7.6

In deciding to park in an illegal place, any individual knows that the probability of getting a ticket is p and that the fine for receiving the ticket is f. Suppose that all individuals are risk averse (i.e., $U''(W) < 0$, where W is the individual's wealth).

Will a proportional increase in the probability of being caught or a proportional increase in the fine be a more effective deterrent to illegal parking? *Hint:* Use the Taylor series approximation $U(W - f) = U(W) - fU'(W) + (f^2/2)U''(W)$.

7.8

In Equation 7.30 we showed that the amount an individual is willing to pay to avoid a fair gamble (h) is given by $p = 0.5E(h^2)r(W)$, where $r(W)$ is the measure of absolute risk aversion at this person's initial level of wealth. In this problem we look at the size of this payment as a function of the size of the risk faced and this person's level of wealth.

a. Consider a fair gamble (v) of winning or losing \$1. For this gamble, what is $E(v^2)$?
b. Now consider varying the gamble in part (a) by multiplying each prize by a positive constant k. Let $h = kv$. What is the value of $E(h^2)$?
c. Suppose this person has a logarithmic utility function $U(W) = \ln W$. What is a general expression for $r(W)$?
d. Compute the risk premium (p) for $k = 0.5$, 1, and 2 and for $W = 10$ and 100. What do you conclude by comparing the six values?

7.9

Return to Example 7.5, in which we computed the value of the real option provided by a flexible-fuel car. Continue to assume that the payoff from a fossil-fuel–burning car is $A_1(x) = 1 - x$. Now assume that the payoff from the biofuel car is higher, $A_2(x) = 2x$. As before, x is a random variable uniformly distributed between 0 and 1, capturing the relative availability of biofuels versus fossil fuels on the market over the future lifespan of the car.

a. Assume the buyer is risk neutral with von Neumann–Morgenstern utility function $U(x) = x$. Compute the option value of a flexible-fuel car that allows the buyer to reproduce the payoff from either single-fuel car.
b. Repeat the option value calculation for a risk-averse buyer with utility function $U(x) = \sqrt{x}$.
c. Compare your answers with Example 7.5. Discuss how the increase in the value of the biofuel car affects the option value provided by the flexible-fuel car.

7.11 Prospect theory

Two pioneers of the field of behavioral economics, Daniel Kahneman and Amos Tversky (winners of the Nobel Prize in economics in 2002), conducted an experiment in which they presented different groups of subjects with one of the following two scenarios:

- Scenario 1: In addition to \$1,000 up front, the subject must choose between two gambles. Gamble A offers an even chance of winning \$1,000 or nothing. Gamble B provides \$500 with certainty.
- Scenario 2: In addition to \$2,000 given up front, the subject must choose between two gambles. Gamble C offers an even chance of losing \$1,000 or nothing. Gamble D results in the loss of \$500 with certainty.

a. Suppose Standard Stan makes choices under uncertainty according to expected utility theory. If Stan is risk neutral, what choice would he make in each scenario?
b. What choice would Stan make if he is risk averse?
c. Kahneman and Tversky found 16 percent of subjects chose A in the first scenario and 68 percent chose C in the second scenario. Based on your preceding answers, explain why these findings are hard to reconcile with expected utility theory.
d. Kahneman and Tversky proposed an alternative to expected utility theory, called *prospect theory*, to explain the experimental results. The theory is that people's current income level functions as an "anchor point" for them. They are risk averse over gains beyond this point but sensitive to small losses below this point. This sensitivity to small losses is the opposite of risk aversion: A risk-averse person suffers disproportionately more from a large than a small loss.

   (1) Prospect Pete makes choices under uncertainty according to prospect theory. What choices would he make in Kahneman and Tversky's experiment? Explain.

   (2) Draw a schematic diagram of a utility curve over money for Prospect Pete in the first scenario. Draw a utility curve for him in the second scenario. Can the same curve suffice for both scenarios, or must it shift? How do Pete's utility curves differ from the ones we are used to drawing for people like Standard Stan?