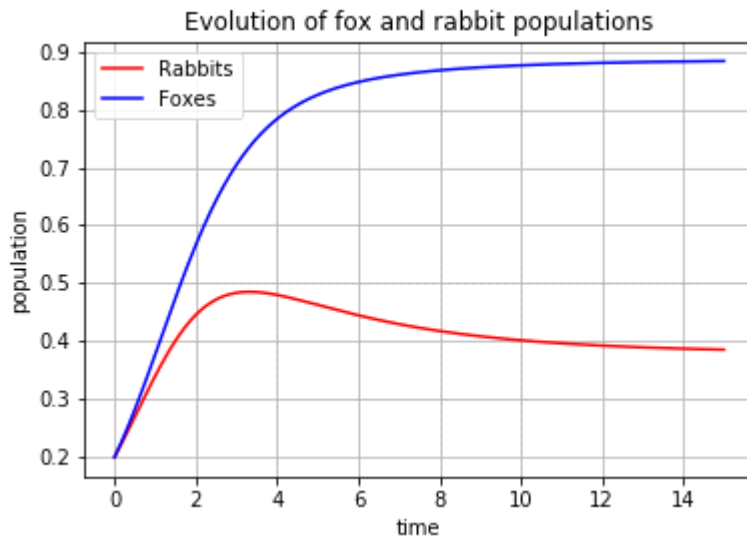


a) Consider the following Lotka-Volterra model

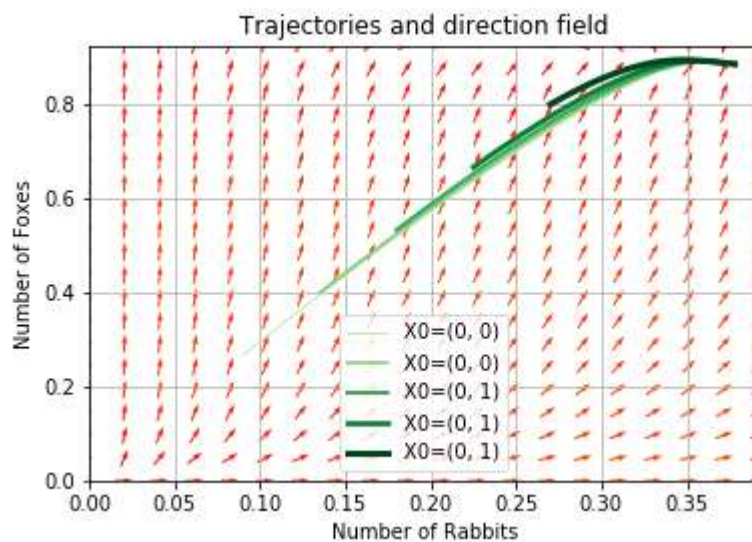
$$dN_1/dt = N_1(1 - N_1 - 0.7N_2)$$

$$dN_2/dt = N_2(1 - N_2 - 0.3N_1).$$

- First, make a plot of $N_1(t)$ and $N_2(t)$ starting with $N_1 = N_2 = 0.2$.



- Then, make a phase plot with the axis corresponding to N_1 and N_2 that shows N_1 and N_2 for several time points starting from a few random initial conditions.



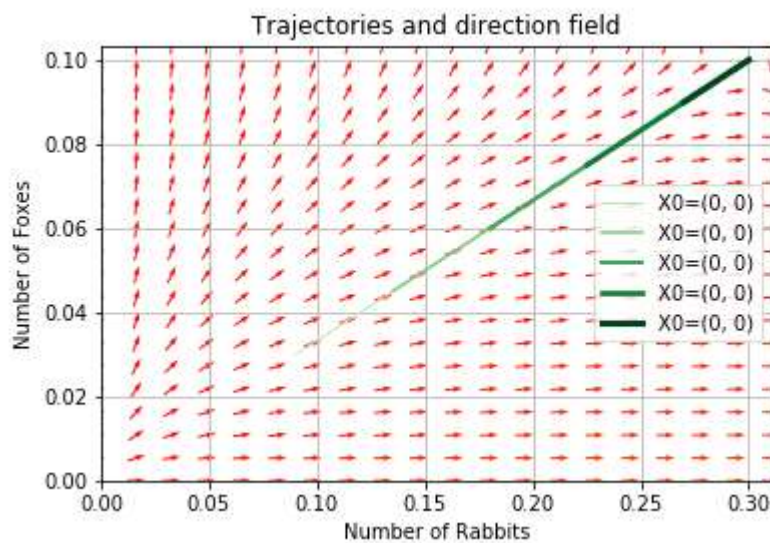
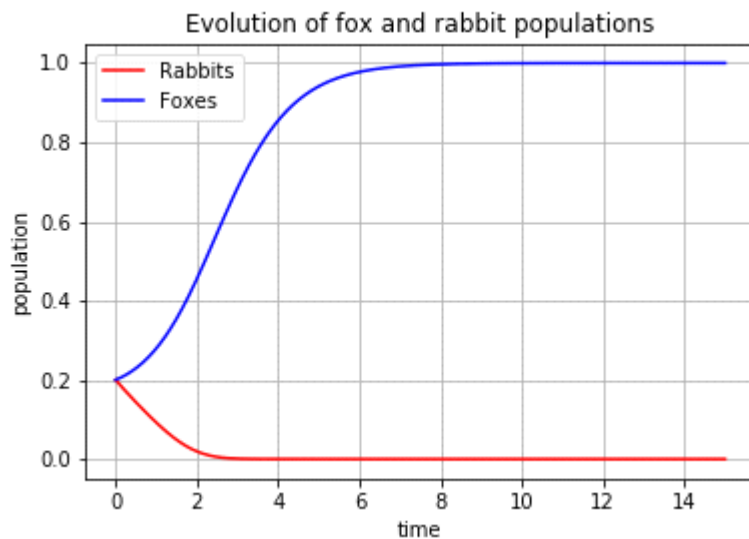
- How do you describe the outcome of the competition between the species? 1/2

The foxes seems to be winning the competition between foxes(1) and rabbits(2) since the second graph shows the convergence of the vector field towards a point where the Population of rabbits is half of the population of the foxes.

(b) Repeat the analysis above for

$$dN_1/dt = N_1(1 - N_1 - 7N_2)$$

$$dN_2/dt = N_2(1 - N_2 - 3N_1),$$

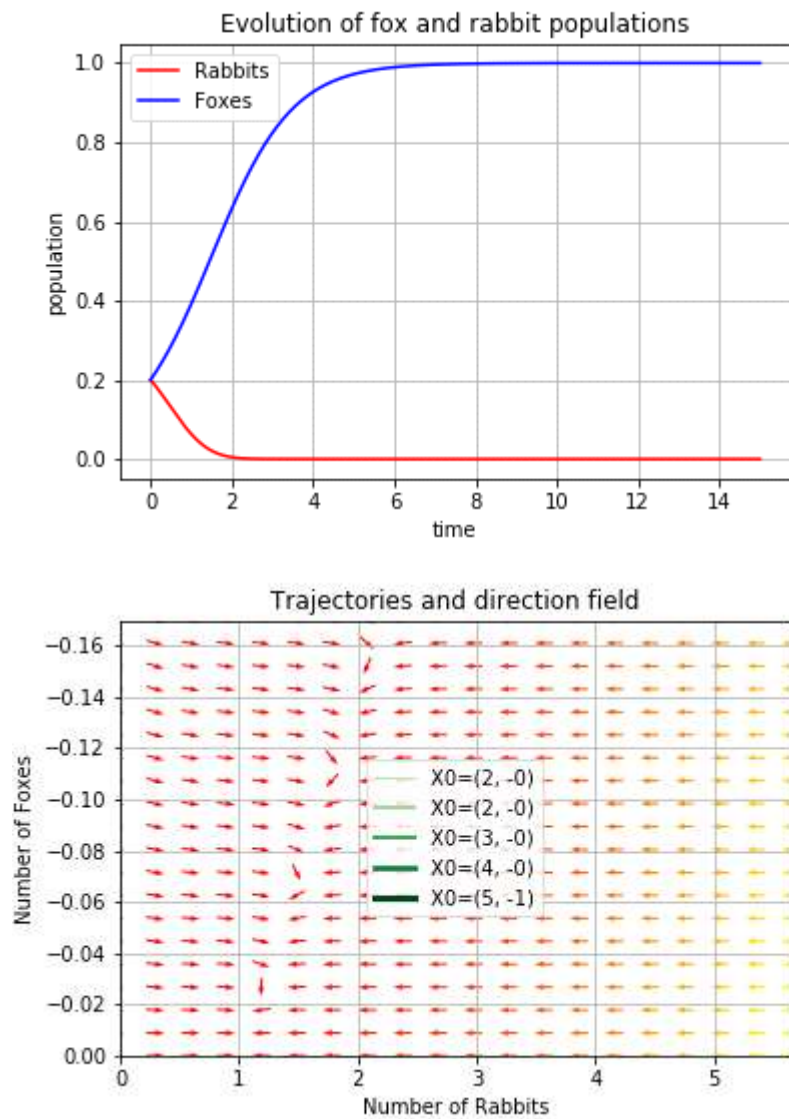


The foxes are seemed to have dominated the niche. Since the population of rabbits is dying very fast and then both the foxes and rabbit's population remains constant.

(c) Repeat the analysis above for

$$dN_1/dt = N_1(1 - N_1 - 7N_2)$$

$$dN_2/dt = N_2(1 - N_2 - 0.3N_1).$$



Since the population of rabbits is declining and reaching to zero, then the fox's population remains constant.