Chapter 7 – Probability and inductive reasoning
"Getting familiar with…" exercises.

The following exercises are not in the book, but they may help you understand the material in this chapter better. We have included answers to the odd numbers below.

Getting familiar with… strong and weak quantifiers.

For each of the following claims, identify whether the quantifier is strong or weak.

1. Many state senators were history majors.
2. Most philosophers who take the LSAT do well.
3. There are a few of us who support the president's initiative.
4. What I was saying is that the majority of students support the school's new policy.
5. Many of the colleges that have tried this program report that it is successful.
6. We looked at a lot of studies, and a significant percentage of them conclude that people are biased when it comes to religious beliefs.
7. It is highly likely that this surgery will be successful.
8. Almost all the candidates for this job have degrees from Ivy League universities.
9. Although the evidence is incomplete, it is possible that there is life on other planets.
10. More often than not, people who get pregnant in high school do not complete a four-year college degree.

Getting familiar with… probability and statistics.

For each of the following claims, identify whether it is expressing a probability or a statistic.

1. 7 out of 10 high school seniors said they have tried marijuana.
2. The risk that you will die in an automobile accident goes down significantly if you wear a seatbelt.
3. The chances of winning the lottery are slim to none.
4. Of those we surveyed, over half said they would vote in the next presidential election.
5. The percentage of deaths caused by police officers jumped dramatically last year.
6. Your portfolio is likely to grow a lot over the next year.
7. It rained 25 days out of 100 last year.
8. The likelihood that a student will get a job right after college has dropped every year for the past five years.
9. The likelihood that you will get a job when you finish college is not high.
10. 4 out of 5 doctors that we interviewed said they are concerned about the effectiveness of this year's flu vaccine.

Getting familiar with… types of probability.

a. For each probability statement, identify whether it is referring to objective, epistemic, or subjective probabilities.

1. I can feel that it's about to rain.
2. The evidence tells us that Iran's new missile program will likely fail.
3. In a jar of 1,203 M&Ms, the probability of choosing a green one is 10%.
4. Twenty-five percent of cards in a deck are spades.
5. They are so incompatible; I know they'll break up within the week.
6. I'm going to win this next hand; I can feel it.
7. Given that there are 38 slots on a roulette wheel, and 18 of them are black, your chances of winning by betting black are about 47%.
8. All of the studies suggest that your chances of getting cancer are lower if you stop smoking.
9. My dog gets this look in her eye just before she bites, and she has it now, so she is probably about to bite.
10. The chances of rolling a prime number on a twenty-sided die are 8/20.

b. For each probability statement, identify whether it is referring to a *dependent* or *independent* probability.

1. The probability of rolling an odd number on a twenty-sided die.
2. The probability of rolling an odd number on a twenty-sided die given that you just rolled an even number.
3. The probability that you rolled an odd number on a twenty-sided die given that the number you rolled is a prime number.
4. The probability of drawing an ace from a deck of 52 cards given that you just drew an ace you didn't replace.
5. The probability that you just drew an ace from a deck of 52 cards given that the card you drew was a spade.

Getting familiar with… cost/benefit analyses.

For each of the following, construct a cost/benefit analysis and identify the best decision. (Make up values where you need to.)

1. You have to decide whether to start dating your best friend.
2. You have to decide whether to take a job in a country with an unstable political environment, though it pays better than any job in your home country.
3. You have to decide whether to sell a new product that causes blindness in 1% of users.
4. You have to decide whether to join a Mars exploration team knowing that you will never be able to return to Earth.
5. You have to decide between looking for work after college or taking a year off after college to backpack the Appalachian Trail (which takes between 4 and 7 months).

Answers to Select Exercises
Chapter 7

Getting familiar with… strong and weak quantifiers.

For each of the following claims, identify whether the quantifier is strong or weak.

1. Many state senators were history majors.

Many – weak

3. There are a few of us who support the president's initiative.

A few – weak

5. Many of the colleges that have tried this program report that it is successful.

Many – weak

7. It is highly likely that this surgery will be successful.

Highly likely – strong

9. Although the evidence is incomplete, it is possible that there is life on other planets.

It is possible - weak

Getting familiar with… probability and statistics.

For each of the following claims, identify whether it is expressing a probability or a statistic.

1. 7 out of 10 high school seniors said they have tried marijuana.

Statistic

3. The chances of winning the lottery are slim to none.

Probability

5. The percentage of deaths caused by police officers jumped dramatically last year.

Statistic

7. It rained 25 days out of 100 last year.

Statistic

9. The likelihood that you will get a job when you finish college is not high.

Probability

Getting familiar with… types of probability.

a. For each probability statement, identify whether it is referring to objective, epistemic, or subjective probabilities.

1. I can feel that it's about to rain.

Subjective

3. In a jar of 1,203 M&Ms, the probability of choosing a green one is 10%.

Objective

5. They are so incompatible; I know they'll break up within the week.

Subjective

7. Given that there are 38 slots on a roulette wheel, and 18 of them are black, your chances of winning by betting black are about 47%.

Objective

9. My dog gets this look in her eye just before she bites, and she has it now, so she is probably about to bite.

Epistemic

b. For each probability statement, identify whether it is referring to a *dependent* or *independent* probability.

1. The probability of rolling an odd number on a twenty-sided die.

Independent

3. The probability that you rolled an odd number on a twenty-sided die given that the number you rolled is a prime number.

Dependent

5. The probability that you just drew an ace from a deck of 52 cards given that the card you drew was a spade.

Dependent

Getting familiar with… cost/benefit analyses.

For each of the following, construct a cost/benefit analysis and identify the best decision. (Make up values where you need to.)

1. You have to decide whether to start dating your best friend.

Let's assume that one possible outcome of dating your best friend is long-term happiness. Another possibility is that you lose the friendship. How valuable are these possibilities and what are their chances?

Long-term happiness might be really important to you since it affects the rest of your life on this planet, so let's set its value at (+100)

Long-term happiness. = V(+100)

Losing the friendship is bad, but you know how the world works. Keeping any friend for the rest of your life is rare. And if you don't marry your best friend, you will likely choose a spouse anyway, and that relationship will take precedence over your friendship.

Losing the friendship. = V(-75)

What are the probabilities that either of these will happen if you date? Long-term happiness is rare no matter who gets married, so we have to set that one low: P(.2). And you still might keep the friendship, so we'll set that one at 50/50: P(.5).

What about not marrying your friend? Again, long-term happiness is rare no matter what you do, so let's keep it at P(.3). And unfortunately, even if you don't get married, you might still lose the friendship. So, let's set that one low, but significant: P(.3).

Calculating, we have:
Marry your best friend: ((P(.2) x V(+100)) + (P(.5) x V(-75))) = -17.5

Do not marry your best friend: ((P(.3) x V(+100)) + ((P(.3) x V(-75))) = +7.5

If our numbers are accurate for your values, your life will be less bad if you don't marry your best friend.

3. You have to decide whether to sell a new product that causes blindness in 1% of users.

The most common value associated with new products is profit. But profit can be affected by a number of different variables, not least of which is public image. So, here, you might measure your company's potential profits against the potential negative image that would come with the news that your product causes blindness. The overall value would be whether the company grows.

In this case, let's say the growth is moderate with no change in company image.

Company grows: (+10)

On the other hand, a bad image could cost the company for a long time.

Company shrinks: (-30)

Selling the new product and growing: P(.6) (There is a good chance of monetary growth, but also a good chance of a poor public image.)

Selling the new product and shrinking: P(.4)

Not selling the new product and growing: P(.7) (If the company was already doing okay, it will likely continue doing okay, though some stockholders may find that not selling the product distasteful.)

Not selling the new product and shrinking: P(.3) (The company invested money in the new product, so they might be set back, but not likely.)

Selling the new product: ((P(.6) x V(+10)) + (P(.4) x V(-30))) = -6

Not selling the new product: ((P(.7) x V(+10)) + (P(.3) x V(-30))) = -2

If these numbers reliably track your values and the probabilities, not selling the product is slightly less bad than selling it. Ah well, that's the nature of business.

5. You have to decide between looking for work after college or taking a year after college to backpack the Appalachian Trail (which takes between 4 and 7 months).

"Gap" years are usually the years between high school and college when you're not working. But some college students take a year or so after college to do something momentous: backpack across Europe, work for the Peace Corps, or hike the Appalachian Trail. If you take a year off, you will lost whatever money and experience you might have obtained working, and on the trail you will also risk some bodily injury. On the other hand, hiking the Appalachian Trail is a monumental achievement, and one you are unlikely to have the opportunity to attain (it takes about 6 months). Plus, there are no guarantees you will get a job right after college. Some people are out of work for 6 months to a year.

In order to assign values, let's assume you really want to hike the Trail and you're not terribly concerned about the money you will miss.

Having meaningful experiences: (+50)

Being financially stable: V(+25)

Hiking and Meaningful Experiences: P(.7)

Hiking and Financially Stable: P(.3)

Looking for a Job and Meaningful Experiences: P(.4)

Looking for a Job and Financially Stable: P(.6)

Taking a year off: ((P(.7) x V(+50)) + (P(.3) x V(+25))) = +42.5

Not taking a year off: ((P(.4) x V(+50)) + (P(.6) x V(+25))) = +35

Notice there aren't any negatives in this calculation. We've figured those into the values up front. Meaningful experiences come with some risk (risk of injury, risk of financial hardship). And being financially stable usually comes with a lot of drudgery. Both numbers would be higher if not for these negatives. But here we are assuming the positives outweigh the negatives in both cases. From this calculation, taking the year off is the better option for you.