ENGG1003 - Lab Week 8

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Task 1

Task 2: Creating 2D and 3D Arrays

Task 3: Indexing 2D and 3D Arrays

Task 4: Slicing 2D and 3D Arrays

Task 5: Mapping Cartesian Coordinates to 2D Array Indices

Task 6: Barnsley Fern

In this task you will modify an existing Python program to generate an image file of the *Barnsley fern fractal*.

A fractal is a mathematically generated image which exhibits "self-similar" geometry. As the image is zoomed in the the same patterns are seen repeated and, in theory, the image can be zoomed in forever and still show the same level of detail as it did when zoomed out.

The Barnsley fern is from a class of fractals known as iterated function systems (IFS). The general pattern for generating fractals of this type is to:

1. Pick (or be given) a point x_0, y_0
2. Generate a new point, x_1, y_1, by applying some mathematical rules
3. Draw a dot on an x-y plane where the new point lies
4. Repeat millions (or billions) of times until an image is drawn

The rules for the Barnsley fern are as follows:

- There are four functions which generate a new point:
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- Each iteration, *one* of the four functions is chosen at random with a probability, p, of:
  - f_1: $p = 0.01$
  - f_2: $p = 0.85$
  - f_3: $p = 0.07$
  - f_4: $p = 0.07$