Assignment week 10

Social Networks

1. Suppose the basic reproductive number is estimated to be $\check{R}_0$ = 1.5 with standard error s.e.$(\check{R}_0)$ = 0.1. If a vaccine giving 100% immunity is available next time and a fraction *v* = 0.2 of randomly selected individuals were vaccinated, an estimate of the new reproductive number would be
    a. 0.9
    b. 1.1
    c. 1.2
    d. 1.5

    Explanation: An estimate of the new reproductive number would be

    $\check{R}$ **(U) =** $\check{R}_0$ (1 − v) = 1.5 ∗ 0.8 = 1.2

2. In the modeling of mitochondrial eve using Wright-Fischer model,
    a. Population size can be anything in any generation
    b. Population size doubles every generation.
    c. Population size remains the same in every generation.
    d. Population size halves every generation.
3. Suppose that a person carrying a new disease enters a population, and transmits it to each person he meets independently with a probability of 9/20. Further, suppose that he meets 1000 people from the population while he is contagious. What is the expected number of secondary infections produced?
    a. 1000^0.45
    b. 450
    c. 1000
    d. 45

    Explanation:
    The expected number of secondary infections produced= 9/20 ∗ 1000 = 450.

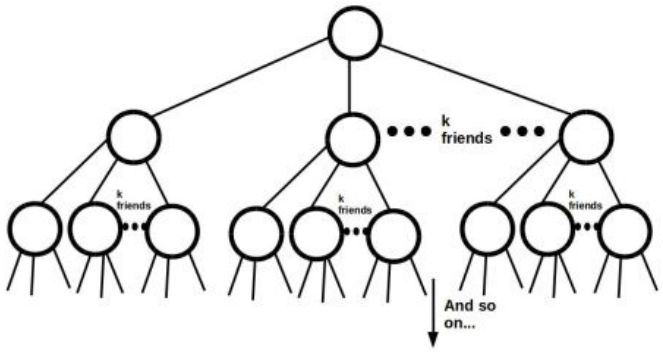
4. Consider a disease 'X'. People who are diagnosed in the earlier stage have a high chance of recovery. But the intense infection of 'X' will lead to death. The recovered people also stand a chance to get infected again. What kind of model does this disease 'X' exhibit?
    a. SIS
    b. SIR
    c. Both SIS and SIR
    d. Neither SIS nor SIR

Explanation: In SIS model, people can go from infected to susceptible, thereby getting prone to infection again.

5. Choose the correct statement from the following.
    a. Both SIR and SIS models can run for an infinite number of steps on a network.
    b. Both SIR and SIS model should come to an end after running for a finite number of steps on a network.
    c. SIS model should come to an end after running for a finite number of steps on a network, while SIR model can keep running indefinitely on a network.
    d. SIR model should come to an end after running for a finite number of steps on a network, while SIS model can keep running indefinitely on a network.

    Explanation: SIR model has a finite supply of nodes. Since, nodes can never be reinfected, the process should come to an end after a finite number of steps. An SIS epidemic, on the other hand, can run for an extremely long time as it cycles through the nodes potentially multiple times.

6. In a tree network (as shown in the following Figure), given that the probability of infection across every edge is p and every node has k children, what will be the expected number of secondary infections produced from an infected person?:



    a. p^2
    b. log(k)
    c. p × k
    d. p^k
7. For a contagion to ultimately die away from a population, the basic reproductive number (R_0) should be:
    a. R_0 > 1
    b. R_0 = 1
    c. R_0 < 1
    d. None of the above

Explanation: Basic reproductive number R_0 is the number of secondary infections produced. Hence, the infection will ultimately die away if $R_0 < 1$.