Exercises

- *What models are*. In each of the following cases (a-d) answer the following: (i) What might be seen as a model, and how might it represent a real-world system? (ii) Give an example of a question about that real-world system that could be at least partly answered by analyzing the model. What are some limitations to how well that question can be answered with the model?
    a) A mathematician writes down equations describing two quantities, X and Y. X increases when Y is small and decreases when Y is large. In contrast, Y increases when X is large, but decreases when X is small. She graphs changes to X and Y over time, and experiments with the exact rates at which X and Y grow and shrink in relation to each other.
    b) A biopsychologist wants to understand the role of hormones in human cognition. He breeds rats that lack receptors for the hormone vasopressin, thought to be involved in social cognition and emotion. He studies the formation of partner preferences with these rats, as well as with other control rates that do not lack the receptors.
    c) An engineer builds a scale replica of the San Francisco Bay watershed in her garage, including the water and all major geological and civic structures (inlets, bridges, etc.). She can modify the replica in any way she likes.
    d) A behavioral economist recruits college students into his lab for an experimental game, in groups of four. He gives each individual $10, and allows each to either keep the money or donate some proportion to a central fund. All donated money is then doubled and distributed evenly among all four players.