DIAGNOSTIC 2

MODELING AND SIMULATION

A certain famous system of differential equations can be approximated by a system of difference equations that looks like this:

$$x_{i+1} = x_i + \sigma (y_i - x_i)\, dt \quad (1)$$

$$y_{i+1} = y_i + [x_i(r - z_i) - y_i]\, dt \quad (2)$$

$$z_{i+1} = z_i + (x_i y_i - b z_i)\, dt \quad (3)$$

Assume that the variables `x`, `y` and `z` have already been created and assigned initial values. Write a script called `lorenz_update` that updates these variables simultaneously (that is, the new values should depend on the old values). You can assume that `r`, `b`, `sigma` and `dt` already exist, too.

DO NOT USE MATRICES/VECTORS. You must update the variables "in place". That means that the syntax `x(i)` should not appear in your solution.

DO NOT USE A LOOP: Your script should compute one time step only.

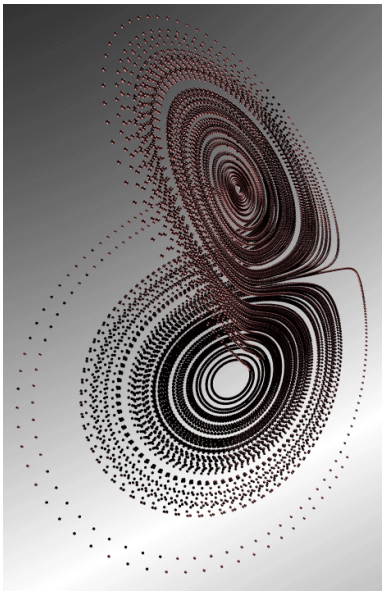

Figure 1: Lorenz attractor from `local.wasp.uwa.edu.au/ pbourke/fractals/lorenz/lorenz11.gif`.

More on the back!

Write a script called `lorenz_loop` that sets the initial values of `x`, `y` and `z` to 1 and the values of σ, b, r and dt to 10, 8/3, 28, and 0.01 respectively.

Then it should use a for loop to run `lorenz_update` 1000 times; each time through the loop it should plot y versus x.

STILL NO MATRICES, PLEASE.