Sample Space Diagrams

Prior Knowledge:

Before attempting this sheet, students should be able to calculate probabilities of independent events.

A sample space diagram is a way of listing all of the outcomes of two events which can then be used to calculate probabilities.

For example:

Two fair coins are flipped. Draw a sample space diagram showing all possible outcomes, then use your diagram to find the probability of obtaining two tails.

We need to include the outcomes for two coins: each coin has heads and tails. Let's use letters to simplify this.

The sample space diagram will look like this:

		Coin 1	
		Heads	Tails
Coin 2	Heads	**HH**	**HT**
	Tails	**TH**	**TT**

There are 4 outcomes, one of which is the outcome 'two tails'.

P(two tails) = $\frac{1}{4}$

When drawing sample space diagrams, make sure you read the question very carefully. Sometimes, you will need to list outcomes, like the sample space diagram above. Sometimes, you will need to find the sum (add) or the product (multiply) of two numbers.

Your Turn

1. A fair dice and a fair coin are thrown. Complete the sample space diagram showing all possible outcomes.

		Dice					
		1	2	3	4	5	6
Coin	H	1, H					
	T						

2. Two fair dice are thrown and the scores are added together.

		Dice 1					
		1	2	3	4	5	6
Dice 2	1	2					
	2						
	3						
	4						
	5						
	6						

a. Complete the sample space diagram showing all possible outcomes.

b. How many outcomes are there altogether?

_____

c. What is the highest possible score?

_____

d. Work out the probability of scoring a 3, giving your answer as a fraction in its simplest form.

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e. Find the probability of scoring a number greater than 9, giving your answer as a fraction in its simplest form.

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3. Two fair dice are thrown and the difference between the scores is recorded.

		Dice 1					
		1	2	3	4	5	6
Dice 2	1	0					
	2			1			
	3						
	4						
	5						
	6						

a. Complete the sample space diagram, showing all possible outcomes.
Hint: subtract the smaller number from the larger.

b. What is the probability that the difference between the scores is 5?

c. What is the probability that the difference between the scores is 7?

4. Two fair dice are thrown and the product of the two scores is found.

		Dice 1					
		1	2	3	4	5	6
Dice 2	1						
	2						
	3						
	4						
	5						
	6						

a. Complete the sample space diagram, showing all possible outcomes.
Hint: product means multiply.

b. What is the probability the product is 1?

c. What is the probability the product is an odd number? Give your answer as a fraction in its simplest form.

d. Find the probability the product is greater than 24, giving your answer as a fraction in its simplest form.

Challenge:

A fair, 4-sided spinner contains the numbers 1, 2, 3 and 4. A second fair spinner has 3 sides and contains the numbers 3, 7 and 11. The spinners are spun and their scores are added together. Find the probability that the total score is a prime number.