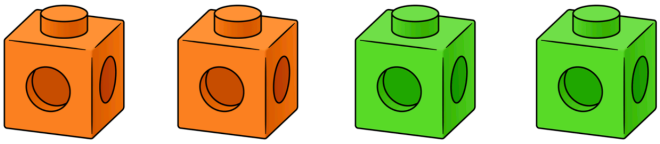
Exploring

1.1) **Towers**

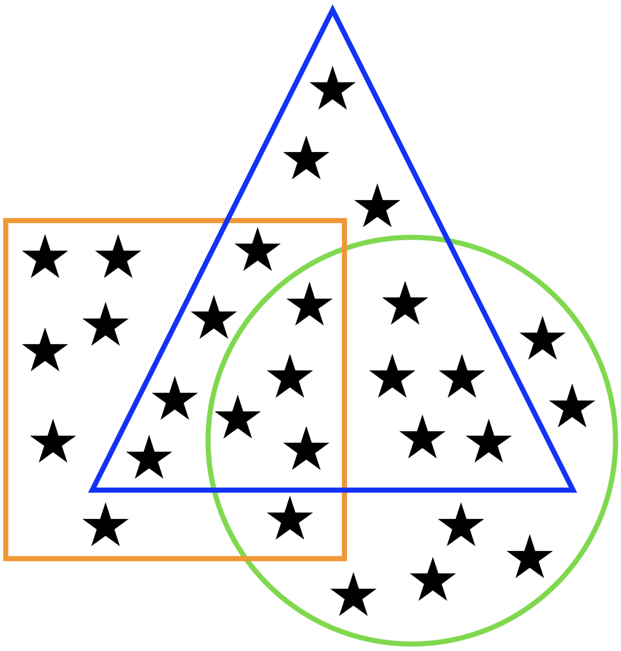
I am going to build a tower with these four blocks by placing them on top of each other.

How many different looking towers can I make?



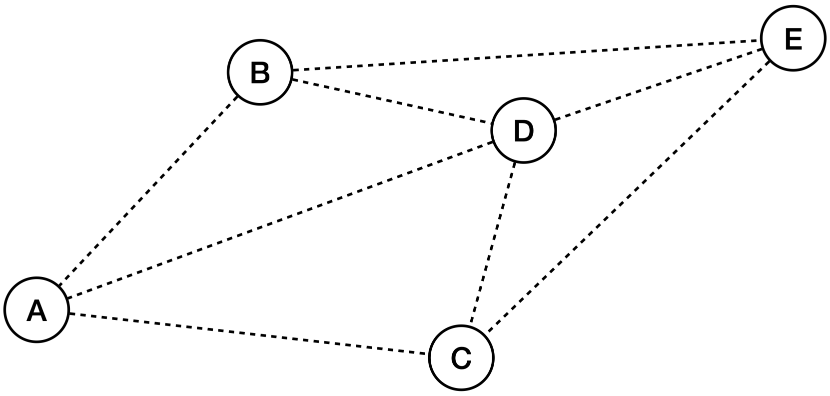
1.2) **Stars**

Look at this diagram. How many stars are inside exactly 2 shapes?



1.3) **A to E**

How many different ways can I travel on the lines from ***A*** to ***E*** if I am always moving towards ***E***?



Extension

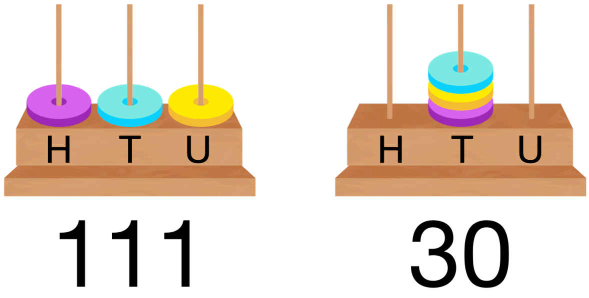
1.4) **Place Value Frame**

This place value frame shows hundreds, tens and units.

I can show numbers by placing 3 rings on the frame.

I have shown how to make 111 and how to make 30.

Altogether, how many numbers can I show on a place value frame using 3 rings?



1.5) **Netball or Hockey**

35 children have arrived at a sports centre.

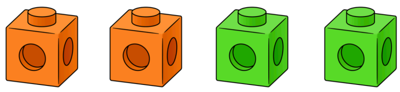
They will either play netball or hockey.

9 more children will play hockey than netball.

How many children will play hockey?

Solution 1.1: Towers

The question is: I am going to build a tower with these four blocks by placing them on top of each other.
How many different looking towers can I make?



Strategy: Write an Organised List.

We can write an organised list to see how many different towers are possible.
We know there are four blocks in the tower and that two are orange and two are green.

1) We can build 3 different towers if we start building on an orange block:

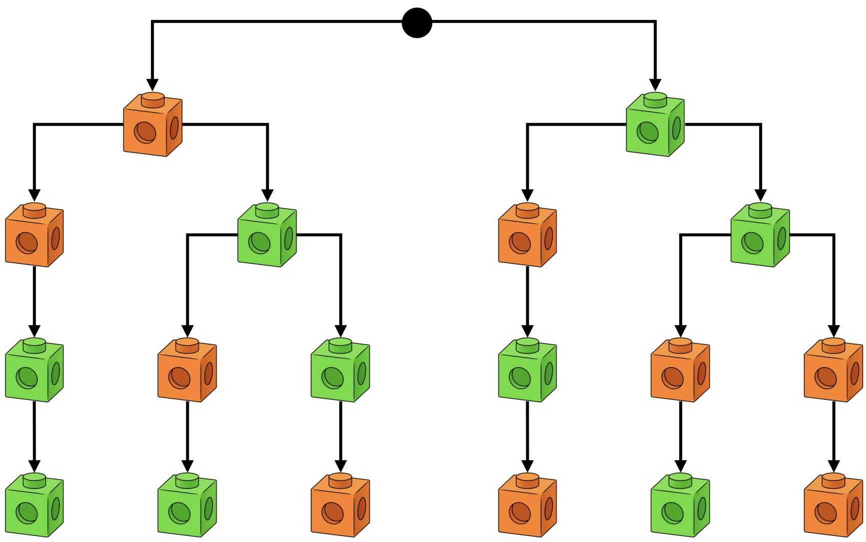
Block 4 →	G	G	O
Block 3 →	G	O	G
Block 2 →	O	G	G
Block 1 →	O	O	O

2) We can build 3 different towers if we start building on a green block:

Block 4 →	O	O	G
Block 3 →	O	G	O
Block 2 →	G	O	O
Block 1 →	G	G	G

There are no other possible towers to build starting with an orange or green block.
Altogether, I can make **6 different towers**.

Strategy: Draw a Tree Diagram.
Another way to find all the different towers that are possible is to draw a tree diagram.



1 2 3 4 5 6

The starting block will either be orange or green.

If the first block is orange, it is possible to make three towers.

It is also possible to make three towers if the first block is green.

Altogether, I can make **6 different towers**.

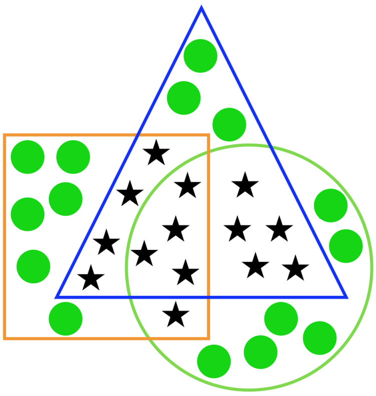
Solution 1.2: Stars

The question is: Look at this diagram. How many stars are inside exactly 2 shapes?

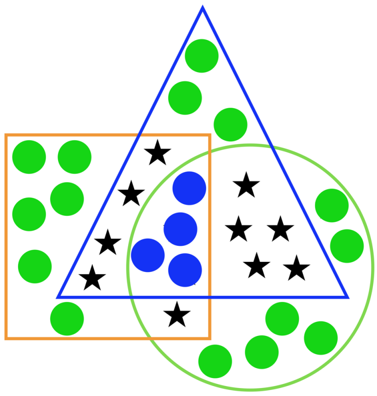
Strategy: Use a Process of Elimination.

In this diagram, stars are inside one, 2 or 3 shapes. To find out how many stars are inside exactly 2 shapes, we can eliminate the stars inside only one shape and starts inside all 3 shapes.

1) Let's put a **green** counter on all the stars inside only one shape:



2) Now let's put a **blue** counter on all the stars that are inside all 3 shapes:



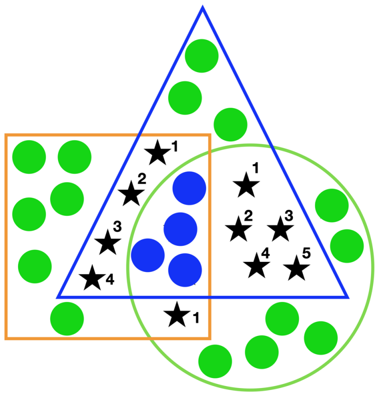
We have now covered up all of the stars except the stars that are inside exactly 2 shapes.

There are **4** stars inside the triangle and square.

There are **5** stars inside the circe and the triangle.

There is **one** star inside the square and the circle.

Altogether there are **10 stars** inside exactly 2 shapes.



Strategy: Use Concrete Materials.

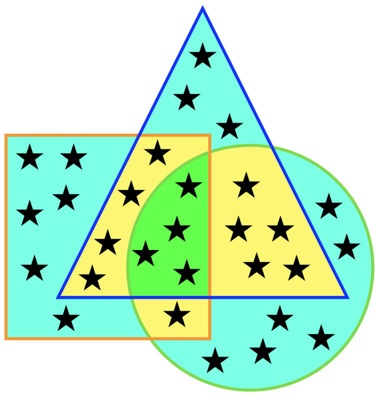
Find 3 different coloured highlighters. Use one highlighter (we have used blue) to colour in all the regions of the figure that are only part of one shape.

Select a second colour (we have used yellow) to colour in all the regions of the figure that are a part of 2 shapes.

Finally, select a third colour (we have used green) to highlight the region of the figure that is a part of all 3 shapes.

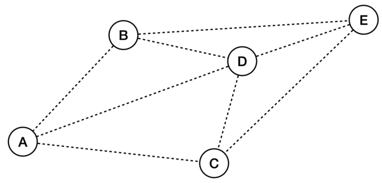
We need to find out how many stars are inside exactly 2 shapes. We need to count the number of stars that are yellow regions.

Altogether, there are **10 stars** inside exactly 2 shapes.



Solution 1.3: A to E

The question is:
How many different ways can I travel on the lines from ***A*** to ***E*** if I am always moving towards ***E***?



Strategy: Write an Organised List.

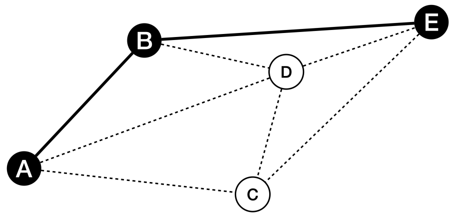
We can write an organised list to see how many different ways there are to travel from ***A*** to ***E***.

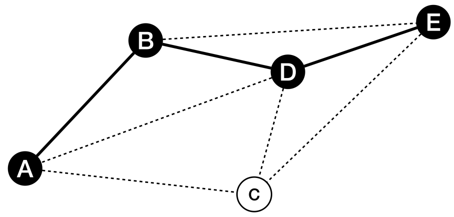
From ***A***, I can travel to ***B***, or ***C*** or ***D***.

If I travel to ***B*** first, I can get to ***E*** in 2 ways:

A B E or

A B D E.

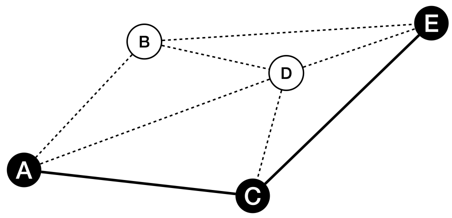


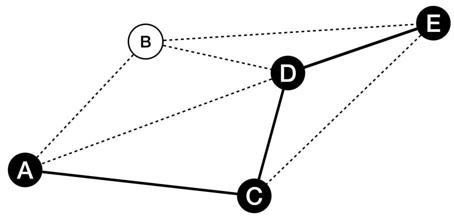


If I travel to ***C*** first, I can get to ***E*** in 2 ways:

A C E or

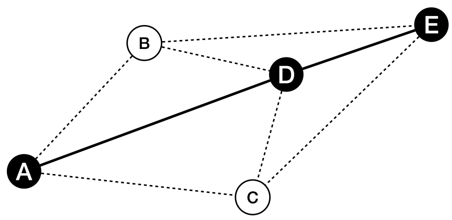
A C D E.





If I travel to ***D*** first, I can get to ***E*** in one way:

A D E.



Altogether, there are **5 ways** to travel from ***A*** to ***E.***

Strategy: Solve a Simpler Problem.

Let's start by finding how many ways there are to travel to ***B, C*** and ***D*** while always moving towards ***E.***

There is only **one** way to travel from ***A*** to ***B.***

A B

There are **3** ways to travel from ***A*** to ***D.***

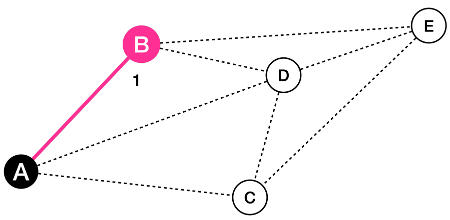
A B D

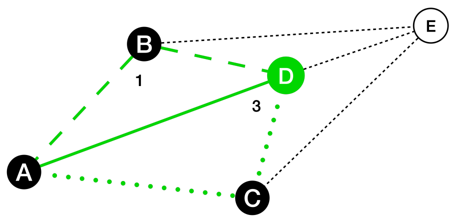
A D

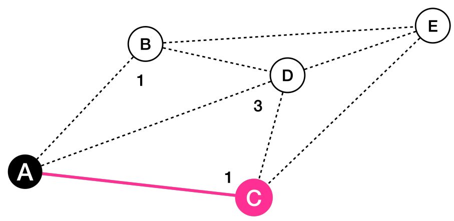
A C D

There is only **one** way to travel from ***A*** to ***C.***

A C





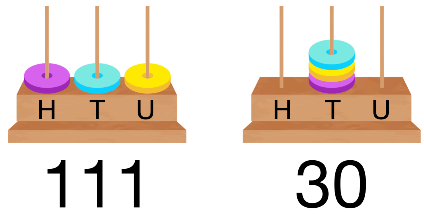


All these locations lead directly to ***E.***

This means we can add the number of ways to get to ***B, C*** and ***D*** (1 + 3 + 1) to find there are 5 ways to travel from ***A*** to ***E.***

Solution 1.4: Place Value Frames

The question is:
This place value frame shows hundreds, tens and units.
I can show numbers by placing 3 rings on the frame.
I have shown how to make 111 and how to make 30.
Altogether, how many numbers can I show on a place value frame using 3 rings?



Strategy: Write an Organised List.

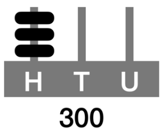
We can write an organised list to see how many different ways there are to show numbers on the place value frame using 3 rings.

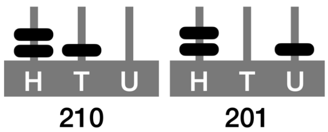
Let's start by finding how many numbers we can show if there is at least one ring on the hundreds peg.

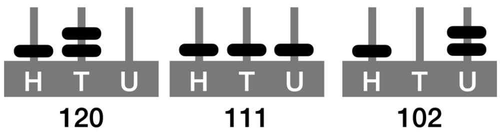
If we place 3 rings on the hundreds peg, we can show **300.**

If we place 2 rings on the hundreds peg, we can show **210** and **201**.

If we place one ring one the hundreds peg, we can can show **120, 111** and **102.**





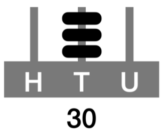


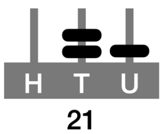
Now let's find out how many numbers we can show if there is at least one ring on the tens peg. We will not include numbers that we have already shown.

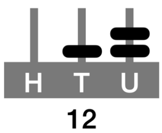
If we place 3 rings on the tens peg we can make **30.**

If we place one ring on the tens peg we can make **21.**

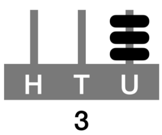
If we place one ring on the tens peg we can make **12.**







The only number we haven't yet shown is the number we can make when all rings are on the units peg, **3.**



With 3 rings, we can show **300, 210, 201, 120, 111, 102, 30, 21, 12** and **3.**
Altogether, we can show **10 different numbers** on this place value frame.

Solution 1.5: Netball or Hockey

35 children have arrived at a sports centre.

They will either play netball or hockey.

9 more children will play hockey than netball.

How many children will play hockey?

Strategy: Build a Table.

Let's put children into netball and hockey, so that there's always 9 more children playing hockey than netball.

We can record our totals in a table.

We know that altogether there are 35 children, so we won't begin our table with just one child playing netball.

Let's start with 10 children playing netball and then keep recording data in our table until the total number of children is 35.

When we have 10 children playing netball, we have 19 children playing hockey.

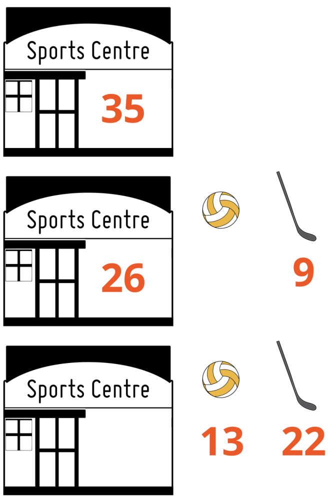
The total of 29 is too low.

If we keep increasing the number of children playing netball by one, we can see that we have a total of 35 children when we have 13 playing netball and 22 playing hockey.

Netball	10	11	12	13	14	15
Hockey	19	20	21	22	23	24
Total:	**29**	**31**	**33**	**35**	**37**	**39**

22 children will play hockey.

Strategy: Reason Logically.



We are told that there are 35 children at the sports centre.

Suppose we took 9 children and put them straight into the hockey team.

Then there would be the **same** number of netball players and hockey players left.

After taking 9 hockey players, there would be 35 – 9 = 26 children left.

Half of these 26 children are netball players and half of them are hockey players.

26 ÷ 2 = 13

Therefore there are 13 children playing netball, and 13 + 9 = **22 children playing hockey.**