EXERCISE 1

24.10.2013

Consider the following system:

\[
\begin{align*}
\dot{x} &= -x + ay + x^2y \\
\dot{y} &= b - ay - x^2y \\
\end{align*}
\]  

(1)

where \(a\) and \(b\) are parameters. Let \(b = 0.6\) and \(a \in [0, 0.5]\).

Answer to the following questions:

a) Find the equilibria of the system.
   Solution: Solve by simple algebra or by using the matlab script equilibria.m.

b) Write the Jacobian matrix as a function of parameter \(a\).
   Solution: Solve by calculating the derivatives of the right hand side of the equations with respect to the state variables, or use the matlab script jacob.m.

c) Evaluate the stability of the equilibria by varying parameter \(a\).
   Solution: Use the matlab script jacob.m.

d) Identify the bifurcations of the equilibrium by simulation.
   Solution: Use the matlab scripts flow.m and model.m.