Homework 4: MATH 490C / BIOL 595N, Due Wednesday, 2/8

THIS IS A GROUP HOMEWORK ASSIGNMENT: turn in one set of solutions per group and list the members of the group on your solution sheet.

1. Consider the system

$$\begin{cases} \dot{x} &= -x^3 + x - y \\ \dot{y} &= \epsilon(y - 2x^2 + x + a) \end{cases}$$

   where a is a parameter and ϵ is a small number. Identify the fixed points of the system, investigate the stability of each, and explain in broad outline the dynamics of the system for $a = -1$, $a = 0$, $a = 1$, and $a = 3$ for ϵ positive and negative (for example, you may use $\epsilon = \pm.01$). In total you have 8 cases to consider.

2. Fall, et al, section 2.8, number 10. You may take screen shots of simulations to show the nullclines and solution trajectory, but you must indicate the parameters that you use.

3. Describe a method to create figures like those in Figure 2.7 in Fall, et al for each of the Ca current and the K current as described by the Morris-Lecar model. You need to give a precise, step-by-step description that could be used by someone familiar with differential equations and numerical solvers but who may not know about the details of the model.

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