Recognizing Combinations

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10.3 Recognizing Combinations

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[Figure 1]

Joanne, Laura and their four children are going to the beach for the day. They are packing lunches and want to choose two snacks from the five different types of snacks they have in their kitchens. Both women have oranges, pretzels, raisons, crackers, and apples available to choose from. How many combinations of the five snacks, taken two at a time, do the women have to choose from?

In this concept, you will learn to recognize combinations.

Combination

Order is important for some groups of items but not important for others. If you are making a salad and you put in some lettuce, carrot, cucumber, and green pepper, then the order in which they are put in the bowl does not natter. Hence you are talking about a **combination**. For combinations, you are merely selecting. A combination is an arrangement of items in which order, or how the items are arranged, is not important.

For combinations, the collection of one order of the items is not functionally different than any other order. Think about a pizza. It doesn't matter which order you put on the toppings once they are all on there. You can put a combination of toppings on a pizza.

Sometimes order does matter like opening the combination lock on your locker. When the order does matter, then you would use a permutation.

Let's look at an example.

Six people–Larry, Sherry, Terri, Carrie, Mary, and Harry all want to ride in a rowboat that can hold only 4 passengers. How many different groups of 4 passengers can ride in the boat?

First, write out a single order.

Larry, Sherry, Terri, Harry

Next, rearrange the order. Did changing the order of the items change the outcome? If so, then order matters.

Sherry, Harry, Larry, Terri

This is a different order but the same 4 passengers.

Order is not important and you would use combinations to solve for the number of groups.

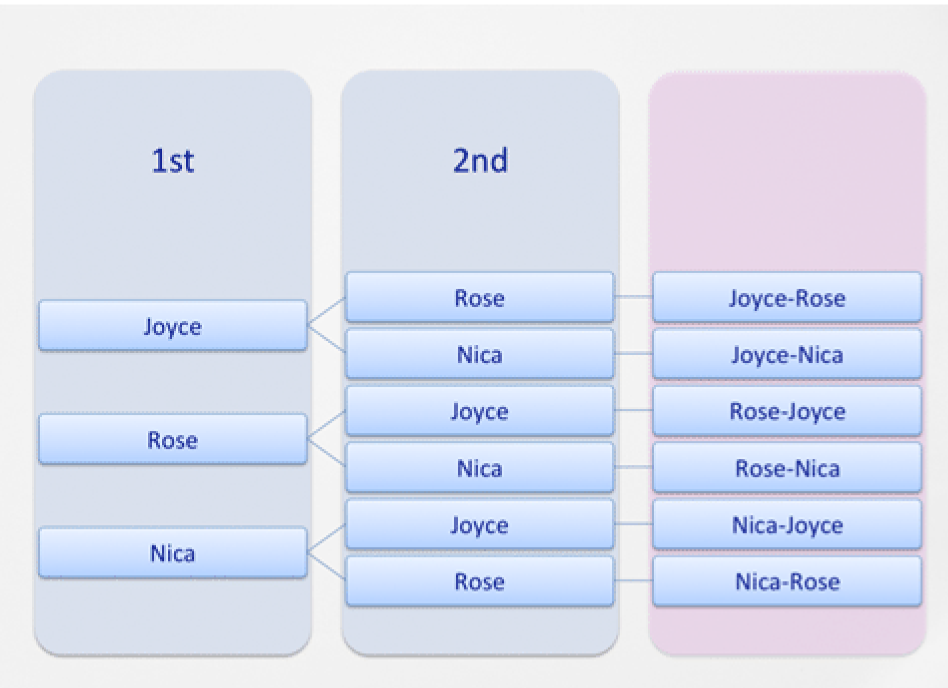
When solving problems, combinations can be used to solve problems when order is not important. One way to find the number of combinations is to use a tree diagram.

Let's look at an example.

For his top tennis doubles team, Coach Yin is considering 3 players: Joyce, Rose, and Nica. How many different doubles teams can the coach consider?

First, draw a tree diagram to show all 6 permutations of the 3 players. Order doesn't matter in this problem.

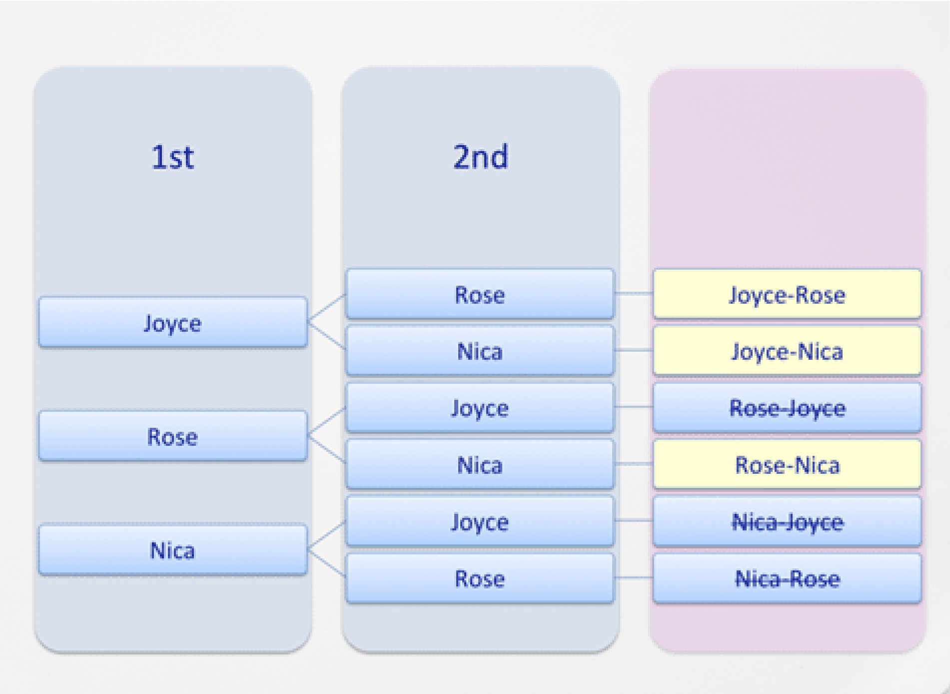
For example, the team of Joyce-Rose is no different than the team of Rose-Joyce.



[Figure 2]

So in the second tree diagram we cross out all outcomes that are repeats. This leaves 3 combinations that are not repeats.

Joyce-Rose, Joyce-Nica, Rose-Nica



[Figure 3]

The answer is that there are three possible combinations.

This method of making a tree diagram and crossing out repeats is reliable, but it is not the only way to find combinations.

Examples

Example 1

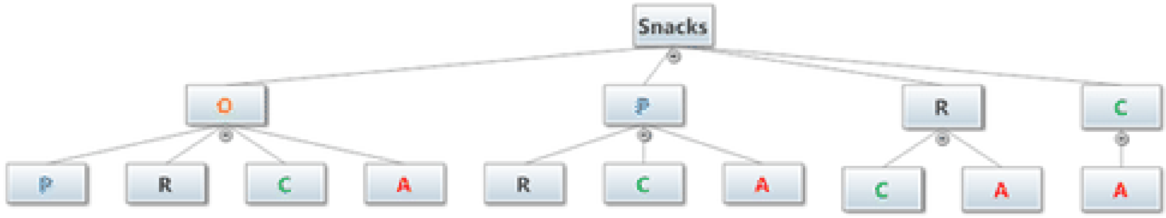
Earlier, you were given a problem about the moms packing snacks for the beach.

Joanne and Laura are getting ready for a day at the beach. The women are packing the lunches to take with them and want to choose two of the five snacks they have available to put with the lunches.

First, list the 5 snacks.

$$\text{Oranges}(O), \text{Pretzels}(P), \text{Raison}(R), \text{Crackers}(C), \text{Apples}(A)$$

Next, draw a diagram showing all of the different combinations.



[Figure 4]

The answer is 10.

There are 10 possible combinations of choosing 2 snacks from the 5 choices.

Example 2

How many different violin duos can Ben, Jen, Ren, Wen, and Ken form?

First, list all of the possible combinations.

	Ben	Jen	Ren	Wen	Ken
Ben		Ben – Jen	Ben – Ren	Ben – Wen	Ben – Ken
Jen	Jen – Ben		Jen – Ren	Jen – Wen	Jen – Ken
Ren	Ren – Ben	Ren – Jen		Ren – Wen	Ren – Ken
Wen	Wen – Ben	Wen – Jen	Wen – Ren		Wen – Ken
Ken	Ken – Ben	Ken – Jen	Ken – Ren	Ken – Wen	

Second, cross out all duplicates. For example Jen – Ben is the same as Ben – Jen.

	Ben	Jen	Ren	Wen	Ken
Ben		~~Ben – Jen~~	~~Ben – Ren~~	~~Ben – Wen~~	~~Ben – Ken~~
Jen	Jen – Ben		~~Jen – Ren~~	~~Jen – Wen~~	~~Jen – Ken~~
Ren	Ren – Ben	Ren – Jen		~~Ren – Wen~~	~~Ren – Ken~~
Wen	Wen – Ben	Wen – Jen	Wen – Ren		~~Wen – Ken~~
Ken	Ken – Ben	Ken – Jen	Ken – Ren	Ken – Wen	

Then, list the possible combinations of violin duos.

Jen – Ben

Ren – Ben

Wen – Ben

Ken – Ben

Ren – Jen

Wen – Jen

Ken – Jen

Wen – Ren

Ken – Ren

Ken – Wen

The answer is 10.

There are 10 possible combinations for these 5 people to be placed in a violin duo.

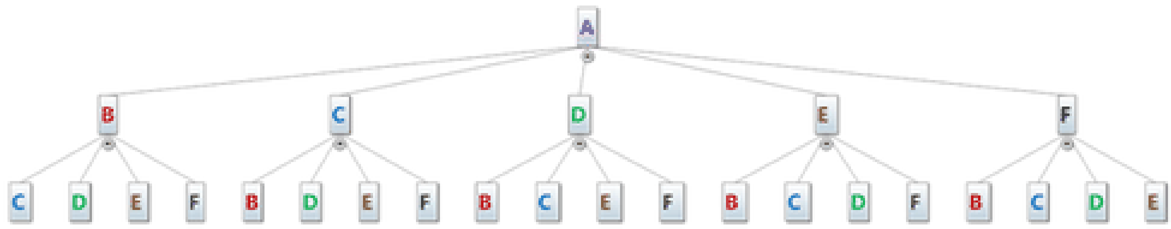
Example 3

How many different letter arrangements can you make if you have six letters but only use three at a time?

First, choose 6 letters.

A, B, C, D, E, F

Next, choose one letter and draw a diagram showing all of the different combinations.



[Figure 5]

The answer is that there are 20 combinations.

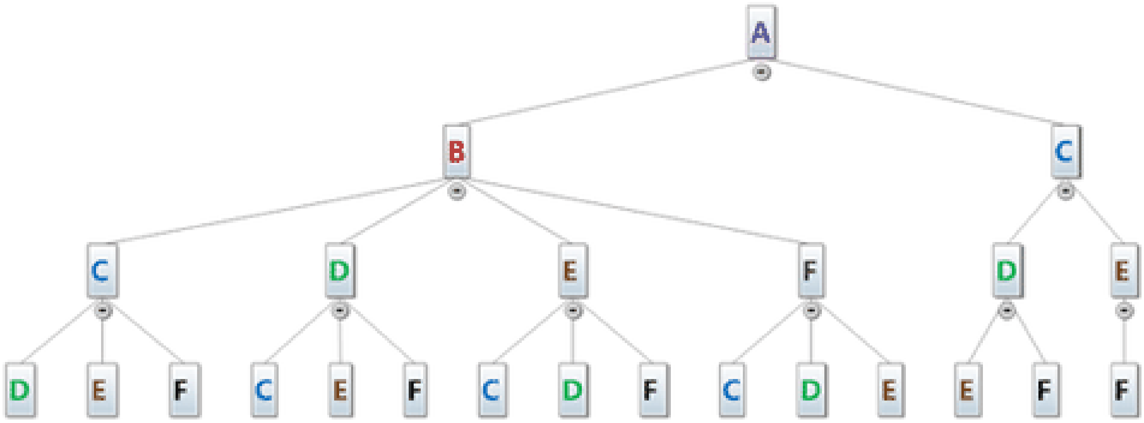
Example 4

How many different letter arrangements can you make if you have six letters, but only use four at a time?

First, choose 6 letters.

A, B, C, D, E, F

Next, choose one letter and draw a diagram showing all of the different combinations.



[Figure 6]

The answer is that there are 15 combinations.

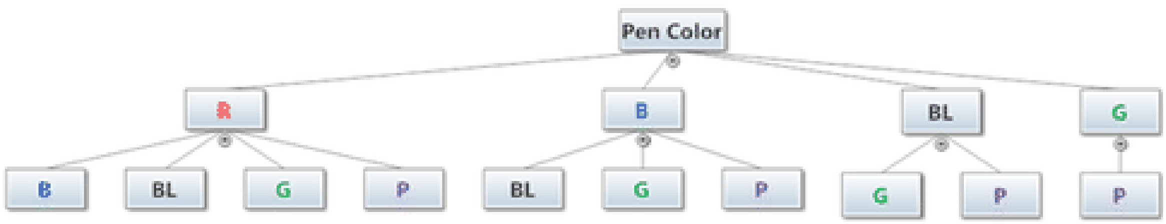
Example 5

You have 5 colored pens. How many different letter arrangements can you make if you only choose two at a time?

First, choose 5 colors.

$$\text{Red }(R), \text{Blue }(B), \text{Black }(Bl), \text{Green }(G), \text{Purple }(P)$$

Next, draw a diagram showing all of the different combinations.



[Figure 7]

The answer is 10.

There are 10 possible combinations of choosing 2 pens from 5.

Review

Solve each combination.

1. At Dudley's Dude Ranch there are 6 riders but only 4 horses. How many different ways can a group of 4 go out on ride?

2. With 4 laps to go, Dale Earnhardt Jr., Robbie Gordon, Kyle Busch, and Kasey Kahne are all in contention to win a NASCAR race. In how many different ways can the top three drivers finish?

3. Ace, King, Queen, Jack, Ten, and Nine of Clubs are face down on a table. How many different 3-card hands can you draw all at once?

4. A bag has 4 marbles: red, blue, yellow, and green. In how many different ways can you reach into the bag and draw out 2 marbles at once and drop them in a cup?

5. How many different 4-horn bands can you choose from a class of 10 horn players?

6. Eight candidates are running in the primary elections for president. How many president and vice president pairs are possible?

7. Fifteen students compete in the Geography Bee. How many different ways can three people be chosen as winners?

8. Nine people want to ride on the banana boat but there are only 4 life jackets. How many different groups can ride on the banana boat at one time?

9. The 5 last people at a movie must compete for the last 3 empty seats. How many different groups of 3 can sit and watch the movie?

Use what you have learned to figure out combinations.

10. Leah collected 3 different flowers for a bouquet – a rose, a tulip, and a daffodil. How many 2-flower bouquets can she make?

11. Leah added a lily to her flowers. How many 2-flower bouquets can she make out of a rose, a tulip, a daffodil, and a lily?

12. How many 3-flower bouquets can Leah make out of a rose, a tulip, a daffodil, and a lily?

13. How many 2-flower bouquets can Leah make out of a rose, a tulip, a daffodil, a lily, and a violet?

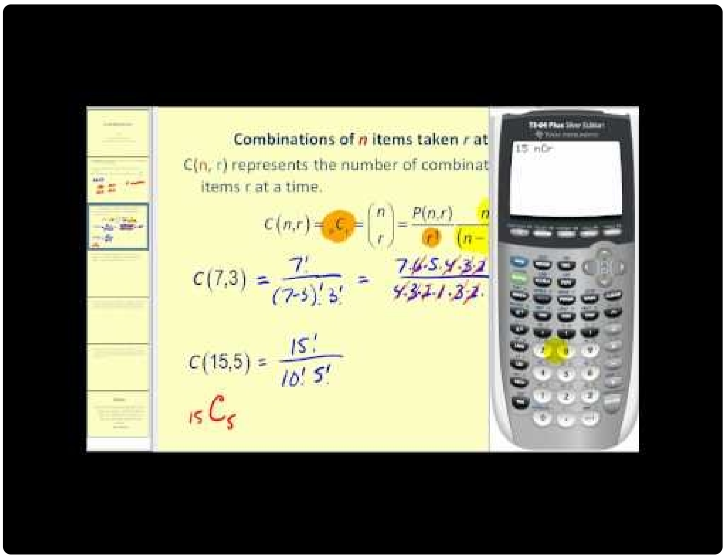
14. How many 3-flower bouquets can Leah make out of a rose, a tulip, a Daffodil, a lily, and a violet?

15. At Dudley's Dude Ranch there are 5 dudes who want to ride – Peg, Greg, Meg, Sue, and Drew – but only 4 horses. How many different 4-horse groups can go out for a ride?

Review (Answers)

To see the review answers, return to the Table of Contents and select ‘Other Versions’ or ‘Resources’.

Resources



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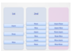	**Credit:** Luke Ma;Rubbermaid Products **Source:** https://www.flickr.com/photos/lukema/14004927459/in/photolist-smTGyY-nkyV1x-nxY9Ud-pdzTmR-dwBkrf-cd6Wzj-btm1E4-6qc6qN-FExV7-dELWGP-dhwHo5-8Rcqe3-4zyHt6-54564D-dpG9eg-5syggy-bGudU4-urx1wt-4A3tnr-cAWhKS-mEWFPP-kuDA7t-4zCXXo-acj54L-Mi216-rAoSeA-pCak9W-nYESVN-o7PVkv-kxGzNN-4AErME-7wfjiL-sKJgj6-dFRTDK-2GBBD5-nQJ4xr-h6KXhq-5ppxTV-n6wDiJ-4xGSH5-2grTy-oCamsq-rdfeSH-pJXp8r-jXTRL-rj53D4-cDogzA-6xqBLU-soZeNc-rokY8F ; https://www.flickr.com/photos/rubbermaid/6909788429/in/photolist-bwAtng-e4LwhA-6AjKRf-d2fN35-bwAtkv-5knS9u-feAdrH-6Z3qo8-ajbTpV-bwAtjx-a24cSu-5fccVN-fEjuJA-62Z2qK-6sNGag-b3BZgR-ca7jeh-4oH9UH-5fUuuF-5qwER2-5fjtBM-bwAtfR-5eTQYo-bwAthg-b5oyzT-85XShW-bwAtcz-bwAC4H-5kx3Xt-bwAtir-bwAtek-a2GikS-5dGS3q-5wkjBC-5e3KT8-5geQUe-5eG7zY-7HiPcj-5knY4j-85UGL6-e4ERmn-5j2XZw-5g8VTP-5hM586-5fc5dA-5pXRgG-5pTupT-5tXWBP-5jNGZN-5nFDbZ
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