CDA5530: Performance Models of Computers and Networks (Fall 2008)

Project 4: Worm Propagation Simulation

(assigned 11/13; due: 11/25)

You are required to simulate simple worm propagation in a medium-scale network by using discrete-time simulation technique.

Assume that in an isolated network with $\Omega = 2^{32-n}$ IP address space (i.e., the network is assigned with /n IP prefix space), there are N vulnerable computers to a particular worm. These vulnerable computers have randomly assigned IP addresses within this network IP space. Now the worm starts its infection within this network from 1 initially infected machine. At each discrete time, a worm infected computer can scan η randomly picked IP addresses within this network. If it finds a vulnerable computer, it infects the vulnerable computer and this newly infected computer can start infecting others from the next discrete time.

For such a worm propagation, we have introduced that it can be modeled by:

$$dI(t)/dt = \eta/\Omega I(t)[N - I(t)]$$

Where I(t) is the number of infected computers at time t.

Your assignments are:

1). Simulate a worm propagation with parameters n=18, N=400, η=2. You need to simulate the worm propagation for 100 runs in order to get the average values for I(t) for each discrete time t. Each of your simulation run should end when all vulnerable machines have been infected.

a). Draw a figure to compare the I(t) derived from the simulations (averaged value) and the above formula. They should be matched with each other (with some statistical errors).

b). Draw a figure shows the I(t) from the first 5 simulation runs. This figure can show the statistical variance in worm propagation process.

2). Suppose the worm does not conduct random scan. Instead, when a computer is infected, it picks its IP address as the starting point and then sequentially scans IP addresses one by one up. After it finishes scanning the largest IP address in this network, it turns back to scan the smallest IP address in this network. The simulation parameters are still n=18, N=400, η=2, and you need to simulation 100 runs to obtain the average values.

a). Draw a figure shows the I(t) for this worm propagation compared with the simulated I(t) in 1). Is there any difference? What is the reason of this difference (or what is the reason there is no difference)?

<u>Submission</u>: Please submit a hard-copy report to me during class. Your report should explain how you design your simulation, what important variable you used in your code. Explain the meaning of each figure you draw. Then submit your simulation source code to me by email.