

---

## Table of Contents

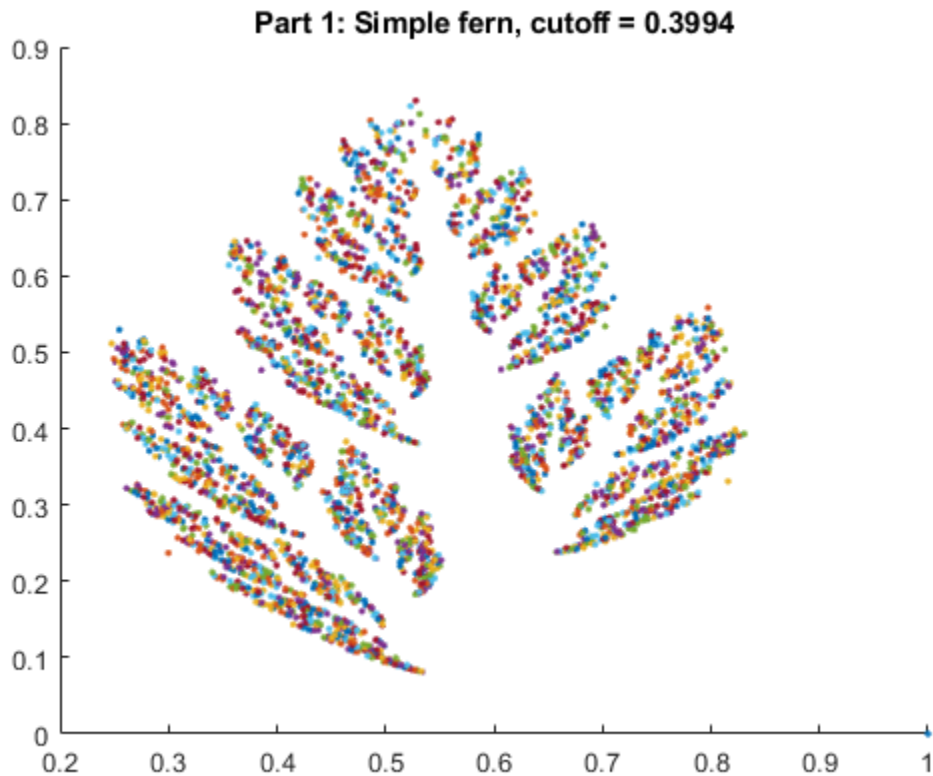
.....	1
PART 1: PLOTTING A SIMPLE FERN .....	1
ANSWER TO PART 1 QUESTION: .....	2
PART 2: PLOTTING AN ADVANCED FERN .....	2

```
% Pierce Zhang, CMOR220, Fall 2023, Project 1: Grow a fern
% fern.m
% Draws two ferns using matrix transformations on 2x1 point matrices set
% by probability thresholds, as specified by the Project 1 specifications.
% Last modified: 11 September 2023
```

```
% Driver function to execute part one and two code
function fern
```

## PART 1: PLOTTING A SIMPLE FERN

```
simplefern(0.3994);
% reduce cutoff
% simplefern(0.2);
% increase cutoff
% simplefern(0.7);
```



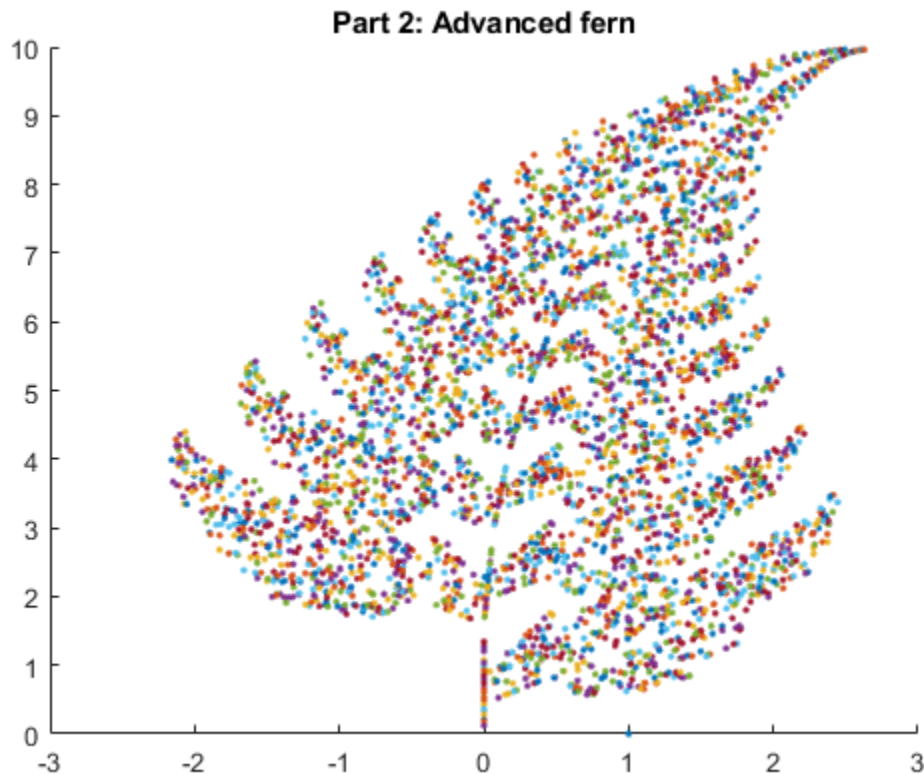
---

## ANSWER TO PART 1 QUESTION:

When the cutoff is increased, the points tend to be more concentrated to the bottom of the fern graph and its branches.  
When the cutoff is decreased, the points are more concentrated towards the top.

## PART 2: PLOTTING AN ADVANCED FERN

```
advancedfern();
```



```
end
```

```
% Inputs: float cutoff, a threshold for determining which form of the
% matrix transformation on z should be used through probability.
% Outputs: none
function simplefern(cutoff)
% This function will display a graph of 4000 points that resembles a
% fern by transforming the starting matrix z = [1 ; 0] based on two
% given transformations according to a probability set as cutoff for
% the first and (1 - cutoff) for the second.
figure()
hold on

% Title
title("Part 1: Simple fern, cutoff = " + cutoff)
```

---

```

% Starting point
z = [1 ; 0];

% Repeat for 4,000 iterations (doc specified)
for i = 1:4000
    % Plot point (z(1),z(2)) pointwise
    plot(z(1), z(2), '.');

    % Random number in [0,1]
    r = rand();
    if r < cutoff % Transformation 1
        z = [0.4 -0.3733 ; 0.06 0.6] * z + [0.3533 ; 0];
    else % Transformation 2
        z = [-0.8 -0.1867 ; 0.1371 0.80] * z + [1.1 ; 0.1];
    end
end
hold off
end

% Inputs: none
% Outputs: none
function advancedfern()
% This function will display a graph resembling a tilted fern by
% plotting all points z that are generated from a series of matrix
% transformations on z based on four probability thresholds.
figure()
hold on

% Title
title("Part 2: Advanced fern")

% Starting point
z = [1 ; 0];

% Repeat for 4,000 iterations (doc specified)
for i = 1:4000
    % Plot point (z(1),z(2)) pointwise
    plot(z(1), z(2), '.');

    % Random number in [0,1]
    r = rand();
    if r <= 0.01 % Transformation 1 (probability 0.01)
        z = [0 0 ; 0 0.16] * z;
    elseif r <= 0.76 % Transformation 2 (probability 0.75)
        z = [0.85 0.04 ; -0.04 0.85] * z + [0 ; 1.6];
    elseif r <= 0.88 % Transformation 3 (probability 0.12)
        z = [0.2 -0.26 ; 0.23 0.22] * z + [0 ; 1.6];
    else % Transformation 2 (probability 0.12)
        z = [-0.15 0.28 ; 0.26 0.24] * z + [0 ; 0.44];
    end
end
hold off
end

```

---

---

*Published with MATLAB® R2023a*