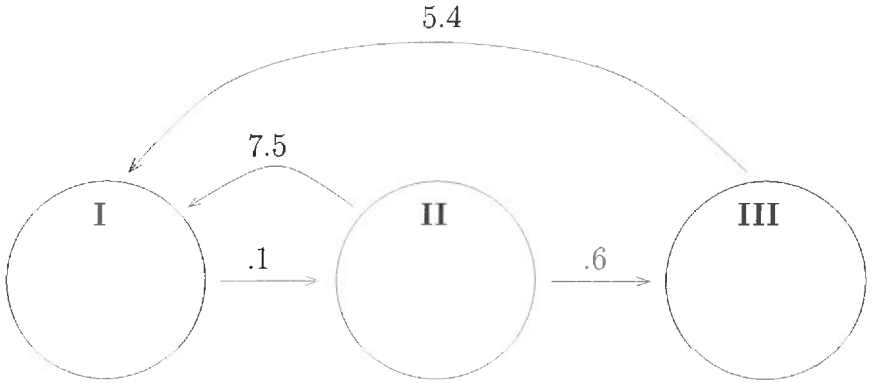
Mathematics 172

Quiz 24 Name: Key

You must show your work to get full credit.

1. The life cycles of a biannual plant are summerized by the loop diagram:



(a) What is the Leslie matrix?

$$L = \begin{bmatrix} 0 & 7.5 & 5.4 \\ .1 & 0 & 0 \\ 0 & .6 & 0 \end{bmatrix}$$

(b) If this year there are there are 45 plants in Stage I, 30 plants in Stage 2, and 9 in Stage III how many are in each stage next year?

Number in Stage I 273.6

Number in Stage II 4.5

Number in Stage III 18.0

(c) What is the proportion in each stage 20 and 21 years from now?

Proportion in Stage I in year 20 .8671

Proportion in Stage II in year 20 .0841

Proportion in Stage III in year 20 .0489

Proportion in Stage I in year 21 .8671

Proportion in Stage II in year 21 .0841

Proportion in Stage III in year 21 .0489

(d) Has the population reached its stable age distribution? Write a couple of sentences explaining your reason. Yes, as the proportion in each age class is staying the same from year to year.

2. For the system of equation for two competing species:

intercepts (100,0), (0,50)

$$\frac{dx}{dt} = .1x\left(\frac{100 - x - 2y}{100}\right)$$

$$\frac{dy}{dt} = .15y\left(\frac{200 - 4x - y}{200}\right)$$

intercepts (0,200), (50,0)

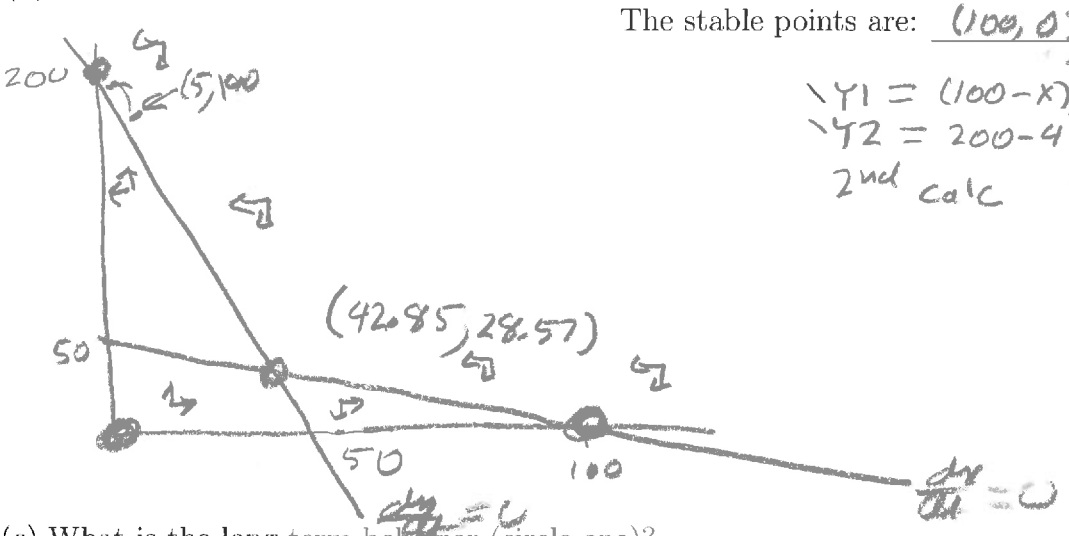
(a) Find the equilibrium points. Equilibrium points are: (0,0), (100,0), (0,200), (42.8, 28.6)

(b) Graph the phase space and use it to classify which of the rest points are stable.

The stable points are: (100,0), (0,200)

(42.85, 28.57)

Y1 = (100-X)/2
Y2 = 200-4X
2nd calc intersect



(c) What is the long term behavior (circle one)?

Competitive coexistence, completive exclusion, x-species dominate, y-species dominates.

(d) If $x(0) = 5$ and $y(0) = 190$ estimate the following:

$x(78) \approx$ 0 $\qquad$ $y(78) \approx$ 200

(e) If $x(10) = 40$ and $y(10) = 30$ estimate the following:

$x(10.1) \approx$ 40 $\qquad$ $y(10.1) \approx$ 30.0225

$$x'(10) = .1(40)\left(\frac{100 - 40 - 2(30)}{100}\right) = 0$$

so

$$x(10.1) \approx x(10) + x'(10)(.1) = 40 + 0(.1) = 0$$

$$y'(10) = .15(30)\left(\frac{200 - 4(40) - 30}{200}\right) = .225$$

so

$$y(10.1) \approx y(10) + y'(10)(.1)$$
$$= 30 + (.225)(.1)$$
$$= 30.0225$$