

HW 2  
Due Sept 21

1. text pg 61: 1(a), (c)

Note: In (a) you can assume  $\alpha \neq 1$  and  $\beta \neq 1$ .

2. text pg 62: 3

Note: In this problem you can assume both  $\alpha$  and  $\beta$  are positive.

3. text pg 63: 8 **but** replace (a)-(c) with the following questions:

a) Find the steady states. For each one give any conditions on the parameters so it is physically relevant.

b) Is the zero steady-state stable or unstable?

c) Is the nonzero steady-state stable or unstable?

4. The Leslie-Gower (1958) competition model that is used to study two species in competition for the same resources can be written as

$$x_{n+1} = \frac{ax_n}{1 + x_n + by_n}$$
$$y_{n+1} = \frac{cy_n}{1 + dx_n + y_n}$$

where  $a$ ,  $b$ ,  $c$  and  $d$  are positive constants.

a) Explain how the terms in the two equations are responsible for this being a competition model.

b) There are four possible steady-states. Find them and for each one give any conditions on the parameters so it is physically relevant.

c) One of the steady-states is  $\bar{x} = \bar{y} = 0$ . Is it stable or unstable?

d) Only one of the steady-states has both values nonzero. Assuming  $a = b = c = d = 2$ , is it stable or unstable?