1   Introduction

Welcome to Pleasanton Math Circle (PMC)! Today we will be working on Fermi Questions and Statistics. Feel free to ask a teacher if you need some help. We will be going over some of these questions throughout the class as well.

2   Fermi Estimations

Fermi Estimations are rough calculations done to arrive at a reasonable estimate. They were named after the Italian physicist Enrico Fermi because he was known for his ability to make good approximate calculations with little or no actual data.

Let's try to answer this Fermi Question: How long would it take to drive to the moon (if you could!)?

1. Let's start off by figuring out how many miles there are between the earth and the moon. Do you have any guesses?

2. What is the typical speed of a car? *Hint: think about the speed limit on highways.*

3. Divide the distance to the moon by the typical speed of a car to figure out how long it would take to drive to the moon. This is our Fermi Estimation.

3   More Fermi Questions

Now try to solve these three Fermi Questions on your own:

1. If all the people in the world were crowded together, how much area would we cover?

2. How many snowflakes would it take to completely cover a driveway?

3. How many sheets of paper could be stacked from the floor to the ceiling?

4   The Fundamental Counting Principle

The Fundamental Counting Principle (also called the counting rule) is a way to figure out the number of outcomes in a problem. If you have an event "a" and another event "b", then all the different outcomes for the events is $a \cdot b$.

Try this problem! You take a survey with five "yes" or "no" answers. How many different ways could you complete the survey?

1. How many questions are there?

2. How many different ways can you complete each question (*Hint: how many options are there for each question?*)

3. Use these answers to solve the problem.

Now try these problems on your own!

- A company puts a code on each different product they sell. The code is made up of 3 numbers and 2 letters. How many different codes are possible?

- Challenge: A fast-food restaurant has a meal special: 5 dollars for a drink, sandwich, side item and dessert. The choices are:

- Sandwich: Grilled chicken, All Beef Patty, Vegeburger and Fish Filet.
- Side: Regular fries, Cheese Fries, Potato Wedges.
- Dessert: Chocolate Chip Cookie or Apple Pie.
- Drink: Fanta, Dr. Pepper, Coke, Diet Coke and Sprite.

How many meal combos are possible?

5 Challenge: The Multiplication Principle

Some license plates in Arizona consist of three digits followed by three letters. How many license plates of this type are possible if:

1. There are 10 digits (0, 1, 2, 3, ...9) and 26 letters.

2. Letters can be repeated but digits cannot.

3. The first digit cannot be zero and both digits and letters can be repeated.

4. Neither digits nor letters can be repeated.