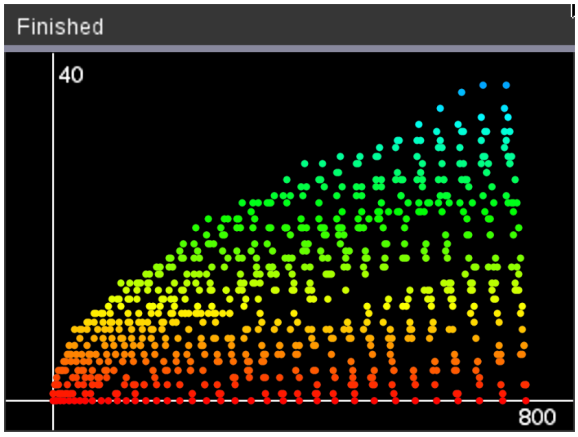
In the PowerPoint there is also an explanation for the behaviour of the sequence for values of n greater than 638.

The tns-file "Sloane" consists of one Python program.

The program plots the sequence interactively using the arrow keys.
Press "s" to toggle between step size 1 and 10.
Press "d" to toggle between big/small dots.
Press "z" to toggle between zoom in and zoom out. (this is interesting for large numbers to view the outcomes near the x-axis)

*The esc-key ends the program.*

# Inventory

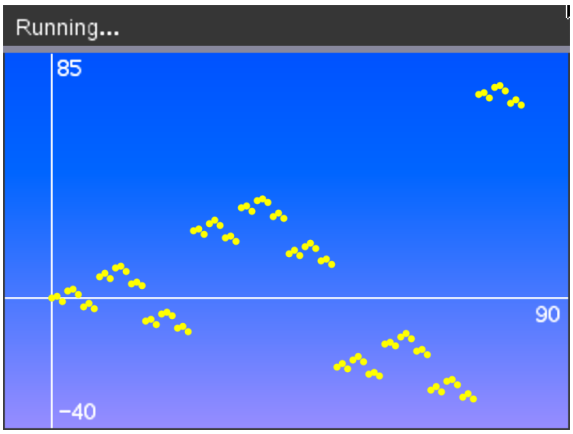



Construction:
To get started we ask: how many zero terms are there? Since there are no terms in the sequence yet, we record a '0', and having recorded a '0', we begin again: How many zero terms are there? There is now one 0, so we record a '1' and continue. How many 1's are there? There's currently one '1' in the sequence, so we record a '1' and continue. How many 2's are there? There are no 2's yet, so we record a '0', and having recorded a 0, we begin again with the question "how many zero terms are there?" And so on.
Also: see PowerPoint

The tns-file “Inventory” consists of one Python program.
The program plots the sequence with length 800.
Press a key to color the first part of the graph.
Press a key again to listen to the sequence.
The frequences are calculated with the formular $f(n) = 110 \cdot 2^{\frac{a(n)}{12}}$.

PS
Connect a TI-Innovator Hub to hear the sound.
When an external speaker is connected uncomment line 4.
(*delete the #-sign in #sound = speaker("OUT 1")*)

# Star Wars



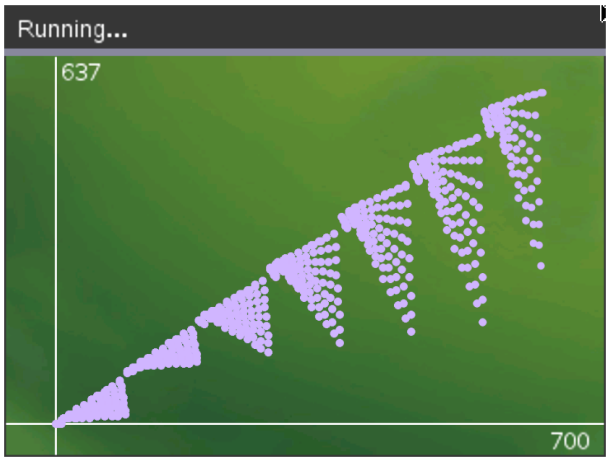

Connect an Innovator Hub to the computer or handheld.

The program plots the Star wars sequence for n = 90.

Press a key to hide the axes.
Press a key again to hear the sound and see the “space ships” fly away.

PS
Connect a TI-Innovator Hub to hear the sound.
When an external speaker is connected uncomment line 4.
(*delete the #-sign in #sound = speaker("OUT 1")*)

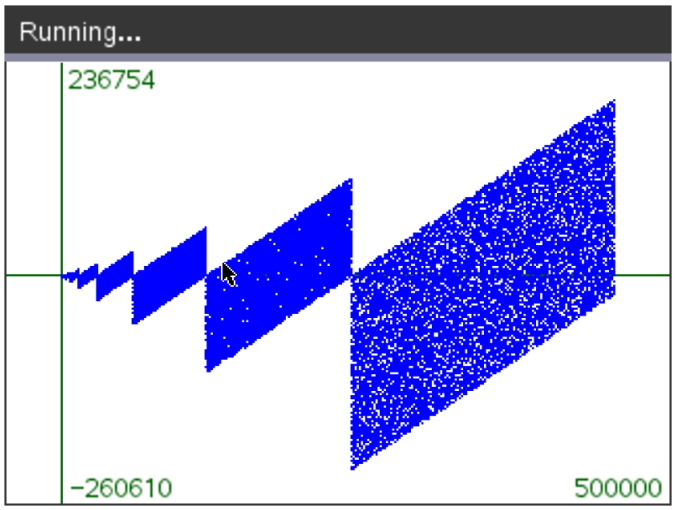
# Wisteria




Construction: see PowerPoint
The graph resembles wisteria flowers

The tns-file “Wisteria” consists of one Python program.
The program plots the sequence on a green background image in a purple color just for the beauty of the graph.
Press a key to toggle between different lengths of the sequence.

# Primes




Construction: see PowerPoint
The graph is interesting for its shape.
Questions to be asked are why appear these rectangles.

The tns-file “Primes” consists of one Python program.
The program plots the sequence for all prime numbers less than 500000.
Press a key to toggle between showing/hiding the number of primes.