

## APEC 8001: Problem Set 5

Professor: Paul Glewwe

TA: Monique Davis

Due Date: October 15th, 2020

1. Consider the two diagrams on page 3 of the Lecture 10 notes. In the diagram on the right, explain whether or not the length of the three line segments that meet at  $L = (p_1, p_2, p_3)$ , where  $p_n$  represents the probability of outcome  $n$  occurring with  $p_n \geq 0 \forall n$  and  $\sum_{n=1}^3 p_n = 1$ , are equal to the corresponding probabilities ( $p_1, p_2$  and  $p_3$ )? First, use your geometry skills to check whether the three line segments sum to 1. Second, regardless of whether they sum to 1, are they proportional to the three probabilities ( $p_1, p_2$  and  $p_3$ )?
2. Consider lotteries  $L_1, L_2$ , and  $L_3$ .  $L_1$  and  $L_3$  represent fixed (certain) amounts of money, where  $L_1 < L_3$ . Suppose that  $L_2$  is also a fixed amount of money where  $L_2 = \frac{L_1 + L_3}{2}$ , and suppose that  $L'_2$  represents a lottery with a probability 0.5 of receiving the amount of money in  $L_1$  and probability 0.5 of receiving the amount of money in  $L_3$ . Consider a utility function over lotteries,  $U(L)$ , that has an expected utility form.
  - a. Consider the shape of  $U(L)$  for lotteries  $L$  that yield fixed (i.e. certain) amounts of money. For what shape of  $U(L)$  would you prefer  $L_2$  to  $L'_2$ ?
  - b. For what shape of utility would you prefer  $L'_2$  to  $L_2$ ?
  - c. Draw a diagram depicting this setup and the general shape of utility from parts (a) and (b).
3. Tonight is Chipotle night, and you are trying to decide whether to have your favorite burrito bowl delivered, or whether to pick it up yourself (skipping the line). Ultimately, you base this decision on the cost of the burrito bowl and whether your bowl is hot or cold (e.g., the trip to Chipotle is irrelevant). The bowl costs \$10. If it is delivered, you pay a \$2 delivery charge, but if your bowl is cold when it arrives, then the burrito bowl is free and the delivery charge is waived. It is common knowledge that Chipotle delivers cold burrito bowls 1 out of 50 times. If you decide to pick the burrito bowl up, there is no delivery charge. However, there is a 1 in 10 chance that you will be late and the burrito bowl will be cold. Chipotle is also running a promotion tonight where the 200<sup>th</sup> customer to pick up their order will receive a free burrito bowl. There is a 1 in 100 chance (independent of whether you are late) that you will be the 200<sup>th</sup> customer.
  - a. List all possible outcomes that could occur across all possible choices.
  - b. The basic choice is between two lotteries. For each lottery, what are the possible outcomes and the probabilities of those outcomes?
  - c. Assume that you prefer a warm bowl to a cold bowl, and less expensive bowl to a more expensive bowl. Does this information alone determine which lottery maximizes your expected utility?
  - d. Assign utilities to each of the outcomes that is consistent with the choice to have the bowl delivered. These utilities should not violate the preferences in c.
  - e. Assign utilities to each of the outcomes that is consistent with the choice to pick up the bowl. These utilities should not violate the preferences in c.
  - f. Assign utilities to each of the outcomes that is consistent with being indifferent to the two lotteries. These utilities should not violate the preferences in c.