

# Topic: Measuring Uncertainty with Probability

## Probability - Introduction to Tree Diagrams

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# What is a Probability Tree Diagram?

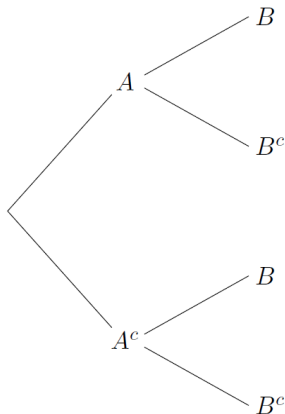
A **tree diagram** is a helpful tool when working with **multi-stage experiments** or **composite events**.

They can help with

- determining the sample space
- calculating probabilities.

Write

- each outcome at the end of the branch
- the probability on the branch



# Tree Diagrams

- Conditional probabilities correspond to second (or higher) level branches in a **tree diagram**.  
 $P(B|A)$        $P(B|A^c)$

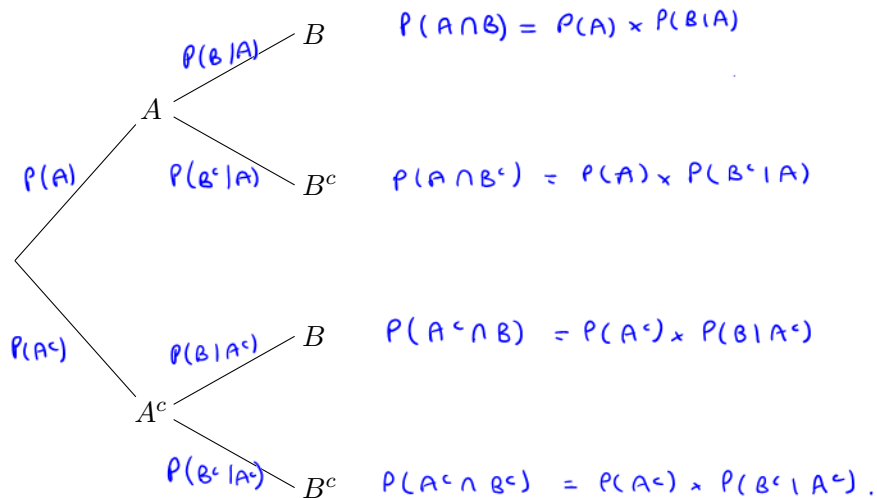
- Multiply** probabilities of all branches along a **path** to find the probability of a single outcome (using the multiplicative law of probability):

$$\underline{P(A \cap B)} = \underbrace{P(A)}_{\checkmark} \times \underbrace{P(B|A)}_{\checkmark}$$

- Sum** probabilities of all paths leading to an **event** to find its probability. The paths represent mutually exclusive outcomes.

$$P(B) = P(A \cap B) + P(A^c \cap B).$$

# Structure of a Tree Diagram

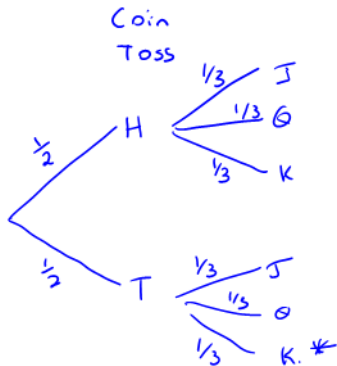


# Example

A fair coin is tossed and one card is drawn from a set of 3 cards labelled: Jack, Queen, King.

- a. Create a tree diagram to determine the outcomes in the sample space and  $n(S)$ .  
 $n(S) = |S| = \text{no. outcomes in } S.$
- b. Determine the probability of getting a Tail and a King.

## Example cont.



(a)

HJ

HQ

HK

TJ

TQ

TK

$n(s) = 6$  possible  
outcomes

(b)

$$P(T \cap K)$$

$$= P(T) \times P(K|T)$$

$$= \frac{1}{2} \times \frac{1}{3}$$

$$= \frac{1}{6}$$