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% Jason Baldwin
% MAth 246
% Extra Credit
% Problem 9.4 number 4 at Alpha = 0
% Problem 9.5 number 4 at Alpha = 1

[x,y] = meshgrid(0:.1:2, 0:.1:2);
U1=x.*(1.5-.5*x-y);
V1=y.*(.75-y-.125*x);
U2=x.*(1.125-x-.5*y);
V2=y.*(-1+x);
warning off all
for alpha=0:.1:1
   figure;hold on
   U=(1-alpha)*U1+alpha*U2;
   V=(1-alpha)*V1+alpha*V2;
   L=sqrt(U.^2+V.^2);
   quiver(x,y, U./L,V./L,.5)
   axis equal
   k=@(t,x)[(1-alpha)*x(1)*(1.5-.5*x(1)-x(2))+alpha*x(1)*(1.125-x(1)-.5*x(2));(1-alpha)*x(2)*(.75-x(2)-
.125*x(1))+alpha*x(2)*(-1+x(1))];
for a=-2:.25:2
for b=-2:.25:2
   [t,xa]=ode45(k,[0 10],[a b]);
   plot(xa(:,1),xa(:,2),'r');
   [t,xa]=ode45(k,[0 -5],[a b]);
   plot(xa(:,1),xa(:,2),'r');
end
end
axis([0 2 0 2])
title (alpha)
end
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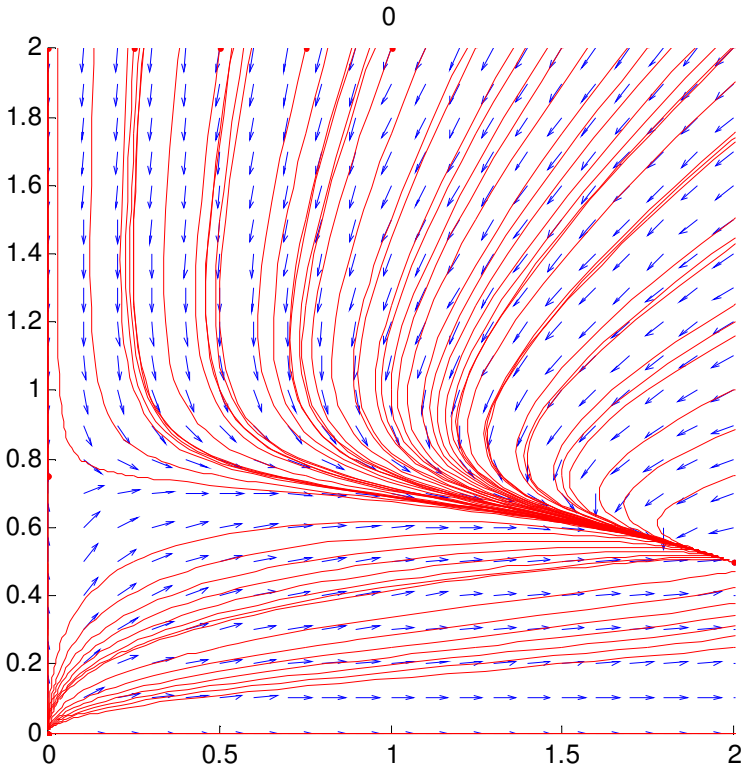
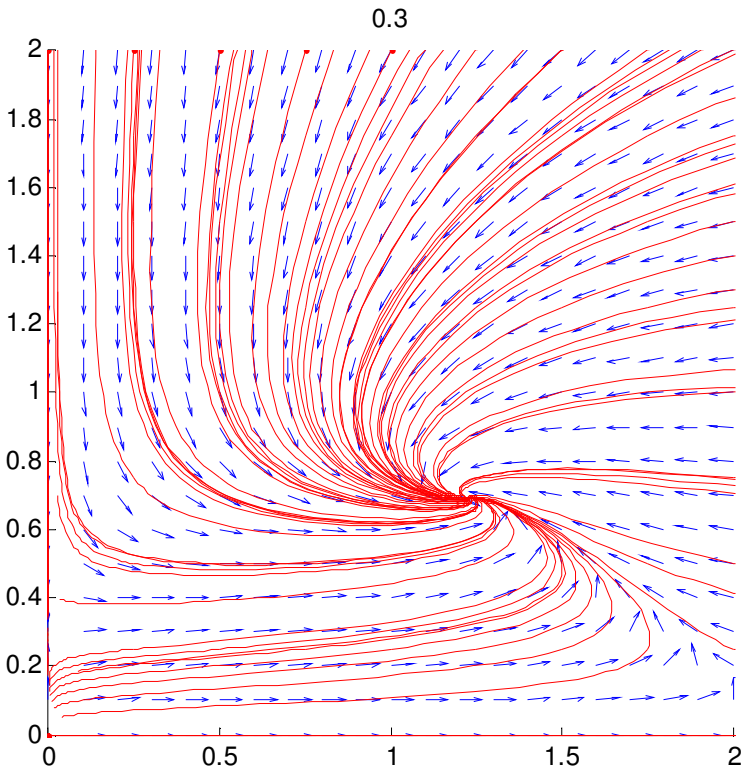
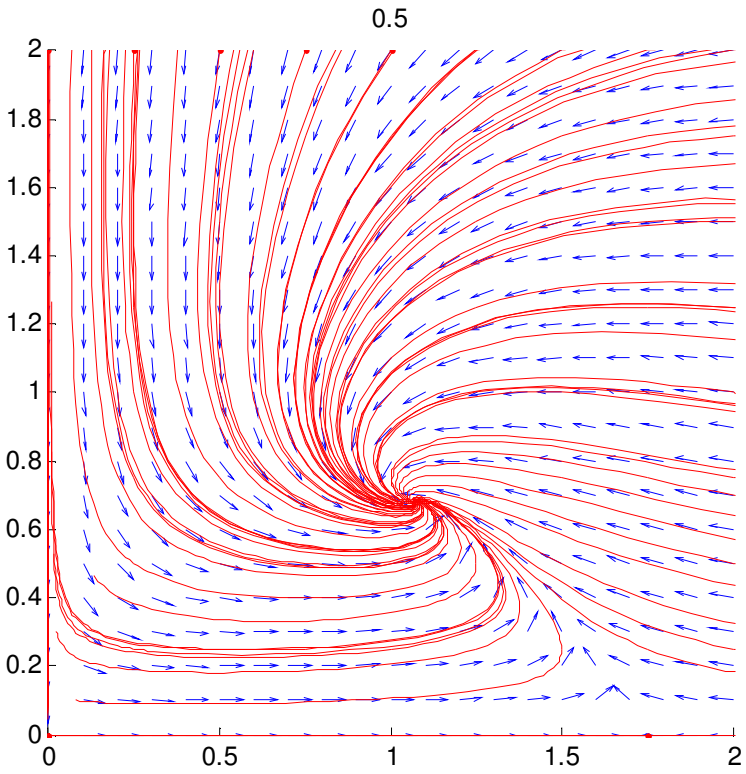


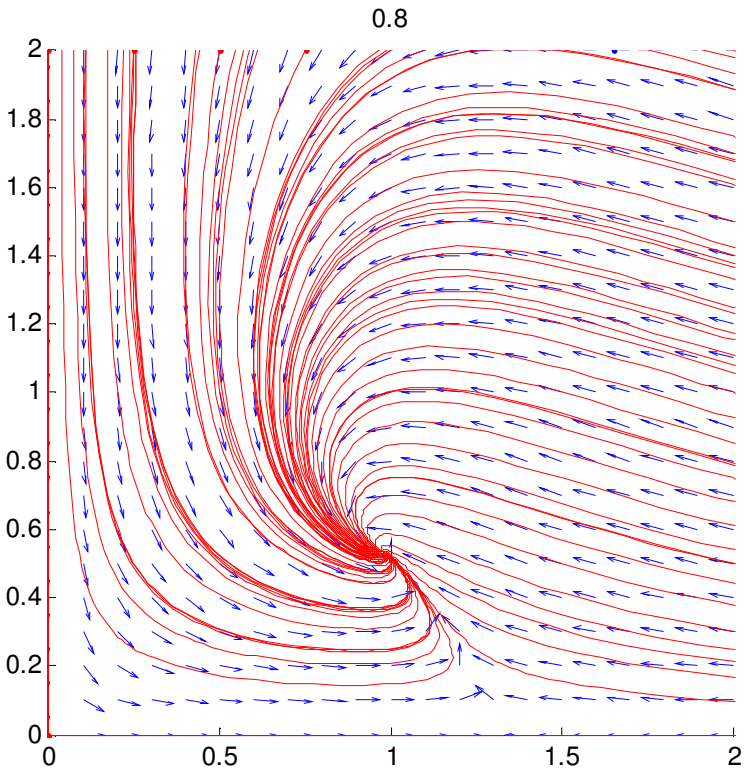
When α=0 the graph shoes a true competing populations. The critical values at this time are (0,0) and (0,0.8). The initial values for this time period seem to go toward a non linear line form (0,0.8) to roughly (3 ,0). This is when neither of the populations really has yet to get an advantage on one another and rather competing for the same food and living space. There are small signs of predator prey happening though the way the top is curling a little shows signs that one may be killing the other now and then.



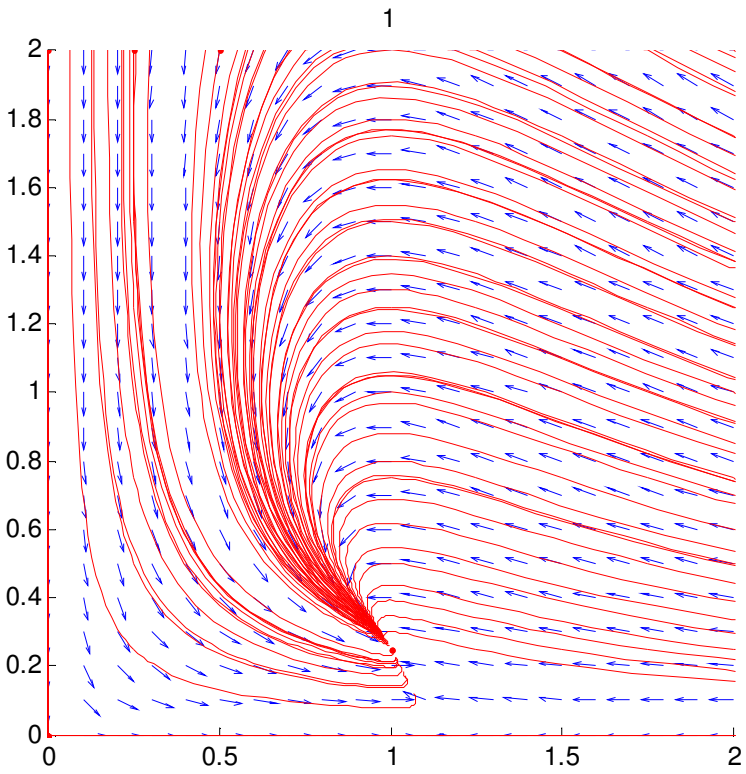
When α=0.3 there are some real signs that the predator prey happens more often with there now being a defined portion of a spiral at roughly point (1.25, .7) the critical point at (0,0) is now mostly gone. There is a trend to emerge with the predator prey relationship and there is slowly becoming less visible of the competition phase for food.



When α=.5 , this is when the there should be half way between the time of competing populations and a true predator prey model there is now a even more defined inward curl for the majority of the graph. A significant portion of the population of the one animal is now consuming or killing the other. The critical point is at roughly (1.1,.7) now.



At α=.8 , the swirl is becoming tighter and more defined showing more and more of the predator prey relationship breaking through. The critical point is now roughly (1, .55) the curving is becoming more evident showing that the animals are truly evolving to the predator and the prey. The large majority of the predators diet are now the pry animal.



At this point α=1, there is a full predator-prey relationship. The one species has completely evolved at this point in which it eats the other animal as its source of food. There is still a critical point but it has moved to (1, .3). Predator is now reliant on the consuming of the prey. The curvature of the swirl is now extremely defined and evident. Due to the placement of the critical point it is evident that the prey is not solely the predator's food source but is a leading limiting factor in the prey's population.