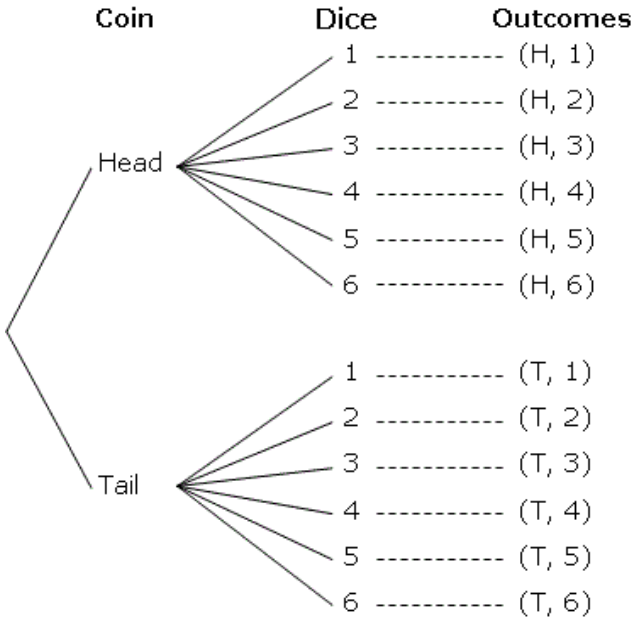
The probability of an event occurring as:

$$P(A) = \frac{(Number\ of\ Favorable\ Outcomes)}{Total\ number\ of\ outcomes}$$

When calculating probabilities, using counting techniques to determine possible outcomes makes the process easier. This chapter will focus on a number of these counting techniques.

The Fundamental Counting Principle:

Consider tossing a coin then rolling a six-sided dice. Let's look at all the possible outcomes by constructing a tree diagram. We will consider tossing the coin and rolling the dice as consecutive events.



The diagram accounts for the first two possibilities where the result can either be heads or tails, and then. When the dice is tossed, it provides all the possible combinations of results there can be with a 6-sided die.

The sample space: All the possible combinations of outcomes in an event.

For this diagram the sample space is.

{H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6}

We can find the total number of outcomes by multiplying the outcomes in the first event by the number of outcomes in the second event individually.

2 x 6=12

This matches the total sample space provided.

Conditional Probability for Independent Events:

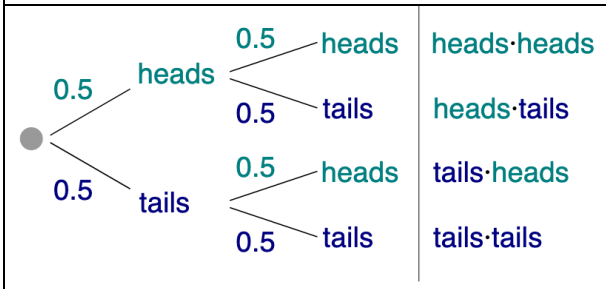
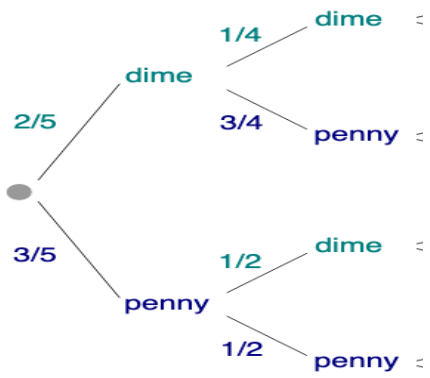
What is the difference between independent and dependent events?

Independent events: Events that do not change if a certain outcome is achieved.

For example: You take out different colored marbles from a bag, every time you take one out, you put it back in, therefore, the probability of getting that same marble stays the same because you put it back in.

Dependent Events: The probability of an event occurring changes based on the occurrence of a separate event.

For example: You take out different colored marbles from a bag, every time you take one out, you don't put it back in, therefore, the probability of getting that same marble changes because the number of marbles in the bag changed.

Independent Events:	Dependent Events:
	

Let's establish the basic equations in probability.

$$P(A) = \frac{(Number\ of\ Favorable\ Outcomes)}{Total\ number\ of\ outcomes}$$

$P(A \cap B) = P(A) \cdot P(B)$-Only works for independent events

$$P\left(A\ /\ B\right) = \frac{P(A \cap B)}{P(B)} - For\ independent\ events = P(A)$$

$$P(A') = \left(1 - P(A)\right)$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

If a question asks you to prove if an event is independent:

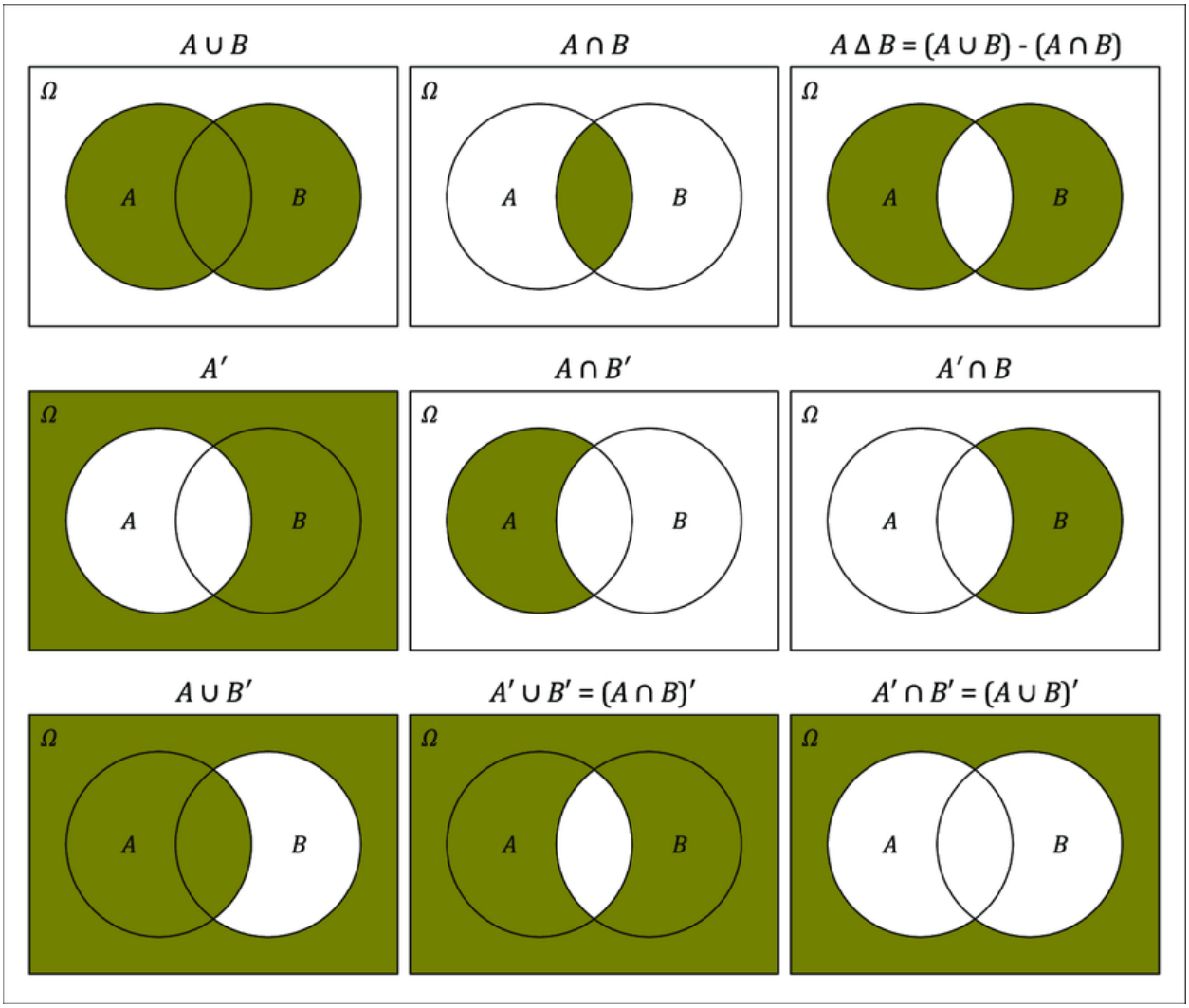
$$P\left(A \ / B\right) = P(A)$$

$$P(A \cap B) = P(A) \cdot P(B)$$

If the question asks you to prove that an event is dependent:

$$P(A \cap B) \neq P(A) \cdot P(B)$$

$$P\left(A \ / B\right) = \frac{P(A \cap B)}{P(B)}$$



Practice Questions:

1. A flight departs from Melbourne to Sydney. The probability that the flight departs on time, given the weather is fine in Melbourne is 0.9, and the probability that the flight departs on time, given

the weather is not fine in Melbourne is 0.7. The probability that the weather is fine on any day in July is 0.4.

By constructing a tree diagram or otherwise, find the probability that the flight from Melbourne to Sydney departs on time in a day in July.

Give your answer in its simplest form.

Find the probability that the weather is fine in Melbourne given that the flight departs on time on a day in July?

Give your answer in its simplest form.

2. A school consisting of 490 primary students and 490 secondary students offers everyone an optional end of year project to improve their grade. There are various types of projects they can do.

A summary of the number of student submissions are shown in the given table:

	Essay	Creative Story	Artwork	Other Project	Did not Submit
Primary	24	74	49	34	309
Secondary	88	82	82	62	176

a. Find the probability of selecting a student that submitted a project.
b. Find the probability of selecting a student that submitted a project given that they are in a secondary year.
c. Does the data suggest that doing a project and being a secondary student are independent or dependent?
d. Find the probability that a submitted project is an essay.
e. Find the probability that a submitted project is an essay given that the project was submitted by a primary student.
f. Does the data suggest that if a student did hand in a project, that being a primary student and writing an essay is independent or dependent?