04/05/2022

Tuesday, April 5, 2022 11:07

5.10. (COMPUTER PROJECT) Twenty computers are connected in a network. One computer becomes infected with a virus. Every day, this virus spreads from any infected computer to any uninfected computer with probability 0.1. Also, every day, a computer technician takes 5 infected computers at random (or all infected computers, if their number is less than 5) and removes the virus from them. Estimate:

(a) the expected time it takes to remove the virus from the whole network;

(b) the probability that each computer gets infected at least once;

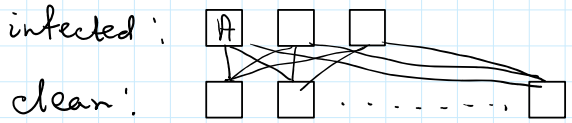
(c) the expected number of computers that get infected.

(*) Decide on N = (large number) of simulations; loop N times.

(*) A single simulation is also a loop thru unknown # days, until the network is clean.

(*) A single day:

(-) Morning: computers infect each other.



For each pair "infected/clean in the morning": Bernoulli trial with p=0.1 to spread the virus along this wire.

(-) Afternoon: technician comes.
If current # infected ≤ 5, cleans all, done with this round of simulation.
If current # infected > 5, pick randomly 5 of the infected and clean them.

(*) What do we need to count in each round of simulation?

(·) Number of days.

(·) Flag for each computer if it has been infected.
Event: "each computer has been infected at least once during the simulation". → YES / → NO

(·) # of computers that have been infected = #(flags = 1) in the end.