

Week 7, LEC02 - November 1st
Discrete Mathematics, Fall 2018

CSCA67 - Lecture Notes

Current Instructor: Dr. Richard Pancer



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1 Introduction to Counting

Counting Pizza Toppings*

The commercial's deal was:

- 2 pizzas
- up to 5 toppings on each
- 11 toppings to choose from
- all for \$7.98 (back in 1997).

Important: duplicate toppings not allowed, order of toppings does not matter, and CHEESE IS NOT A TOPPING.

The commercial's math kid claimed there are 1,048,576 possibilities.

Let's do the calculation ourselves.

Q. How many ways can we order a pizza with 0 toppings?

A. 1

Q. How many ways can we order a pizza with 1 topping?

A. 11

Q. How many ways can we order a pizza with 2 toppings?

A. $\frac{11 \cdot 10}{2} = 55$

Q. How many ways can we order a pizza with 3 toppings?

A. $\frac{11 \cdot 10 \cdot 9}{3!}$

Combinations of $x, y, z = 6 = 3! = 3 \cdot 2 \cdot 1$

Q. How many ways can we order a pizza with 4 toppings?

A. $\frac{11 \cdot 10 \cdot 9 \cdot 8}{4!}$

5 toppings: $\frac{11 \cdot 10 \cdot 9 \cdot 8 \cdot 7}{5!}$, 6 toppings: $\frac{11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6}{6!}$

Therefore, the total number of ways to order a single pizza with up to 5 toppings when choosing from 11 toppings is:

$$1 + 11 + \frac{11 \cdot 10}{2} + \frac{11 \cdot 10 \cdot 9}{3!} + \frac{11 \cdot 10 \cdot 9 \cdot 8}{4!} + \frac{11 \cdot 10 \cdot 9 \cdot 8 \cdot 7}{5!} = 1024$$

Note: On the final, you will not need to resolve this calculation.

Q. How did they get 1,048,576 in the commercial?

A. $1024 \cdot 1024 = 1,048,576$, This is not the correct answer!