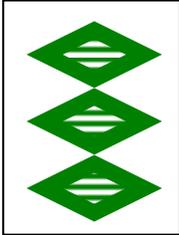# The Set Game

Game Rules

The game is based on a deck of cards varying in 4 features:

Shape (diamond, squiggle, oval)
Number (one, two, or three)
Shading (full, striped, or empty)
Colour (red R, green G, or blue B).

For each possible combination of shape, number, shading, colour, there is exactly one card of that type in the deck.

At all times, 12 cards are placed face up in the middle of the game area. The players have to spot SETS. If you spot one, say SET and show the three cards. If you're right, keep the set. The middle area has to be replenished. If no set can be found, three more cards can be laid down. The winner is the person with most sets at the end of the game.

A SET is made of 3 cards in which each individual feature either stays the SAME on all 3 cards card... OR DIFFERS in each of the 3 cards:

The first example is a set because all features are different: 3 different numbers, 3 different shapes, 3 different shadings, 3 different colours.

The second is a set because there are the same numbers and colours on all cards, but different shapes and shadings. The last is not a set because there are two solid and one striped cards.

Set Game Questions:

1. Here we will explore how many cards of some fixed types there are in the deck.

a) How many cards in the deck contain exactly 1 red diamond?

b) How many cards in the deck contain exactly 1 diamond?

c) How many cards in the deck contain diamonds?

d) How many cards are there in the deck?

2. How many different pairs of cards can be made with the cards in the deck?

3. Choose any pair of cards. In how many ways can you complete it to a SET?

Example:
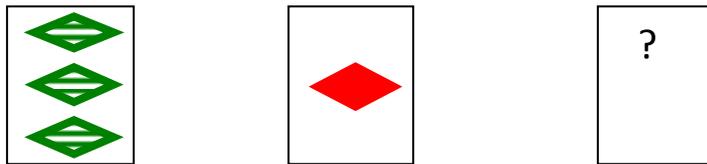
4. How many SETS can be formed with the cards in the deck?

5. A simple strategy is when you decide in advance what to look for in each of the 4 features: cards which are the same or cards which are different.

First, let's try to find the number of sets that have the **same shape, same colour, same shading, but different numbers**. Pick a card from the deck. In how many ways can you complete this to sets that will have the **same shape, same colour, same shading, but different numbers**?
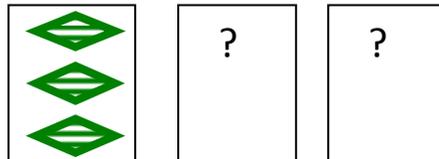

Now imagine you can start with any card. Can you now count the **total** number of sets that have the same shape, same colour, same shading, but different number?

Now repeat this process for different kinds of sets. For instance, in how many ways can you complete the card below to sets that have the **same shape, same colour, but different shading and different numbers**:
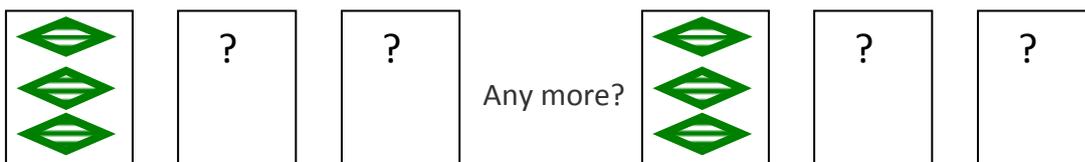
Now imagine you can start with any card. Can you now count the **total** number of sets that have the same shape, same colour, but different shading, and different numbers?

Now repeat the process for sets that have the **same shape, different colours, different shadings and different numbers**:

...
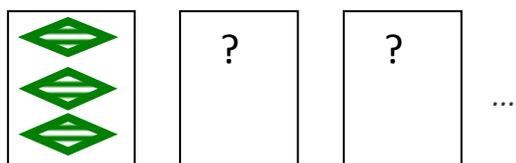
In the table below, each row represents a simple strategy. Can you now fill it in using the results above?

Strategy name	Shape	Colour	Shading	Number	How many SETS of this type?
SSSD	Same	Same	Same	Different	
SSDD	Same	Same	Different	Different	
SDDD	Same	Different	Different	Different	
DDDD	Different	Different	Different	Different	
SSSS	Same	Same	Same	Same	

What other simple strategies are there?

Type of strategy	List all strategies of this type
1 feature different, 3 the same	SSSD, SSDS,
2 features different, 2 the same	SSDD, SDDS,
3 features different, 1 the same	SDDD,
4 features different	
Total number of strategies	

Now can you add up your previous answers to find the total number of sets where 1 feature is different and 3 are the same?

6. Which types of SETS are most frequent in the game?

Type of SETS	How many	What percentage
Sets whose cards differ in exactly 1 feature		
Sets whose cards differ in exactly 2 features		
Sets whose cards differ in exactly 3 features		
Sets whose cards differ in exactly 4 features		

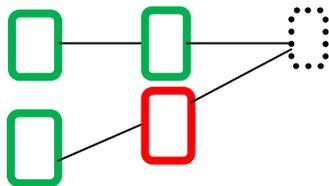7. a) What are the chances that 3 cards chosen randomly from the deck will not be a SET?
   b)What are the chances that 4 cards chosen randomly from the deck will not contain a SET?

Set Game Extension Questions

8. In the last round of 12 cards in the game, the very last 3 cards are placed **face down** in the playing area. How can you know with certainty if the three hidden cards form a SET? (No memorization, no guessing, no cheating are necessary).

We will come back to this question in a later session.

9. a) Place any three cards in the green areas. In how many ways can you fill in the red card area so that any three cards connected by a straight line should form a set?

b) Is it possible to place cards in all the red areas so that all 4 lines represent SETS?
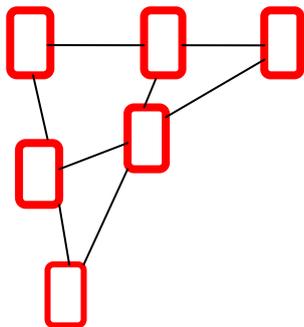
Hint: try each feature at a time. For example: In how many ways can you complete the diagram above with 1, 2, 3-s so that they are either all the same, or all different on each line? What happens when you consider all features at the same time?

10. If 5 cards are chosen randomly from the deck, what are the chances that they will not contain a SET?