MATH 3MB3 FALL 2018 HOMEWORK 2
Due Monday October 15 at 11:59PM

Format your report using some form of word processing software (Word, Latex, OpenOffice, ...), export it to a PDF file and submit it via email to:

- Alexandra Bushby, bushbya@mcmaster.ca if your last name starts with A-G or if you are submitting using R
- Robert White, whitere@mcmaster.ca if your last name starts with a H-Z, or you plan on using Python, and you don't plan on using R

together with a file containing the code you used for your computer simulations.
Make sure that your email has the proper subject line and information from the outline.

Question 1

Lets let A be the number of young adults in a population and E be the number of elderly people in the population. We assume that the birth rate for young adults is b, and the birth rate for elderly is 0. Furthermore we assume that survival rates for adults and elderly are s_A, s_E respectively. It is further assumed that if a young adult survives for the year they magically become elderly. Recall that all rates are always between 0 and 1.
a) Find the eigenvalues

b) Find the eigenvectors (do not simplify the complicated one)

c) Use a) and b) to setup the explicit solution given initial values $A(0) = A_0$ and $E(0) = E_0$. Do NOT solve for C_1, C_2

For the rest of question 1) use computer software and set $s_A = \frac{1}{10}$, $s_E = \frac{1}{20}$, $b = \frac{1}{4}$, $A(0) = 50$, $E(0) = 20$:
d) What is the explicit solution now?

e) Calculate $A(10)$ and $E(10)$

f) Describe what you expect to happen to A and E over time. Justify

using b), c), d), e).

g) Plot A and E as functions of time (at least till time 10), and describe their long term dynamics

1. QUESTION 2

Given the system $x' = x^2 - 2x - 3$.
a) Classify the model

b) Find the fixed points

c) Find the stability of the fixed points

d) Find an explicit solution of the model

For the following use computer software:
e) Run three numerical experiments with initial conditions of (N(0)=-5, N(0)=1, N(0)=10) and use the explicit formula with $t = 1, 10, 100$ to determine the long term dynamics of each initial condition.

f) Do your results in part e) agree with part b), c)? Explain!