Assignment 1

Due Friday, February 8 at 11:59 pm.

Please submit all work on Canvas as a PDF or Word file. Make sure you clearly label each solution, and include the answers to the in-class quiz at the beginning of the assignment.

Part 1: Decision Analysis

1) Engineering or Baking? Consider the following scenario:

> Christina is a college student majoring in Electrical Engineering, which she decided to pursue because of her love of math. Growing up, she also enjoyed baking, particularly making sweets such as cookies. However, at this point in her life, she doesn't have any formal culinary training and bakes only as a hobby, even though she has always dreamt of owning a bakery.
>
> As a college student getting ready to graduate and move on to the next stage of her life, Christina needs to figure out if she would be happier continuing towards a career in Electrical Engineering, or if she wants to work towards becoming a pastry chef and owning a bakery.

(a) **What are the alternatives in this decision? (1 point)**

(b) **What is the objective? (1 point)**

(c) **What are the possible future events and consequences? (1 point)**

2) Lottery, Part 1 Suppose that you are deciding whether to buy a $1 lottery ticket. The jackpot is 1.2 million and there is a 1/1,000,000 chance of winning.

(a) **What are the alternatives in this decision? (1 point)**

(b) **What is the objective? (1 point)**

(c) **What are the possible future events and consequences? (1 point)**

Part 2: Payoff Matrix and Decision Rules

3) Split or Steal Recall the "Split or Steal" game from the in-class activity:

> Two players each have the option of choosing either **Split** or **Steal**.
>
> - If both players choose **Split**, then they split the jackpot and get $50,000 each.
> - If one chooses **Split** and the other chooses **Steal**, then the player who chose **Steal** takes all $100,000, and the player who chose **Split** gets nothing.
> - If both players choose **Steal**, then both players get nothing.

Answer the following questions based on the decision that one of the players must make.

(a) **What are the alternatives in this decision? (1 point)**

(b) **What is the objective? (1 point)**

(c) **What are the possible future events and consequences? (1 point)**

(d) **Construct a payoff matrix. (2 point)**

(e) **What decision should a player make according to the maximax rule? (1 point)**

(f) **What decision should a player make according to the maximin rule? (Hint: This is somewhat of a trick question) (1 point)**

(g) **What decision should a player make according to the minimax regret (see R-2, Ragsdale 2015, page 742) rule? (1 point)**

4) What to Offer? Recall the "What to Offer?" game from the in-class activity:

> Player A can offer any split of $10. Player B can **accept** or **reject**. If player B **accepts**, each player gets money according to the proposed split. If player B **rejects**, then both players get nothing.

Answer the following questions from the perspective of the person making the initial offer (player A).

(a) **What are the alternatives in this decision? (1 point)**

(b) **What is the objective? (1 point)**

(c) **What are the possible future events and consequences? (1 point)**

(d) **Construct a payoff matrix. (2 points)**

(e) **What decision should a player make according to the maximax rule? (1 point)**

Part 3: Expected Value

5) Lottery, Part 2 Suppose that you are deciding whether to buy a $1 lottery ticket. The jackpot is 1.2 million and there is a 1/1,000,000 chance of winning.

(a) **Construct a payoff matrix for this problem. (2 points)**

(b) **What is the expected value of buying the ticket and of not buying the ticket? (1 point)**

(c) **What decision should you make according to the expected value decision rule? (1 point)**

(d) **Create a strategy table showing how the optimal decision would change as the jackpot varies from $800,000 to $1,400,000 in $100,000 increments. (3 points)**

6) Insurance Suppose that you are trying to decide whether to buy renters insurance. You estimate that the potential damage to your apartment in the next year as:

Damage in dollars	0	150	300	450	600	750	900	1050
Probability	0.25	0.08	0.10	0.12	0.15	0.12	0.10	0.08

You are considering the following three policies:

- You can buy a policy for $470 that would cover 100% of any damage.
- You can buy a policy for $250 that would cover all losses in excess of $350.
- You can choose not to buy insurance, in which case you will not have to pay any insurance premium but will pay for any losses that occur.

Based on this information, answer the following questions:

(a) **Construct a payoff matrix for this problem. (2 points)**

(b) **What decision should you make according to the maximax decision rule? (1 point)**

(c) **What decision should you make according to the maximin decision rule?(1 point)**

(d) **What decision should you make according to the expected value decision rule?(2 points)**

(e) **What is the expected value of perfect information? (1 points)**

7) Rock-Paper-Scissors Suppose you make a bet of $1 on a game of "Rock-Paper-Scissors" (`https://en.wikipedia.org/wiki/Rock-paper-scissors`), with ties resulting in no money being exchanged.

(a) **What are the alternatives? (1 point)**

(b) **Construct a payoff matrix for this situation. Assume that your opponent is equally likely to choose each of the options. (2 points)**

(c) **Compute the expected value for each possible choice. (1 point)**

(d) **Research suggests that people tend to choose a winning gesture more frequently (see** `https://www.bbc.co.uk/news/science-environment-27228416`**). Your opponent just beat you with "Rock". What should you choose next? Justify your answer using expected values. (Hint: You may find it useful to adjust the probabilities and compute new expected values.) (2 points)**