

What's on Back?

POW 5 pg111/112

This game involves three cards.

- One card has an **X** on both sides.
- One card has an **O** on both sides.
- One card has an **X** on one side and an **O** on the other side.

The three cards are placed in a bag. You draw one card at random and look at only one side. You cannot look at the other side or at the other cards. The goal of the game is to predict whether there is an **X** or an **O** on the other side of the card that you drew.

There are many strategies for making this prediction - some good, some not as good. Here are two possible strategies.

- Predict that the mark on the other side will be different from the mark you see. (That is, if you see **X**, predict **O**; if you see **O**, predict **X**.)
- Always predict that the mark will be an **X**.

No strategy will be successful all of the time. Try to find the probability of success for each strategy you consider.

Your ultimate goal is to find the strategy with the highest possible probability of being right.



For each strategy you consider, do these two tasks.

* Find an *experimental estimate of the probability of success using that strategy*. That is, devise an experimental method of testing your strategy. It will probably be useful to make a set of cards to do this. You will need to repeat your experiment quite a few times to get a good experimental estimate. You may want to repeat it until your overall results begin to stay roughly the same.

* Analyze the probability of success for that strategy by using a *theoretical model*.

Begin with the two strategies described earlier. Look for both an experimental estimate and a theoretical model for the probability of predicting correctly with each strategy.

Then think of other strategies. Try to determine the strategy with the highest probability of success for correctly predicting “what’s on back.”

Write-up

Your write-up should contain these four parts.

1. *Problem Statement*

2. *Process: Include a description of exactly what you did to carry out the experiments for part a.*

3. *Results: Describe each strategy you tried. For each, tell what you found as the probability of predicting correctly. If possible, describe your results in terms of both your experimental results and your theoretical analysis. State what strategy you think gives the highest probability of predicting successfully. Justify your answer.*

4. *Self-assessment*

Mia's Cards pg 113

1. Mia is playing a game that involves picking a card from a standard deck. A standard deck consists of 52 cards, with 13 cards in each of 4 suits. The suits are clubs, diamonds, hearts, and spades. The 13 cards in each suit are ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, jack, queen, and king.

Mia mixes up the cards and then picks a card at random from the deck. She gets 10 points if the card is a heart and 5 points if it's a club, spade, or diamond. Then she puts the card back in the deck.

Suppose she does this many times. What will be her average number of points each time she picks a card? Explain your answer.



2. On February 14, Mia changes the game so that she gets 20 points for a heart, 15 points for a diamond, and no points for a club or a spade. If she plays this new game many times, what would you expect her average score per card to be?

3. Now create and analyze your own game.

- Make up a game like Mia's, in which a person picks a card and receives a number of points that depends on the type of card picked.
- Calculate the average score per pick in the long run for your game.