1163-39-1170 **Harold M Hastings*** (hhastings@simons-rock.edu) and **Tai Young-Taft**. *Vector difference equations, Gerschgorin's theorem, and design of multi-networks for human interactions to reduce spread of epidemics.* Preliminary report.

We start with the SIR model (susceptible, infected, removed) on a network. Since the goal is to make $I = 0$ a (Lyapunov) stable equilibrium, we linearize the discrete-time SIR model to obtain difference equations of the form $I_{new} = I(1+aS-b)$ at each node before including infections derived from other nodes. We assume S equal to its initial value at that node. Here a depends upon the infectivity and contact rate, $b = 1/\tau$ where $\tau =$ duration of infectivity and the traditional $Rt = aS/b$ ($Rt < 1$ corresponds to $aS < b$). This yields a vector difference equation $\mathbf{I_{new}} = \mathbf{MI}$. Since all entries in M are assumed non-negative, one expects that the maximum row sum is a relatively tight bound on the maximum eigenvalue by the Gerschgorin circle theorem. Interpretation: for 0 to be a stable equilibrium (the infection dies out), the total flow into any node must be less than the value of $aS - b$ at that node. The entries of M may vary in time, even discontinuously as flows between nodes are turned on and off. This may yield useful design constraints for a multi-network composed of weak and strong interactions between pairs of nodes representing interactions within and among cities. (Received September 15, 2020)