

# HPC week

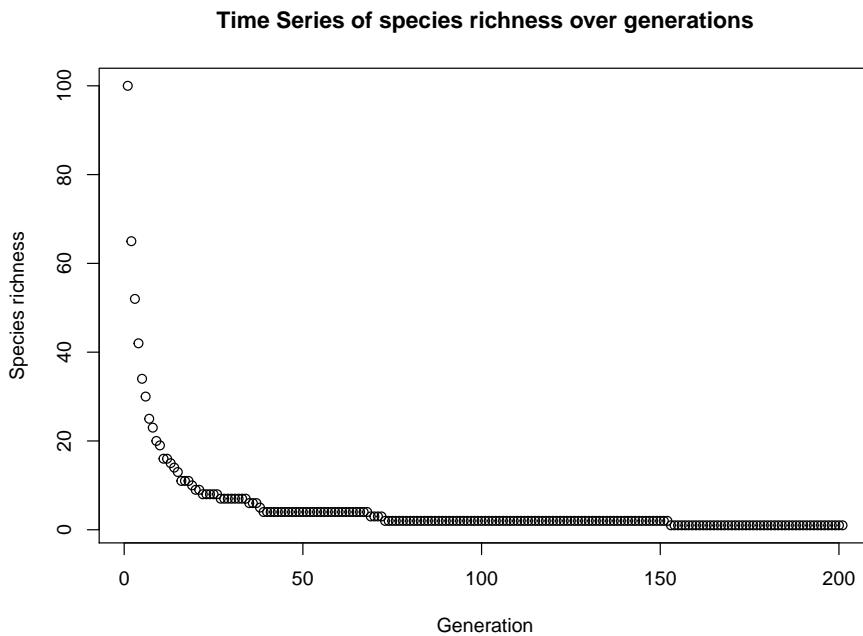
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December 2018

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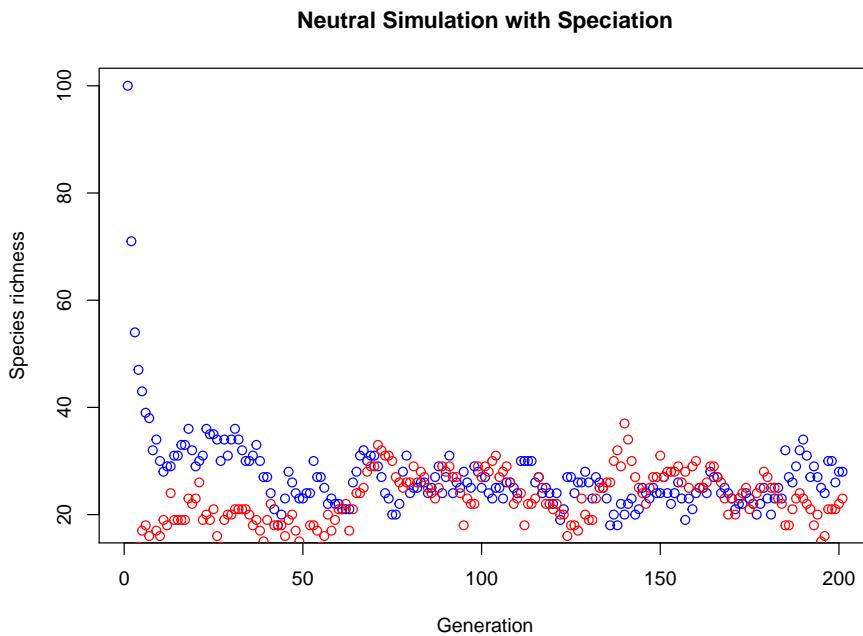
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# 1 Question 8



Question 8: a time series showing neutral simulation of species richness changes over time without speciation. The system will always converge to a species richness of 1 as there is no speciation involved in this simulation. Much like in the Voter Model, individuals are picked at random and have their identity changed to that of one of their neighbours. The stochasticity involved means that eventually all models without speciation will converge to 1.

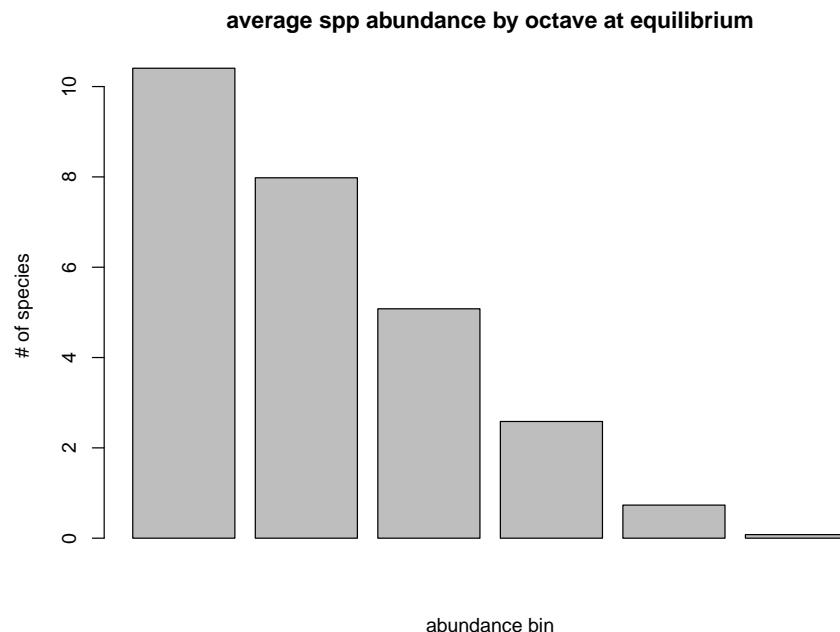
## 2 Question 12



Question 12: a time series showing neutral simulation of species richness changes over time with speciation, with initial richness being initialized as both max (blue) and min (red).

Initial condition actually makes little difference, as at equilibrium both states are roughly equal in species richness. The model gives these results as the speciation rate, at equilibrium, is roughly equal to the rate of loss of species. Therefore initial richness does not matter, only the number of individuals in population.

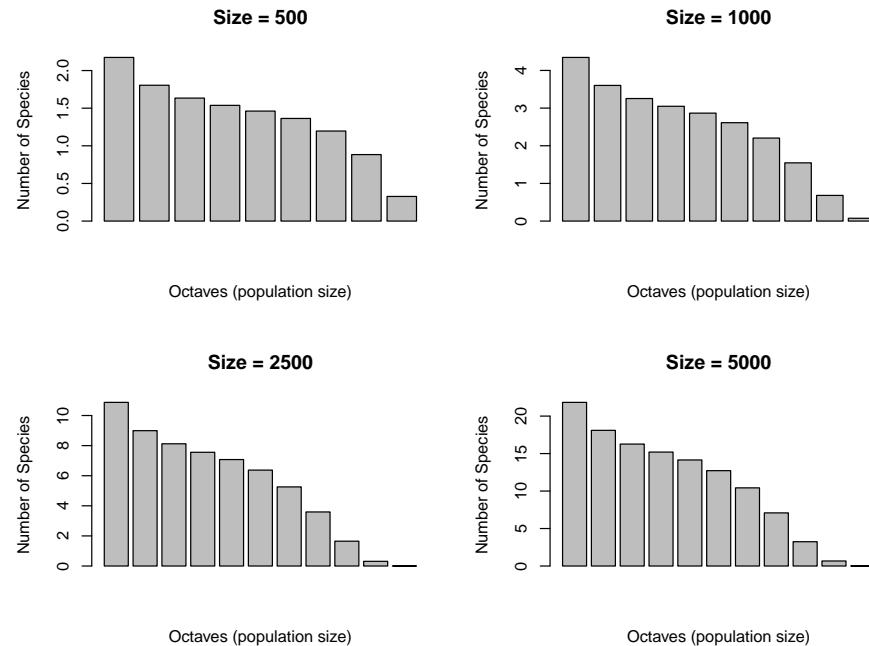
### 3 Question 16



Question 16: Average species abundance octaves at equilibrium in a maximized initial richness community. Burn in of 200 generations, equilibrium for 2000 generations, speciation at 0.1, community size of 100.

The initial condition doesn't matter here, as was the case in question 12, we saw that at equilibrium the communities look very similar regardless of whether they were a max or min community.

## 4 Question 20



HPC final run output. Speciation was set at a rate of 0.004346

## 5 Fractals - Question 21

General equation for working out rough dimensionality of a fractal;  
 $x^D = y$

where  $x$  is the size/length of one unit up (or down) ,  $y$  is the how many units make up a larger whole and  $D$  is the dimension.

This can be rearranged to  $D * \log(x) = \log(y)$

And then further rearranged to  $D = \log(y)/\log(x)$

to solve roughly how many dimensions a given fractal has.

### 5.1 'Flat' Fractal:

$$D = \log(8)/\log(3)$$

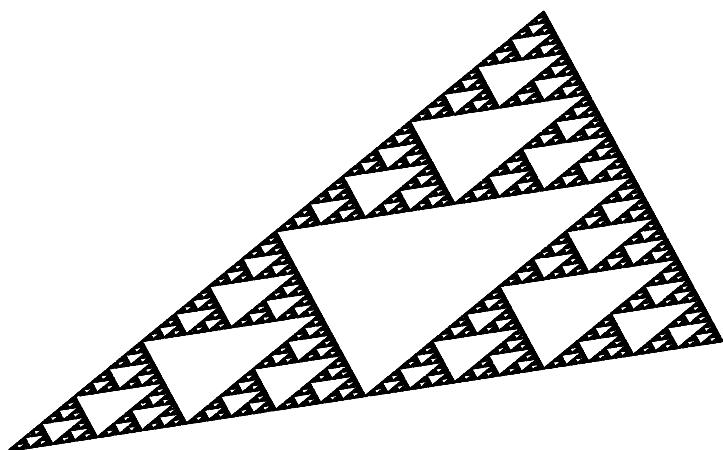
$$D = 1.892789$$

## 5.2 More '3D' Fractal:

$$D = \log(20)/\log(3)$$

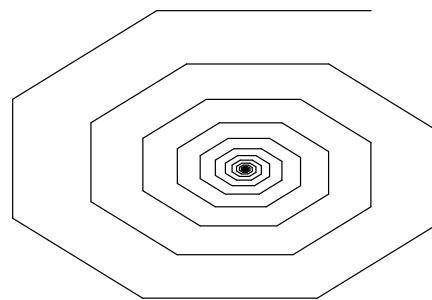
$$D = 2.726833$$

## 6 Question 22



Chaos game, randomized plotting of a point, creating a fractal

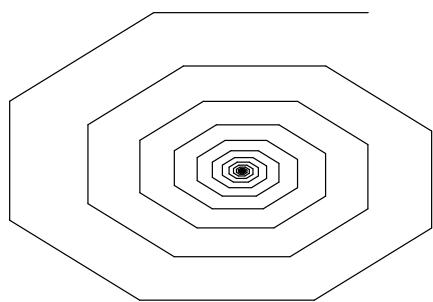
## 7 Question 25



Spiral, error messages given when created

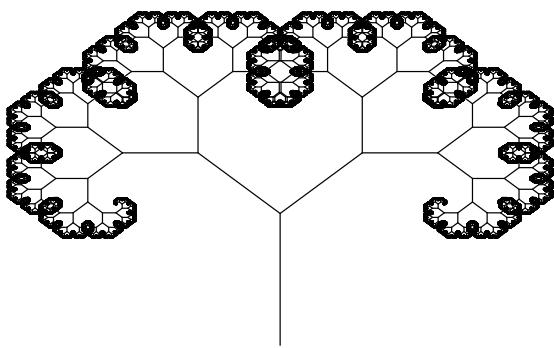
Spiral iteratively calls itself to draw ever smaller lines at an angle to one another. There is no limit on how small the lines it draws can be, so you get an error message 'Error: C stack usage 7969604 is too close to the limit'.

## 8 Question 26



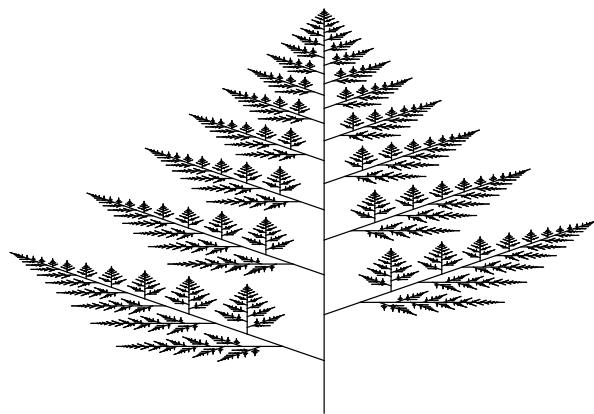
Spiral 2, no error messages given this time!

## 9 Question 27



Tree - an attractive tree shape made of fractals

## 10 Question 29



Fern - an attractive fern shape made of fractals