A Simple Combined Continuous-Discrete Model of Bacterial Growth on a Leaf Surface

Suppose that bacteria on a leaf grow according to the differential equation:

\[
\frac{dP}{dt} = 8.3178 \cdot P(t) \cdot \left(1 - \frac{P(t)}{M}\right)
\]

where M is the maximum number of bacteria that can be supported on the leaf. For this problem, suppose that \( M = 10,000,000 \). Suppose that the bacteria will grow as long as it’s raining, and when it stops raining, half of the bacteria immediately die, and the growth rate equation becomes:

\[
\frac{dP}{dt} = 0
\]

Suppose that the time between rains is about 7 days (exponential distribution with mean 7), and that once it starts raining, the rain lasts for at least one hour plus a random number from an exponential distribution with mean 3 hours. Start with an initial bacterial population of 1000. Simulate for 100 days. Generate a plot of the population for the 100 days. Turn in the network diagram and plot of bacterial population as a function of time for one replication. For this assignment, you do not need to worry about analyzing the output over multiple replications.