HW 18 Tim Nosratka

7.3

1) $x'(t) = x(t)(1 - x(t) - y(t))$ $\quad f(x,y) = x(1-x-y) = x - x^2 - yx$

$y'(t) = x(t)(3 - x(t) - 2 - y(t))$ $\quad g(x,y) = x(3 - 2x - y) = 3x - 2x^2 - xy$

$0 = f(x,y)$ $\quad x = 0,\ y = y$ or $x = 2\ \ y = -1$

$0 = g(x,y)$

FP's = $(0,y)$ or $(2,-1)$

2) $J = \begin{bmatrix} 1-2x-y & -x \\ 3-4x-y & -x \end{bmatrix}$

3) J at $[0,y] = \begin{bmatrix} 1-y & 0 \\ 3-y & 0 \end{bmatrix}$ $\quad \det(J - I\lambda) = (1-y-\lambda)(-\lambda)$ $\quad \lambda_1 = 0$ $\quad \lambda_2 = 1-y$

Regardless of what y is, this point will at most be semistable as $\lambda_1 = 0$. However, if λ_1 was less than 0, then y must be greater than 1 for this pt to be stable.

J at $(2,-1) = \begin{bmatrix} -2 & -2 \\ -4 & -2 \end{bmatrix}$ $\quad \det(J - I\lambda) = (-2-\lambda)^2 - 8$

$\lambda_{1,2} = -2 \pm 2\sqrt{2}$

Since λ_1 $(-2+\sqrt{2} \cdot 2)$ is greater than 0, this point is not stable either.