

Problem 2

Growing a fern. As we have learned, natural processes that are subject to chance influences can produce objects of high regularity. To demonstrate this, write a program to iteratively generate points in two-dimensional space using the following rules:

$$(x_{n+1}, y_{n+1}) = \begin{cases} (0.5, 0.27y_n), & \text{with 2\% probability} \\ (-0.139x_n + 0.263y_n + 0.57, 0.246x_n + 0.224y_n - 0.036), & \text{with 15\% probability} \\ (0.17x_n - 0.215y_n + 0.408, 0.222x_n + 0.176y_n + 0.0893), & \text{with 13\% probability} \\ (0.781x_n + 0.034y_n + 0.1075, -0.032x_n + 0.739y_n + 0.27), & \text{with 70\% probability} \end{cases}$$

Start from an initial point $(x_1, y_1) = (0.5, 0.0)$. Carry out the iteration at least 30,000 times and plot all the data you obtain (as points) in an x - y plot.