Homework 12
MO412 - Network Science

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(Classic Epidemics on Bipartite Networks)

Consider a bipartite network with two types of nodes, which we indicate as male (M) and female (F). Assume we have the same number N of nodes of each type. On this network, a pathogen can be transmitted only from a node of one type to a node of the other type. Assume that the rate of transmission from an M node to an F node, $\beta 1$, is different from the rate of transmission from an F node to an M node, $\beta 2$. Write the equations of the corresponding SI model, assuming a classical approach with homogeneous mixing. Specifically, write the differential equations governing the growth over time of both $f(t)$, the fraction of infected F nodes over total F nodes, and of $m(t)$, the fraction of infected M nodes over N as well.

You do not need to solve the equations, just to write them down. But please explain all the steps you take.

Number of nodes $= 2N$

Probability that the infected person (M) encounters a susceptible individual is $S(t)/N$

Probability that the infected person (F) encounters a susceptible individual is $S(t)/N$