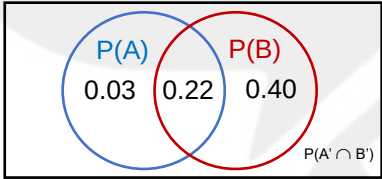
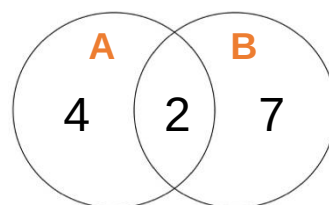


Conditional Probability

Conditional Probability	
$P(A \cap B)$	$P(A \cup B)$
<u>If A and B are independent:</u> $P(A \cap B) = P(A) \times P(B)$ <u>If A and B are dependent:</u> $P(A \cap B) = P(A B) \times P(B)$	<u>If A and B are mutually exclusive</u> $P(A \cup B) = P(A) + P(B)$ <u>If A and B not mutually exclusive</u> $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
The probability of event A, given that event B has already occurred: $P(A B) = \frac{P(A \cap B)}{P(B)} = \frac{\text{number of elements in A and B}}{\text{number of elements in B}}$	
EXAMPLE: You are about to sit an English and Maths exam at school. Let $P(A)$ = A in English Let $P(B)$ = A in Maths The results have been released and 62% of students scored an A in Maths, 25% scored an A in English and 22% of students scored an A in both exams.  The overlap section is written as $P(A \text{ and } B)$ or $P(A \cap B)$.	QUESTION: Find $P(A B)$. Given that you have already scored an A in Maths (B), what is the probability that you will score an A in English (A)? $P(A B) = \frac{P(A \cap B)}{P(B)} = \frac{0.22}{0.62} = 0.355$ The probability that you will score an A in English, given that you have already scored an A in Maths, is 35.5%. QUESTION: Find $P(A \cup B)$. $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $P(A \cup B) = 0.25 + 0.62 - 0.22 = 0.65$ The probability of getting an A in English or an A in Maths is 65%.
EXAMPLE: Find the following probabilities. (1) $P(A) = \frac{\text{number of elements in A}}{\text{total number of elements}} = \frac{6}{13}$ (2) $P(A \text{ and } B) = \frac{\text{number of elements in A and B}}{\text{total number of elements}} = \frac{2}{13}$ (3) $P(A B) = \frac{\text{number of elements in A and B}}{\text{number of elements in B}} = \frac{2}{9}$ (3) $P(B A) = \frac{\text{number of elements in A and B}}{\text{number of elements in A}} = \frac{2}{6} = \frac{1}{3}$	



Note: $P(A' \cap B')$ is the probability of not A and not B

Instructions: Answer the probability questions below.

1

The percentage of adults who are male and like gardening is 35.5%. Assume that the probability of being a man is 50%.

(a) Construct a Venn diagram.

Let A = likes gardening

Let B = male

(b) Find the probability of liking gardening, given that you are a man.

(c) Find the probability of liking gardening and being male.

2

In a class of 20 students, eight students take Biology and seven take History. Of these students, five of them take both classes.

(a) Construct a Venn diagram.

Let A = student taking Biology

Let B = student taking History

(b) Find the probability that a student takes only Biology.

(c) Find the probability that a student takes only History.

(d) Find the probability that a student takes Biology, given that they are already taking History.

(e) Find $P(B|A)$. Explain what this probability represents.

3

In a random survey, 21% of participants were female and below 25 years of age. Assume that the probability of being female is 50%.

(a) Construct a Venn diagram.

Let A = female

Let B = under 25

(b) Find the probability that a participant was below 25, given that they were female.



(c) Find the probability that a participant is under 25 but not female if 40% of the participants were under 25.

(d) Find the probability that a participant was female, given that they were under 25.

(e) Find the probability that a participant is female or under 25, but not both.

4

The table below shows the frequency of favourite sport activities in a Year 10 cohort ($n = 180$).

	Soccer	Basketball	Tennis	Swimming	Rugby
Male	29	17	8	23	25
Female	23	10	11	15	19

Find the following probabilities.

(a) $P(\text{male} \mid \text{basketball})$

(b) $P(\text{female} \mid \text{rugby})$

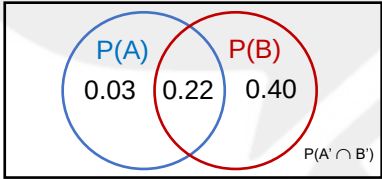
(c) $P(\text{female} \mid \text{not soccer})$

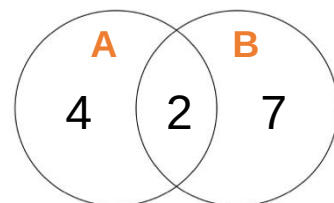
(d) $P(\text{male} \mid \text{basketball or swimming})$

(e) $P(\text{not male} \mid \text{not tennis})$



Conditional Probability

Conditional Probability	
$P(A \cap B)$	$P(A \cup B)$
<u>If A and B are independent:</u> $P(A \cap B) = P(A) \times P(B)$ <u>If A and B are dependent:</u> $P(A \cap B) = P(A B) \times P(B)$	<u>If A and B are mutually exclusive</u> $P(A \cup B) = P(A) + P(B)$ <u>If A and B not mutually exclusive</u> $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
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Note: $P(A' \cap B')$ is the probability of not A and not B



Instructions: Answer the probability questions below.

1

In a group of wolves, 60% of them are female and 28% are female with white fur.

(a) Construct a Venn diagram.

Let A = female

Let B = white fur

(b) Find the probability that a wolf is female, given that it has white fur and that the probability of a wolf with white fur is 38%.

(c) Find $P(A \cup B)$

2

The percentage of students in a class who like the colour red is 56%. In addition, 34% of students like blue and 10% like both colours.

(a) Construct a Venn diagram.

Let A = likes red

Let B = likes blue

(b) Find the probability that a student likes red, given that they like blue.

(c) Find the probability that a student likes blue, given that they like red.

(d) Find $P(A')$

(e) Find the probability that a student does not like blue.