Chapter 5 - Probability

Personal notes:

5.1 - Calculating Probabilities

Probability concepts

- An *experiment* is a repeatable process that gives rise to a number of outcomes.
- An *event* is a collection of one or more outcomes.
- A *sample space* is the set of all possible outcomes (usually illustrated as a sample space diagram or a Venn diagram).

Example

Two fair spinners each have four sectors numbered 1 to 4. The two spinners are spun together and the sum of the numbers indicated on each spinner is recorded.
Find the probability of the spinners indicating a sum of
(a) exactly 5 (b) more than 5

Example

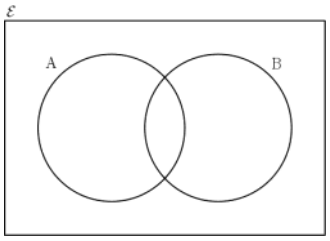
The table shows the times taken, in minutes, for a group of students to complete a number puzzle.

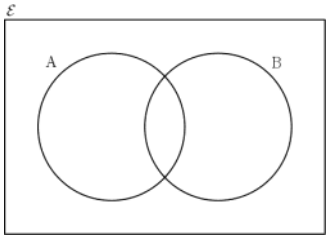
Time, t (min)	$5 \leq t < 7$	$7 \leq t < 9$	$9 \leq t < 11$	$11 \leq t < 13$	$13 \leq t < 15$
Frequency	6	13	12	5	4

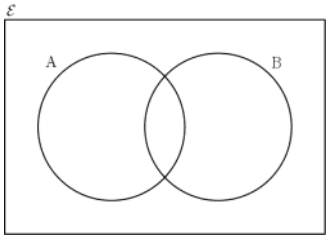
A student is chosen at random. Find the probability for a group of students to complete a number puzzle
(a) In under 9 minutes (b) in over 10.5 minutes.

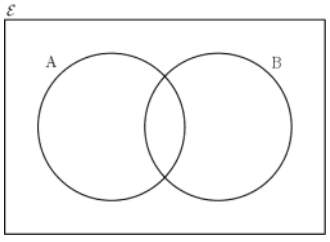
5.2 - Venn Diagrams

- Venn diagrams are named after the English mathematician John Venn (1834 - 1923)









Intersection of "not A" and "not B"

<u>Example</u>

Given that $P(A) = 0.6$ and $P(A \text{ or } B) = 0.85$, find the probability of:

a) $P(\text{not } A \text{ and } B)$

b) $P(\text{neither } A \text{ nor } B)$

5.2 - Venn Diagrams

Example

A vet surveys 100 of her clients. She finds that:

- 25 own dogs
- 11 own dogs and fish
- 10 own cats and fish
- 7 own dogs, cats and fish
- 40 own fish
- 15 own dogs and cats
- 53 own cats

A client is chosen at random. Find the P(B) that the client

a) owns dogs only

b) does not own fish

c) does not own dogs, cats or fish

Exam Practice

Jan 2012 Q6

The following shows the results of a survey on the types of exercise taken by a group of 100 people.

65 run 48 swim

60 cycle 40 run and swim

30 swim and cycle 35 run and cycle 25 do all three

(*a*) Draw a Venn Diagram to represent these data. **(4)**

Find the probability that a randomly selected person from the survey

(*b*) takes none of these types of exercise, **(2)**

(*c*) swims but does not run, **(2)**

(d) takes at least two of these types of exercise. **(2)**

5.3 - Mutually exclusive and Independent events

Mutually Exclusive

- Mutually exclusive events

- If A and B are mutually exclusive, then

- Venn diagram

Independent

- If two events are independent,

- If A and B are independent, then

- Independence does not affect how the Venn diagram circles are drawn.

5.3 - Mutually exclusive and Independent events

Example

Events A and B are mutually exclusive and $P(A) = 0.2$ and $P(B) = 0.4$.

Find: **a** $P(A \text{ or } B)$ **b** $P(A \text{ but not } B)$ **c** $P(\text{neither } A \text{ nor } B)$

Example

Events A and B are independent and $P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{5}$.

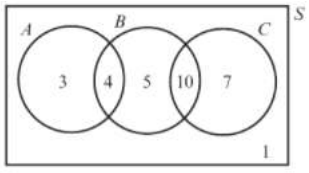
Find $P(A \text{ and } B)$.

Example

The Venn diagram shows the number of students in a particular class who watch any of three popular TV programmes.

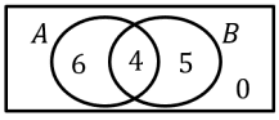
a Find the probability that a student chosen at random watches B or C or both.

b Determine whether watching A and watching B are statistically independent.



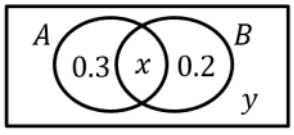
Practice

The Venn diagram shows the number of people who like each of two different colours. Determine if A and B are independent.



Practice

The Venn diagram shows the probability of each event. Given that A and B are independent, determine the possible values of x.



5.4 - Tree Diagrams

Example

There are 3 yellow and 2 green counters in a bag. I take two counters at random. Determine the probability that:

a) Draw a tree diagram to represent the situation.
b) They are of the same colour.
c) They are of different colours.