The tree.txt consists of locations of certain species of tree. Do the following problems.

1. Use a quadrat method to test the complete spatial randomness. Specify the number of quadrats you use in the test; give the test statistics and the p-value. What is your conclusion?

2. Calculate and plot the $G$ function. Obtain the simulated envelope and plot the envelope along with the $G$ function. What can you conclude from the $G$ function?

3. Calculate and plot the $K$ function. Obtain and plot the simulated envelope. What can you conclude from the $K$ function?

4. If we assume the spatial point patterns are from the homogeneous Poisson process, what is your estimated intensity $\lambda$?

5. *(Optional for non-stat majors)* The Cox process is a doubly stochastic process where the intensity function is considered to be a random process and conditional on the intensity function, the point process is a Poisson process. Formally, let $\Lambda$ be the random intensity with a probability density function

$$f(\lambda) = \frac{1}{\Gamma(\alpha)} \lambda^{\alpha-1} \exp(-\lambda)$$

and conditional on $\Lambda = \lambda$, $N(A)$ has a Poisson distribution with mean $\lambda |A|$. Please show that $N(A)$ has a negative Binomial distribution.