Combinations

- Groups of objects where their order does not matter.

change in your pocket

Permutations

- Arrangements of objects where their order counts

crud
druc

CRUD

Permutations: $4! = 24$

Combinations: 1

5 people:

Andy, Bart, Carrie, Dart, Eart

AB, CE, BE, DC

DE, ~~EB~~, AC, BD

8 permutations

7 combinations

ABCDE

$${}_5P_2 = \frac{5!}{(5-2)!} = \frac{5!}{3!} = 20$$

$${}_5C_5 = 1$$

$${}_nC_r = \frac{n!}{(n-r)!\,r!}$$

$$= \frac{5!}{(5-5)!\,5!} = 1$$

$${}_5C_2 = \frac{5!}{(5-2)!\,2!} = \frac{5!}{3!\,2!} = \frac{5\cdot4\cdot3\cdot2\cdot1}{3\cdot2\cdot1\cdot2\cdot1} = 10$$

25 students in Algebra. As a reward, Mr. Bregar will take 10 of them to play in the dumpster.

(a) The first person he picks gets a free rotten egg

How many permutations of 10 students can he pick?

$$_{25}P_{10} = \frac{25!}{(25-10)!} = \frac{25!}{15!} = 25\cdot 24\cdot 23\cdot 22\cdot 21\cdot 20\cdot 19\cdot 18\cdot 17\cdot 16$$

(b) there are no rotten eggs

$$_{25}C_{10} = \frac{25!}{(25-10)!\,10!} = \frac{25!}{15!\,10!}$$

$$\frac{\cancel{25}\cdot\cancel{24}\cdot 23\cdot 22\cdot\cancel{21}\cdot\cancel{20}\cdot 19\cdot\cancel{18}\cdot 17\cdot\cancel{16}}{\cancel{10}\cdot\cancel{9}\cdot\cancel{8}\cdot\cancel{7}\cdot\cancel{6}\cdot\cancel{5}\cdot\cancel{4}\cdot\cancel{3}\cdot\cancel{2}}$$

5 4 7 2 2 8

$$5\cdot 23\cdot 22\cdot 2\cdot 19\cdot 2\cdot 17 = 3{,}268{,}760$$

Evaluate the expression.

1. ${}_8C_4 = \frac{8!}{(8-4)!\,4!} = \frac{8!}{4!\,4!}$

$2\,\frac{8\cdot7\cdot6\cdot5}{4\cdot3\cdot2\cdot1} = 70$

2. ${}_5C_5 = 1$

3. ${}_{12}C_0 = 1$

$\frac{12!}{(12-0)!\,0!} = 1$

4. ${}_7C_1 = \frac{7!}{(7-1)!\,1!} = \frac{7!}{6!\,1!}$

7

5. ${}_{15}C_{11} = \frac{15!}{(15-11)!\,11!}$

$\frac{15\cdot14\cdot13\cdot12}{4\cdot3\cdot2} =$

$15\cdot7\cdot13 = 1365$

6. ${}_{10}C_3$

$\frac{10!}{(10-3)!\,3!} = \frac{10!}{7!\,3!}$

$\frac{10\cdot9\cdot8}{3\cdot2\cdot1} = 10\cdot3\cdot4 =$

120

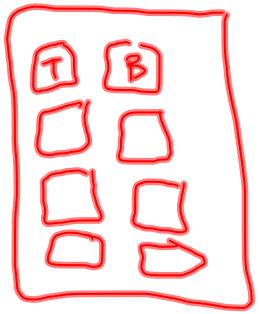
$0! = 1$

Using combinations to help you find probabilities:

$$\text{probability} = \frac{\#\text{ of desired outcomes}}{\text{total \# of outcomes}}$$

Ex. 14 people in a class

- Picture: everyone's face arranged randomly
- What is the probability of Tyler & Bregan's faces being at the top?



$$\text{probability} = \frac{1}{{}_{14}C_2} = \frac{1}{\frac{14!}{(14-2)!2!}} = 7\frac{1}{\frac{14 \cdot 13}{2}} = \frac{1}{7 \cdot 13}$$

$$= \frac{1}{91} \approx 1.2\%$$

Ex. · Bag with apple, onion, tomato, potato, lizard

· Pull out two things

· What's the probability of getting lizard & onion?

$$\text{probability} = \frac{1}{{}_5C_2} = \frac{1}{\frac{5!}{(5-2)!\,2!}} = \frac{1}{\frac{5 \cdot 4 \cdot 2}{2}} = \boxed{\frac{1}{10}}$$

19. **Sweaters** The buyer for a retail store must decide which sweaters to stock for the upcoming fall season. A sweater from one manufacturer comes in 5 different colors and 3 different textures. The buyer decides that the store will stock the sweater in 3 different colors and 2 different textures. How many different sweaters are possible?

T1-C1
T2-C1
T3-C1
T1-C2
T2-C2
T3-C2

15 sweaters from man.

T1-C1
T2-C1
T1-C2
T2-C2
T1-C3
T2-C3

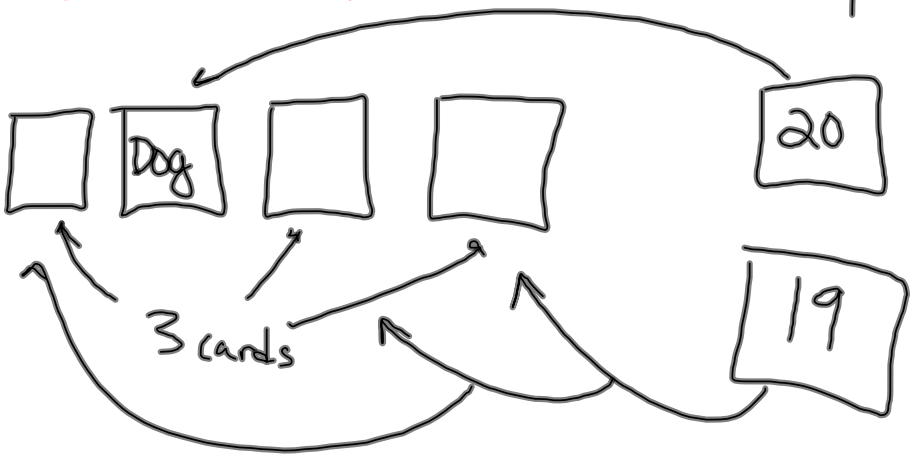
Combinations of

Choose 6

$$_{15}C_6 = \frac{15!}{(15-6)!\,6!} = \frac{15!}{9!\,6!} = \frac{15\cdot14\cdot13\cdot12\cdot11\cdot10}{6\cdot5\cdot4\cdot3\cdot2\cdot1} = 7\cdot13\cdot11\cdot5 = 5005$$

20. **Greeting Cards** A greeting card company packages 4 different cards together that are randomly selected from 10 different cards with a different animal on each card. What is the probability that one of the cards in a package is the card that has a dog on it?

$$\text{probability} = \frac{\#\text{ desired outcomes}}{\text{total possible outcomes}} = \frac{}{{}_{10}C_4}$$



Homework:

p. 858: 2-14 even
15-20 all
23, 24