

*You must show your work to get full credit.*

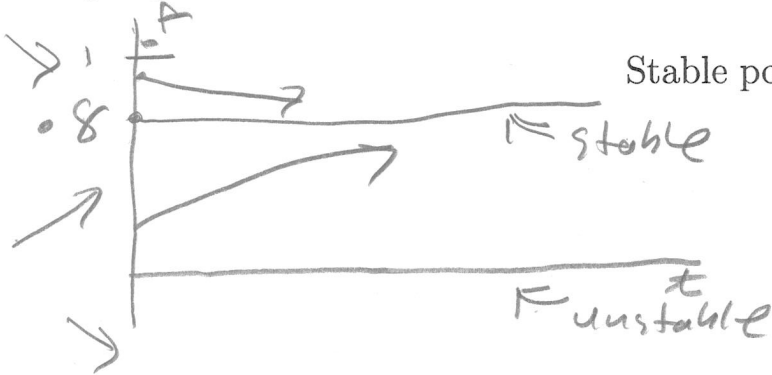
A group of islands in the Indian Ocean has a group of small islands that has a metapopulation of fruit bats. If  $f$  is the fraction of the islands that have a population of bats at time  $t$ , the rate of extinction on any one island is  $p_e = .1$  and the rate of colonization is  $p_i = .5f$ .

1. Write a rate equation for  $f$ .  $\frac{df}{dt} = p_i(1-f) - p_e f$  which becomes  
 $\frac{df}{dt} = .5f(1-f) - .1f$

2. What are the equilibrium points?

Solve  
 $\frac{df}{dt} = .5f(1-f) - .1f = 0$  Equilibrium points are: 0, .8  
 $f(.5(1-f) - .1) = 0$   
 $f = 0$  or  $.5(1-f) - .1 = 0$   
 $.5 = .5f + .1$   
 $-.5f = -.4$   
 $f = \frac{.4}{.5} = .8$

3. Which of the equilibrium points are stable? *Hint: Draw a graph to see what is going on.*



Stable points are: .8

4. In the long run do the bats go extinct? If not what fraction of the islands has a bat population?

Does population go extinct? No

Proportion of islands with bats: .8 = 80%