**Exercise 2: SIR model continued.**

Part 1: SIR model with drug therapy

Using your SIR model from exercise 1 and running the model for 1000 days,

1. Incorporate a birth and death rate of 1/100 persons per day.
2. Incorporate a loss of immunity rate of 1/50 days
3. Incorporate drug therapy into your model in the following ways
   1. as a flow from I to R
   2. as a flow from I to T
   3. as a flow from S to I and T

Assume that Treated individuals are not infectious. Comment on the differences in the models

Part 2: Thinking about disease

(adapted from Brauer F, van den Driessche P & Wu J (2008) Mathematical Epidemiology, Mathematical Biosciences Subseries, Springer-Verlag, Berlin)

1. Ebola

The Ebola virus erupts occasionally in Africa. Ebola causes hemorrhaging and death in humans after about 10 days and people in contact with infectives can become infected. It is also possible to get infected through contact with infectives after death. Quarantine (isolation) of patients is an effective control procedure for Ebola. Develop a model for the spread of Ebola that includes quarantine of a fraction of the patients.

2. Gonorrhea

Gonorrhea is a sexually transmitted disease caused by a gonococcus bacterium. Assume that it is spread from women to men and from men to women. Recovery from gonorrhea does not confer immunity. Formulate a model for gonorrhea with heterosexual transmission. How would you change your model to include consistent condom use by a fraction of the population?

3. Tuberculosis

Worldwide, tuberculosis (TB) accounts for more deaths than all other diseases combined. The standard treatment for active tuberculosis is to give multiple drugs for at least 6 months. This therapy is effective if the person has drug sensitive TB. Drug resistant strains of TB emerge when people do not complete a full course of treatment. Formulate a model for TB with drug sensitive and drug resistant strains of TB.