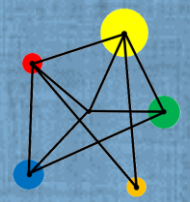
Listing Problems



Use a strategy to list all outcomes.

Vocabulary

Systematic
Doing things in an orderly manner.

Simple Lists

In how many different ways can Amy rearrange the letters of her name?
Two ways have been listed already.

1. A M Y
2. A Y M
3. ___ ___ ___
4. ___ ___ ___
5. ___ ___ ___

___ ___ ___

___ ___ ___

___ ___ ___

___ ___ ___

Solution

There are six ways in total.

1. A M Y
2. A Y M
3. M A Y
4. M Y A
5. Y A M
6. Y M A

Can you describe the system that was used to list the ways?

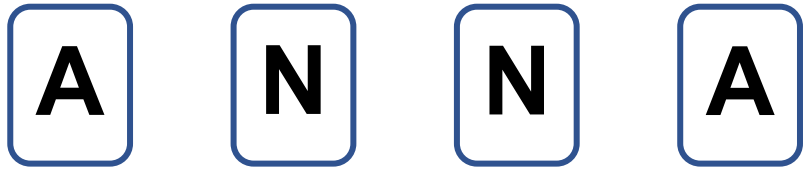
Exercise

1. How many different ways can Tom rearrange the letters of his name?
   Make a list of all the different ways.

2. How many ways can you rearrange the letters of the word BIB?
   Make a list of them.

3. A country has a flag that is made of three rectangular sections.
   The president insists there is one blue section, one green section and one white section.
   How many different flags can be made?

4. Anna has some cards with the letters of her name on.



How many different rearrangements of the cards can Anna make?

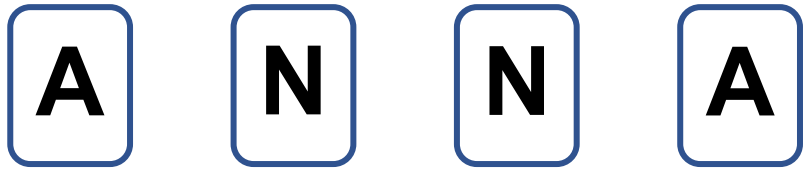
Challenge

Repeat question 4 but with the letters of the name ‘Anne’.

Solutions

1. How many different ways can Tom rearrange the letters of his name?
   Make a list of all the different ways.
   6 ways: MOT , MTO , OMT , OTM , TMO , TOM
2. How many ways can you rearrange the letters of the word BIB?
   Make a list of them.
   3 ways: BBI , BIB , IBB
3. A country has a flag that is made of three rectangular sections.
   The president insists there is one blue section, one green section and one white section.
   How many different flags can be made?
   6 ways:

4. Anna has some cards with the letters of her name on.



How many different rearrangements of the cards can Anna make?
6 ways: AANN , ANAN , ANNA , NANA , NNAA , NAAN

Challenge
Repeat question 4 but with the letters of the name ‘Anne’.

12 ways: ANNE , ANEN , AENN , EANN , ENAN , ENNA , NAEN , NANE , NNAE , NEAN , NENA , NNEA

Question

In how many ways can the letters A, B, C and D be arranged?

A **B** **C** **D**

Solution

In how many ways can the letters A,B,C and D be arranged?

ABCD	**BB**CD	**CA**BD	**DA**BC
ABDC	**BB**DC	**CA**DB	**DA**CB
ACBD	**BC**BD	**CB**AD	**DB**AC
ACDB	**BC**DB	**CB**DA	**DB**CA
ADCB	**BD**CB	**CD**AB	**DC**AB
ADBC	**BD**BC	**CD**BA	**DC**BA

24 ways

When you are asked to make a list of things, try to use a system so that you can keep track of everything.

Exercise

1. How many 3 digit numbers can you make using the digits, 5 , 6 and 8?
   Use each digit only once.

2. Alfin has four pens:

   Blue , Black , Red . Green

   In how many ways can he choose two of them?

3. There are 5 people in a room.
   Olivia wants to choose 3 of them for an interview.
   How many ways can she do this?

4. Isabel wants to put four different Books on a shelf.

   A Tale of Two Cities
   Back to the Future
   Charlie & the Chocolate Factory
   Dracula

   In how many different ways can she place the books on the shelf?

Challenge

How many different 3-digit numbers can you write down using the digits 1, 2 and 3?
Use each digit only once.

Solutions

1. How many 3 digit numbers can you make using the digits, 5 , 6 and 8?
   Use each digit only once. **6**

2. Alfin has four pens:

   Blue , Black , Red . Green

   In how many ways can he choose two of them? **6**

3. There are 5 people in a room.
   Olivia wants to choose 3 of them for an interview.
   How many ways can she do this? **10**

4. Isabel wants to put four different Books on a shelf.

   A Tale of Two Cities
   Back to the Future
   Charlie & the Chocolate Factory
   Dracula

   In how many different ways can she place the books on the shelf? **24**

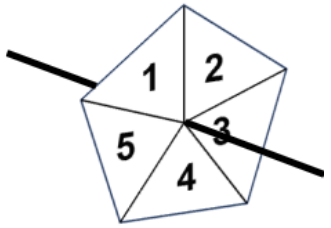
Challenge

How many different 3-digit numbers can you write down using the digits 1, 2 and 3?
Use each digit only once. **27**

Example

Anna has a coin and a 5-sided spinner.

She tosses the coin and spins the spinner.



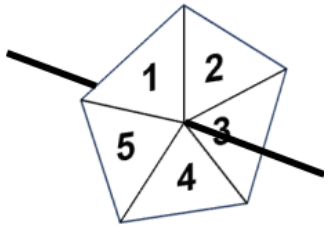
One possible outcome is (2 , Heads).

Make a list of all the possible outcomes.

Solution

Anna has a coin and a 5-sided spinner.

She tosses the coin and spins the spinner.



One possible outcome is (2 , Heads).

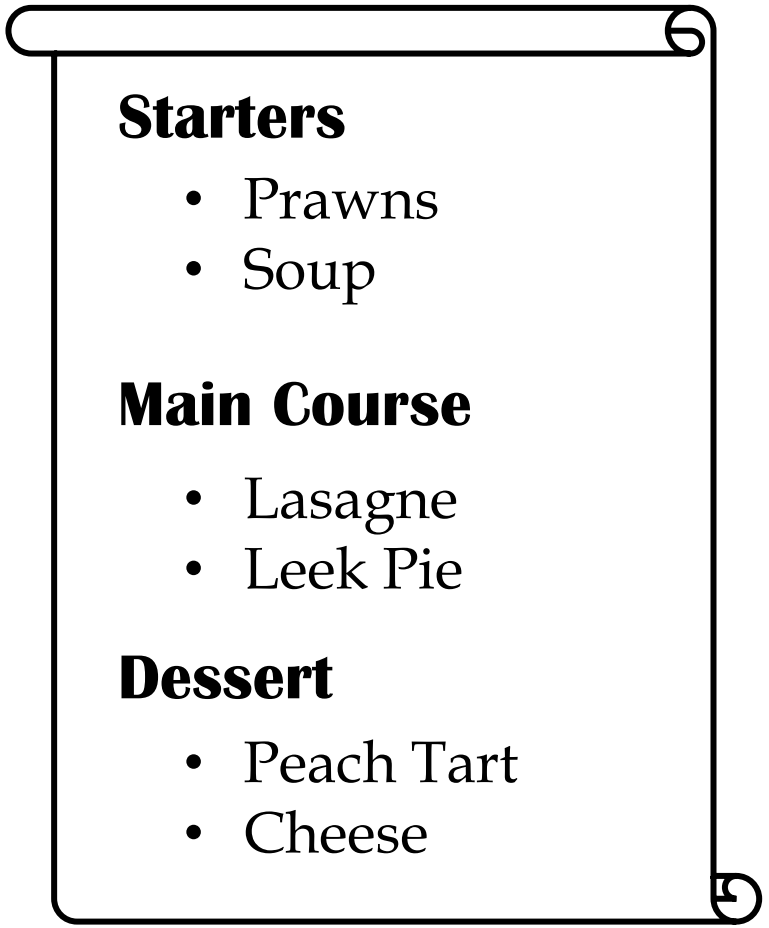
Make a list of all the possible outcomes.

(1 , Heads) **(2 , Heads)** **(3 , Heads)** **(4 , Heads)** **(5 , Heads)**

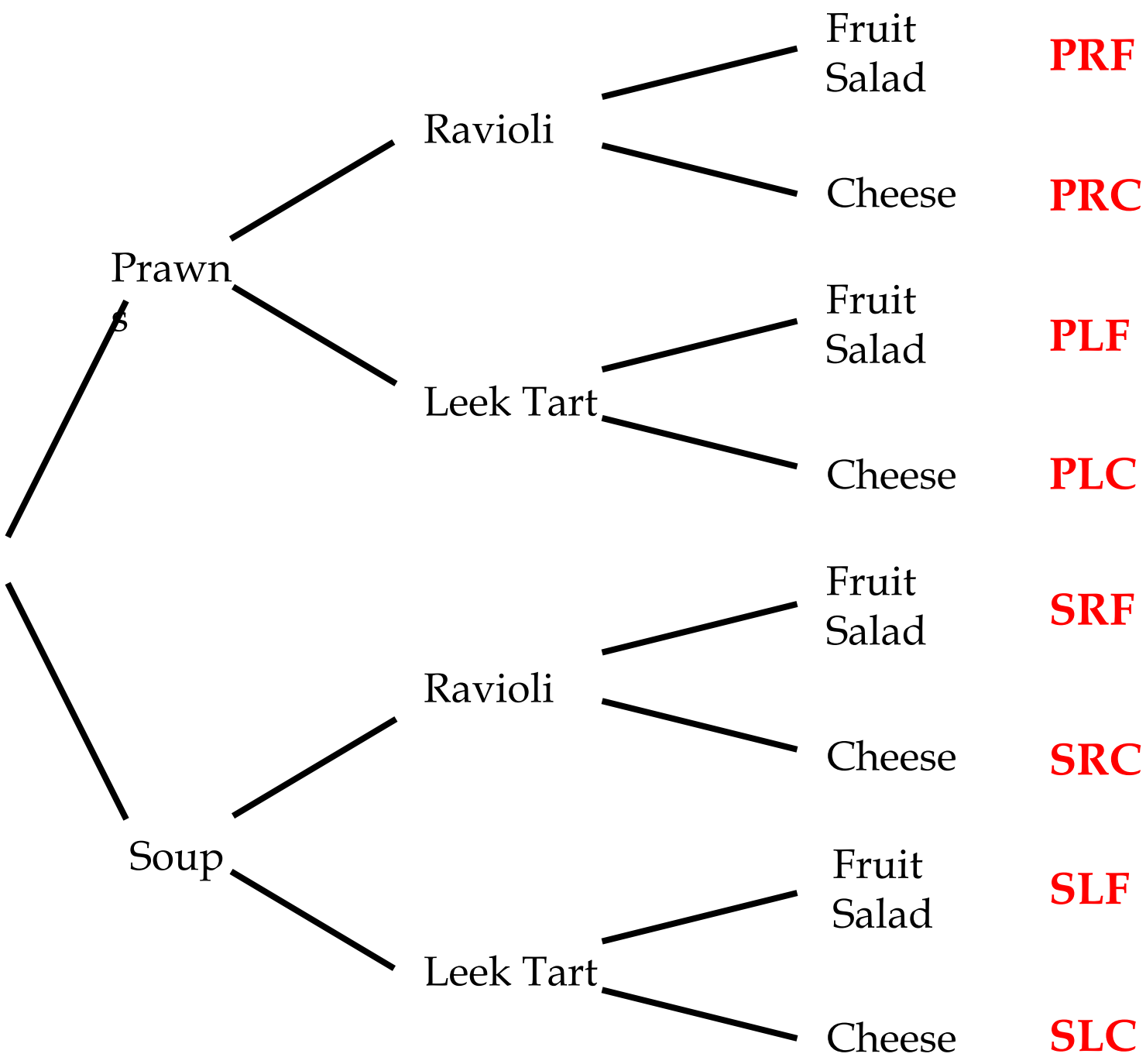
(1 , Tails) **(2 , Tails)** **(3 , Tails)** **(4 , Tails)** **(5 , Tails)**

Question

Here is a lunch menu from a restaurant.



How many different combinations of starter, main course and dessert are possible?



Starters

- Prawns
- Soup

Main Course

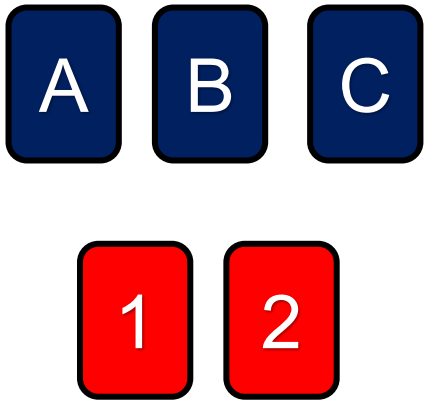
- Ravioli
- Leek Tart

Dessert

- Fruit Salad
- Cheese

There are 8 combinations in total.

Exercise



Annabel is going to choose one letter card and one number card.

In how many ways can she do this?

Three children are to be picked from a team of eleven to receive a prize.

How many different combinations of prizewinners are possible if:

a) The children can win more than one prize.

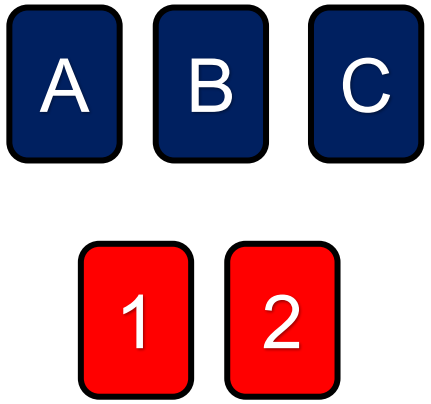
b) Each child can only win one prize

Most UK number plates are made up of two letters, two numbers and then three letters.

a) How many possible number plates are there?

b) Given that the two digits are fixed, how many number plates are possible?

Solutions



Annabel is going to choose one letter card and one number card.

In how many ways can she do this?

3 x 2 = 6

Three children are to be picked from a team of eleven to receive a prize.

How many different combinations of prizewinners are possible if:

a) The children can win more than one prize.

b) Each child can only win one prize.

a) 11 x 11 x 11 = 1331

b) 11 x 10 x 9 = 990

Most UK number plates are made up of two letters, two numbers and then three letters.

a) How many possible number plates are there?

b) Given that the two digits are fixed, how many number plates are possible?

a) $(26)^2$ x 99 x $(26)^3$ = 1,176,256,224

b) $(26)^2$ x $(26)^3$ = 11,881,376

Extension

How many different ways are there to rearrange all 26 letters of the alphabet?

i.e.

Z Y X W V U T S R Q P O N M L K J I H G F E D C B A

Extension

How many ways are there to rearrange all the letters of the alphabet?

26 x 25 x 24 x ……..x 3 x 2 x 1

= 403,291,461,126,605,635,584,000,000

Exam Style Question

After school, Misele will

- Go to the gym (G)
- Walk her dog (D)
- Make her lunch for tomorrow (L)

Complete the list of the 6 possible orders in which she could do these tasks.

One order has already been filled in.

G D L	

Solution

After school, Misele will

- Go to the gym (G)
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Complete the list of the 6 possible orders in which she could do these tasks.

One order has already been filled in.

G D L	G L D
D G L	D L G
L D G	L G D