

Your Name: \_\_\_\_\_

Names of people you worked with: \_\_\_\_\_

**Instructions:** Work on this problem in class with your group (if you are attending class synchronously) or out of class (hopefully with a person or two! if you are attending class asynchronously). The problem should be done on a piece of paper with a pencil or on some kind of tablet. The problem should **not** be typed up or done in LaTeX.

Work for a *maximum* of 15 minutes on the problem (regardless of what time you are working). *Do not* come back to the problem to “fix it up” or “finish it.” Be sure to write down the names of the people you worked with during class (or outside of class).

Take a picture of your work and use a scanning app to create a pdf (or create a pdf directly from your tablet). Upload your work to Gradescope (via Sakai) within 24 hours of class.

**Task:** Rose rides a bicycle to work. There is a sequence of two sets of traffic lights on her route, not far apart. For simplicity, we ignore the yellow and assume the lights are only red or green. Suppose the probability that the first set is green when she arrives at it is 0.3. If she gets through on green at the first set, the probability that the second set is green when she arrives is 0.6; if she has to stop on red at the first set, the probability that the second set is green when she arrives is 0.4.

**Given the second light is green, what is the probability that the first light was also green?**

To start: This part is sometimes hard, but it is always super important. You should practice being able to convert the words in the problem into the notation we’ve seen in class. I’ve written it here so that you can see a full example. Consider the sample space to be the following (note that the outcomes are not all equally likely!):

$$S = \{(g_1, g_2), (g_1, r_2), (r_1, g_2), (r_1, r_2)\}$$

With the following events (can you match which outcomes in the sample space would go into each event?):

$$\begin{aligned} G_1 &= \{ \text{first light is green} \} \\ G_2 &= \{ \text{second light is green} \} \\ R_1 &= \{ \text{first light is red} \} \\ R_2 &= \{ \text{second light is red} \} \end{aligned}$$

In terms of the sets above, how do you write the probability of interest? Use Bayes’ Rule to find the value of the probability.

Hint: you can start by writing down the given numbers in terms of the events of interest.

Extra thought question: are the events  $G_1$  and  $G_2$  independent? How would you know?