MATH 3MB3 FALL 2016 SAMPLE MIDTERM 2

Question 1. Consider the state variable $N(t)$ given by

$$N(t+1) = N(t)(0.3 + (1-\alpha)N(t)).$$

Here $0 \leq \alpha \leq 1$ is a constant. In what follows, we study the dynamics of the model and, in particular, its dependence on α.

a) Classify the model.

b) Find the fixed points.

c) Determine the stability of each fixed point.

Hint: the case $\alpha = 1$ should be treated separately in all three subquestions above.

Question 2. For a specific choice of parameters s_J, s_A and f, the juvenile-adult model takes the form

$$\begin{bmatrix} J(t+1) \\ A(t+1) \end{bmatrix} = \begin{bmatrix} 0 & 3/16 \\ 1/3 & 1/2 \end{bmatrix} \begin{bmatrix} J(t) \\ A(t) \end{bmatrix},$$

where J is the number of juveniles, A the number of adults and t is time.

a) Classify the model.

b) Find the fixed points.

c) Determine the stability of each fixed point.

Question 3. The evolution in time of a quantity $x(t)$ is given by

$$\frac{dx}{dt} = 2x.$$

The initial condition $x(0)$ is not known.

a) Classify the model.

b) Find the fixed points.

c) Determine the stability of each fixed point.

d) For the initial condition $x(0) = 5$, both obtain and graph the solution $x(t)$.