

PASCAL'S TRIANGLE - COMBINATORICS

Combinatorics is the study of counting things in different ways. Combinatorics deals with answering questions like:

- (1) If I toss two coins, how many ways are there to get exactly one head and one tail?

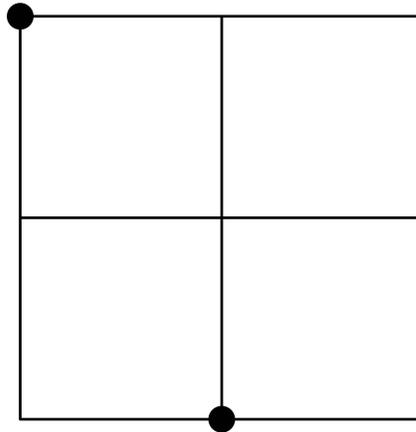


- (2) A pizza shop offers three toppings: mushrooms, tomatoes, and peppers:



How many different pizzas can I order if I only want two toppings?

- (3) Torontopolis is a city with four blocks, with roads in between, arranged in a square.



How many ways are there to get from the top left corner of Torontopolis to the middle of the bottom edge of the city, if you are only allowed to walk right and down?

To answer these questions, turn over the page...

1. TOSSING COINS

In the coin-tossing question, we will write **H** as heads, and **T** as tails. The possible outcomes for two coin tosses are then:

HH HT TH TT

so there is exactly one option for two heads, one option for two tails, and two options for heads and tails.

What happens if I toss five coins? How many options are there for exactly one head? two heads? Three heads? Four heads? Five heads? What happens if we toss more coins?

2. PIZZA MAKING

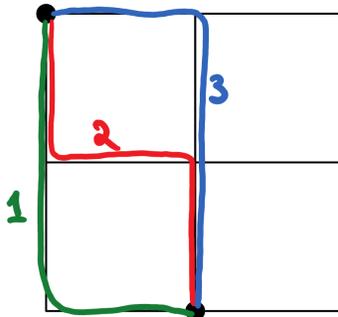
If I only want two toppings, then I can make exactly three pizzas:

Mushrooms & Tomatoes	Tomatoes & Peppers	Mushrooms & Peppers
		

If I still want two toppings, what happens if the pizza shop offers four toppings? What about five? Can you spot a pattern?

3. PATHS

We draw all of the possible paths:



You can see that there are exactly three!

What happens if we want to get to a different point in the grid? How many paths are there to other points when Torontopolis grows?