Assignment 2_Q1: How fluctuations vary with population size

Repeat Assignment 1 (mutation without selection) in a slightly different way. Divide population of size N equally between two types of individuals A and B represented by the numbers 0 & 1. Define mutation rates u1 and u2. Use u1=0.003 and u2=0.001

1. Repeat each simulation for different population sizes N=50, 100, 200, 300, 400, 600, 800,1000, 5000 for N_T=100 trials
2. For each value of N, choose a time-step at which the system has equilibrated (use your results from Assignment 1 to make this choice). For that time step, calculate the mean frequency and variance of the frequency by averaging over N_T=100 trials. Use the type with the large equilibrated frequency.

$$< f >_{trials} = \frac{1}{N_T} \sum_{i=1}^{N_T} f \qquad \text{: Mean}$$

$$< (\delta f)^2 >_{trials} = < f^2 >_{trials} - (< f >_{trials})^2 \quad \text{:Variance}$$

Plot a graph of Variance vs (1/N) and show that it is a straight line. This simulation is meant to show that fluctuations arising due to finite size of the population (quantified by variance) is *inversely proportional to population size (N).*

Assignment 2_Q2

Genetic Drift (neutral evolution) without mutation: Take a population of N=500 individuals *half of which* consist of type 0 and the remaining half of type 1, **initially**.
Assume that the fitness of both types are equal and neither type can mutate to the other.

(i) Write a program to obtain the time-evolution of the frequencies of the two types in the population when individuals making up the population in the next generation are chosen randomly from members of the current generation following Moran process.
Run the simulation for as long as it takes for any one of the two types to get fixed in the population.

(ii) Obtaining the Fixation Probability: Repeat the above simulation for **Nt=100** trials and find out the fraction of times each of the two types 0 and 1 get fixed ?
What do you expect the theoretical value of fixation probability for either sub-type to be ?

For any one trial, plot the evolution of frequency of type 0 and type 1 with time.