Exercises for The Little Logic Book may be downloaded by the instructor as Word documents and then modified for distribution to students; or students may be instructed to download the exercises and then told which ones to answer. This is an exercise bank; it is not assumed that students will do all the exercises for any one chapter. Comments, questions or suggestions for Chapter Eight of The Little Logic Book can be sent to logic@calvin.edu

Exercise Bank for Chapter Eight:
Probability
(Posted June, 2014)

1.0 Basic Concepts
Define or identify the following:

    1.1 Conditional probability
    1.2 Frequentism
    1.3 Propensity theory
    1.4 Classical theory
    1.5 Subjectivist theory
    1.6 Bayesianism
    1.7 Salience
    1.8 Gambler's fallacy
    1.9 Conjunction fallacy
    1.10 Base rate fallacy

2.0 Probability Basics
Indicate whether the following statements are true or false; briefly explain your answer.

    2.1 If we are all really convinced that a proposition P is true, then the probability that P is true is 1.
    2.2 If proposition P is the conclusion of a deductively valid argument, and all the premises of that argument are true, then the probability that P is true is 1.
    2.3 There are some things whose probability value we are unable to determine.
    2.4 Any necessary falsehood has a probability of less than .5.
    2.5 Rational people can disagree over the probability value of some specific thing or event.
    2.6 The Gambler's Fallacy is just a problem for gamblers.
    2.7 If a proposition has a probability of being true of .4, the probability of its being false is -.4.
    2.8 If $(P \rightarrow Q)$ is true, then the probability of $(P \land Q)$ is equal to: Prob(P) + Prob (Q).

3.0 Probability Theory

    3.1 What are two reasons sometimes given for thinking that probabilities are important?
    3.2 All probability values lie between 0 and 1? What sorts of propositions do
    we find with probabilities at each of those two limits?

3.3 What is the frequentist interpretation of probability? Indicate one of its main limitations.

3.4 What is the subjectivist interpretation of probability? Why do some people worry about this interpretation?

3.5 If two people initially disagree about a probability, under what conditions will their probability assessments converge toward some shared value?

3.6 Let's say that bicycle ridership in the city of Grand Rapids doubled over the last three years. What kind of background information would we need to know in order to evaluate the significance of that fact?

3.7 Let's say that the incidence of gang violence in Beverley Hills dropped by 50% since last year. What kind of background information would we need to know in order to evaluate the significance of that fact?

3.8 Briefly describe the concept of "salience" and how it tends to skew our sense of probabilities. Give an example.

3.9 Briefly describe the Gambler's Fallacy and how it tends to skew our sense of probabilities. Give an example.

3.10 Briefly describe the Conjunction Fallacy and how it tends to skew our sense of probabilities. Give an example.

3.11 How is Bayes' Theorem supposed to help us overcome the seemingly arbitrary character of the subjectivist interpretation of probability?

4.0 Calculating Probabilities

4.1 The weather report for today says that there is a 30% chance of rain. What is the chance there will be no rain? How did you figure that out?

4.2 A team of five climbers is scaling the Matterhorn. Only one of members of the team can reach the summit first, and all of them have an equal chance of summiting first. Albert and Otto belong to this team. What are the chances that Albert or Otto will summit first? How did you figure that out?

4.3 Let's say the chance of rain today is 30% (a probability of .3). And let's say the probability of your getting an A in your Human Biology quiz today is .4 (a 40% chance). What is the probability that it will rain today and that you will get an A on your Human Biology exam? How did you figure that out?

4.4 Celeste could be a Republican. Celeste could also be a member of the lacrosse team. Assign a probability number to each of these possibilities. What is the probability that Celeste is either a Republican or a member of the lacrosse team? How did you figure that out?

4.5 Let's say the probability that you will skip breakfast tomorrow is .3. If you skip breakfast, the probability that you will have a large lunch is .9. What is the probability that tomorrow you will both skip breakfast and have a large lunch? How did you figure that one out?

4.6 The probability that the tree outside your classroom will fall down on the condition that there is a 50 mph wind is .2. According to the weather report, the probability that there is a 50 mph wind today is .6. What is the probability that the tree outside your classroom will fall down today? How did you get that answer?

4.7 Imagine you have two containers before you. Each container has six balls in it—three white and three black. You can't see into the containers. The chances of drawing a white ball from a container is 3 out of 6, or 50%. The chances of drawing a black ball out of a container is 3 out of 6, or 50%. You draw one ball from each container. What is the probability that you draw two black balls? What is the probability that you draw one black ball and one white ball? Explain how you calculated your answers.

4.8 On the same scenario as 4.7, what is the probability that you do *not* draw two black balls? What is the probability that you do *not* draw one black ball and one white ball? Explain how you calculated your answers.

4.9 Same containers again as in 4.7 (three white balls and three black balls in each). You pick a ball from the first container. What is the probability that you pick a white *or* a black ball? You proceed to pick a ball from the other container. What is the probability that you picked in total either two black balls *or* two white balls? Explain how you got your answers.

4.10 Suppose you have a pair of dice. Each die has 6 sides to it, with one to six dots. With each roll of the pair of dice, how many possible combinations are there? What is the probability of rolling a combination with a total of 12 dots? What is probability of rolling a combination with a total of 10 dots? 7 dots?

4.11 Imagine you have a deck of cards, a regular deck with 52 cards in it. There are four deuces in the deck. What is the chance that the first card you draw from the deck will be a deuce? What is the chance that your first *two* draws from a regular full deck (without replacing the first draw) will be deuces? Explain how you calculated your answer.

5. 0 A Stretch

5.1 Determine the probability of aliens blowing up the Washington Monument during your lifetime. Discuss the challenges of determining this probability. (If you can demonstrate conclusively that the above probability is greater than .4, call NASA immediately.)