Antiplagiarism Poem System

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***Abstract*— This report is related to the simulation of Galton_Watson process to evaluate extinction probability within generation based on Poisson distribution for different lambdas.**

I. STRUTURE OF SIMULATOR

In the following, we address different parts of the simulation.

A. Assumption:

We assume Every generation-i vertex v in the tree produces a random number Yv of generation-i + 1 vertices with Poisson distribution. Furthermore, all Yv are i.i.d. and generation stops if/when an empty generation is obtained.

B. Inputs:

The parameters are:

- Number of vertices in generation 0
- Simulation time
- Lambda list
- Generation termination condition

C. Outputs:

Outputs are probability of extinction for each generation q_i and asymptotic probability q for different value of lambda. Besides, a histogram is provided indicating number of generated nodes of each simulation for lambda = 0.8.

D. Data structure and algorithm:

To generate q_i, we run the simulation for 500 times for each lambda. In each run, there is a while_loop which has two conditions to stop:

1. Continue until empty generation is obtained
2. Continue until specific generation number is reached, in a sense that we need a certain generation number to see the whole behavior of extinction probability. Here, it is 30.

After finishing all runs, we compute cumulative frequency of each generation in which extinction is obtained and then calculate probability of each generation.

E. Output metrics:

We are looking for a relationship between generation and extinction probability for lambda = [0.6, 0.8, 0.9, 0.95, 0.99, 1.01, 1.05, 1.1, 1.3].

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II. RESULTS

The results are shown in figures below. We provide both extinction and survival probability vs generation.

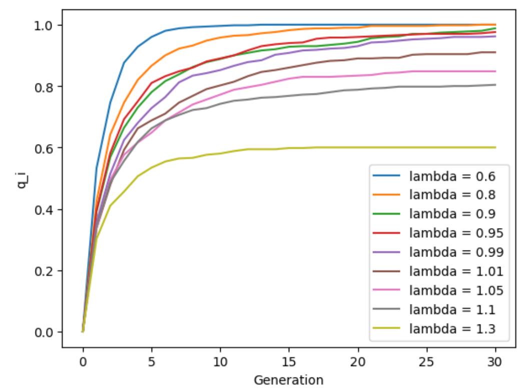

Fig1. Extinction probability vs generation

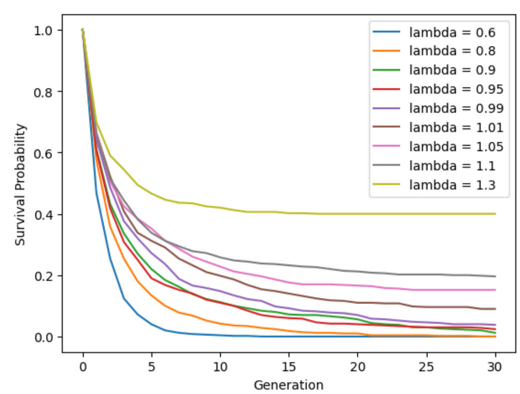

Fig2. Survival probability vs generation

The plots show that asymptotic extinction probability and extinction rate decreases as lambda increases. It is reasonable since we know that extinction probability should go to 1 for lambda < 1, and go to p0 for lambda > 1.

In terms of theory comparison, we showed that in fig1, equation q(i+1) > q(i) and phi(q) properties are satisfied. For example, on the one hand, when lambda = 0.6, extinction probability for generation 0 is q0 = exp (- 0.6) = 0.54 and it reaches close to 1 as generation increases. On the other hand, when lambda = 1.3, extinction probability for generation 0 is q0 = exp (- 1.3) = 0.27 and it reaches close to 0.5 as generation increases.

Histogram of node numbers of the tree for lambda = 0.8 is shown in figure 3.

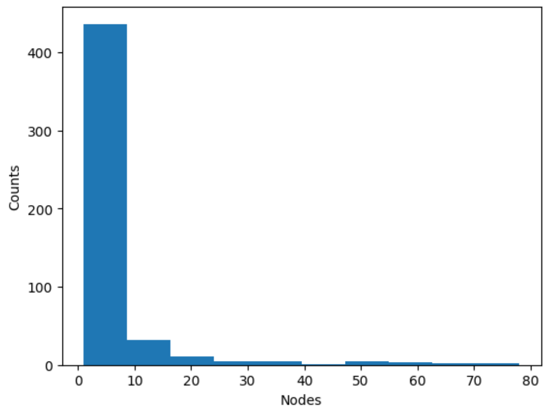

Fig3. Number of nodes in the tree in 500 runs