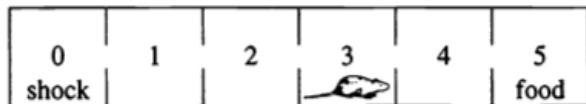


# Math 112B/212B, Introduction to Mathematical Biology, Homework 5

1. Which project have you chosen as your Final Project? (Please print the project number if it is from the list, and the project title. If it is a different project, please email the Professor first, before the weekend). Please list your group members.
2. Suppose a system is characterized by a stochastic variable that can take values  $\{0, 1, 2, 3, 4\}$ . The probability to go from  $i$  to  $i + 1$  is given by 0.1 for  $i = 1, 2, 3$ . The probability to go from  $i$  to  $i - 1$  is 0.2 for  $i = 1, 2, 3$ . There are no other jumps that can happen, except for  $i \rightarrow i$ . (a) Write down the transition matrix for this problem. (b) Are there any absorbing states and transient states? Which ones? (c) What is the probability that the system ends up in each of the absorbing states, starting from state  $i = 1$ ? Starting from  $i = 2$ ? Starting from  $i = 4$ ?
3. Assume that in the previous system, the probability to jump  $i \rightarrow i - 1$  is 0.2 for states  $i = 1, 2, 3, 4$ . Same questions (a-c).
4. Assume that in the previous system, the probability to jump  $i \rightarrow i - 1$  is 0.2 for states  $i = 1, 2, 3, 4$  and the probability to go from  $i$  to  $i + 1$  is given by 0.1 for  $i = 0, 1, 2, 3$ . Same questions (a-c).
5. A rat is put into the linear maze as shown: (a) Assume that the rat is equally likely to



move right or left as each step. What is the probability that the rat finds food before getting shocked? (Assume that the shock is very mild, just a bit of unpleasantness!!)

(b) As a result of learning, at each step the rat moves to the right with probability  $p = 1/2 + s$  and to the left with probability  $1/2 - s$ , where  $0 < s < 1/2$ . What is the probability that the rat finds food before getting shocked?