1. *The selfish shopper.* Jim is gift shopping. He has to decide whether to shop online or go to the store. If he shops online he will be able to find a gift (g) or three things that he would like for himself (j_1, j_2, j_3); the menu of options he faces if he shops online is $\{g, j_1, j_2, j_3\}$. The stores have fewer things that interest Jim, so if he shops at the store he faces a menu $\{g, j_3\}$.

   When Jim chooses an item x from a menu A he derives utility

   $$U(A, x) = u(x) - s(A, x) - c_{store}. \tag{1}$$

   $s(A, x) = \max_{y \in A} v(y) - v(x)$ is the cost of self-control, which depends on the most tempting thing foregone. Since prices are a little higher at the store, $c_{store} = 0.5$ if Jim shops at the store and $c_{store} = 0$ if he shops online.

   Jim likes to buy things for himself, but he is very generous and so likes to give gifts more: $u(j_1) = 4$, $u(j_2) = 2$, $u(j_3) = 1$, $u(g) = 6$. However, he is often tempted to buy things for himself when he should be buying gifts: $v(j_i) = u(j_i)$, $v(g) = 0$. In each part of this question, assume that Jim is restricted to buy only one item (for example, because of a budget constraint).

   a) Where will Jim shop? What does he buy?

   The store owner is concerned that he doesn't carry j_1, the most popular gadget of the season. He decides to add j_1 to his stock, so that the menu of options at the store is now $\{g, j_1, j_3\}$. Continue to assume that $c_{store} = 0.5$.

   b) Where will Jim shop? What does he buy?

   A new store opens that sells only g, so it offers a menu $\{g\}$, but is also more expensive than online, so that $c_{newstore} = x$, $x > 0$.

   c) How high can the new store make its price premium $c_{newstore}$ while still selling to Jim?

   d) In this question, the menu of alternatives mattered for Jim's utility because he suffered a self-control cost that depended on the most tempting thing foregone. Briefly propose another, different way in which a DM's utility from a choice may depend on the menu from which the choice was made. What is a setting in which a model of your proposal would predict different choices than the standard model? [100-200 words]

2. *Choice from menus.* In the previous question we used an example of a 'choice from menus' model: the menu from which a selection was made influences the DM's utility. In this example that was because the DM suffers a self-control cost: if there is another item that was more tempting than the one they chose, they must exercise self-control equal to the most tempting thing foregone. For this question: propose two different 'choice from menus' model of your own that you think capture plausible types of behavior. In each case, explain the behavior you are trying to capture and, in math and in words, what the DM's utility function looks like in your model and why. What choice patterns can your model rationalize that the standard model cannot?

3. *Risk aversion.* Person A has Bernoulli utility function $u_A = \sqrt{x_A}$ and person B has $u_B = \ln x_B$, where x_i is DM i's final wealth. Both are Expected Utility maximizers.

   a) Say that both people are offered a gamble with a \$50 stake. Can we say that if A rejects the gamble then B definitely also rejects it? Why or why not?

   b) Say instead that the gamble had been for a stake of 5% of current wealth. In this case, can we say that if A rejects the gamble then B definitely also rejects it? Why or why not?

4. An expected utility maximizer has zero initial wealth, and has a Bernoulli utility function $u = x^2$, where x is 'final wealth'. He holds a lottery ticket that pays \$1 with probability $\frac{1}{2}$ and pays nothing with probability $\frac{1}{2}$.

   a) What is his expected utility?

   b) What is the smallest amount of money he would accept to give up the ticket?

   c) Calculate this individual's coefficient of absolute risk aversion. Interpret it in words.

   d) Calculate this individual's coefficient of relative risk aversion. Interpret it in words.

5. *Using Expected Utility.* DM A is a risk-averse expected utility maximizer has a Bernoulli utility function $u = \sqrt{x}$, where x is final wealth. They currently have \$1. They are offered a lottery ticket that costs \$1. It will pay \$y with probability $\frac{1}{100}$ and zero with the remaining probability.

   a) What is the smallest acceptable prize y such that the DM is willing to buy the lottery ticket?

   b) If the DM had \$100 in initial wealth instead of \$1, would the smallest acceptable prize be bigger, smaller, or the same as in b)?

   DM B is an expected utility maximizer with a Bernoulli utility function $u = x^2$ and who currently has \$1.

   c) What is the smallest prize y such that DM B would be willing to buy the \$1 lottery ticket?

   d) If B rejects some gamble g, can we say whether A will accept or reject it? Explain how you know.

   Consider a different problem for the same two DMs. Assume each has \$100 in initial wealth, but with probability $\frac{1}{10}$ will lose it all. They are offered an insurance policy at a price $c \geq 0$ that will cover the whole loss should it occur.

   e) What is the most that each DM would be willing to pay for the insurance policy?

6. *Consistency conditions under EUT.* In this question we will construct an example of a consistency condition on the choices of an Expected Utility maximizing DM. Consider the following two lotteries:

A. Win \$4000 with probability 0.8, else nothing.

B. Win \$3000 with probability 1, else nothing.

a) Assume that an 'outcome' is the lottery's money prize. Write an inequality that must hold if an Expected Utility maximizer prefers lottery B to lottery A.

Consider the following two lotteries:

C. Win \$4000 with probability 0.2, else nothing.

D. Win \$3000 with probability 0.25, else nothing.

b) Using a degenerate lottery that pays nothing with probability 1 and lottery A, construct a compound lottery whose reduced lottery is equivalent to lottery C.

c) Using a degenerate lottery that pays nothing with probability 1 and lottery B, construct a compound lottery whose reduced lottery is equivalent to lottery D.

d) Demonstrate mathematically and explain why an Expected Utility maximizer who prefers lottery B to lottery A must also prefer lottery D to lottery C.