
Stats1 Chapter 5: Probability

Chapter Practice

Key Points

Summary of key points

- 1** A **Venn diagram** can be used to represent events graphically. Frequencies or probabilities can be placed in the regions of the Venn diagram.
- 2** For **mutually exclusive** events, $P(A \text{ or } B) = P(A) + P(B)$.
- 3** For **independent** events, $P(A \text{ and } B) = P(A) \times P(B)$.
- 4** A **tree diagram** can be used to show the outcomes of two (or more) events happening in succession.

Chapter Exercises

- 1 There are 15 coloured beads in a bag; seven beads are red, three are blue and five are green. Three beads are selected at random from the bag and replaced. Find the probability that:
- a the first and second beads chosen are red and the third bead is blue or green (3 marks)
 - b one red, one blue and one green bead are chosen. (3 marks)
- 2 A baseball player has a batting average of 0.341. This means her probability of making a hit when she bats is 0.341. She bats three times in one game. Estimate the probability that:
- a she makes three hits
 - b she makes no hits
 - c she makes at least one hit.

- 3 The scores of 250 students in a test are recorded in a table.

One student is chosen at random.

- a Find the probability that the student is female.
- b Find the probability that the student scored less than 35.
- c Find the probability that the student is a male and scored between 25 and 34.

Score, s	Frequency (male)	Frequency (female)
$20 \leq s < 25$	7	8
$25 \leq s < 30$	15	13
$30 \leq s < 35$	18	19
$35 \leq s < 40$	25	30
$40 \leq s < 45$	30	26
$45 \leq s < 50$	27	32

In order to pass the test, students must score 37 or more.

- d Estimate the probability that a student chosen at random passes the test. State one assumption you have made in making your estimate.

Chapter Exercises

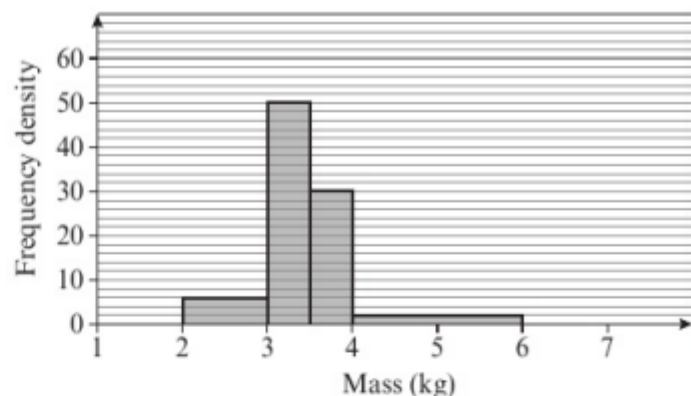
- 4 The histogram shows the distribution of masses, in kg, of 50 newborn babies.

a Find the probability that a baby chosen at random has a mass greater than 3 kg.

(2 marks)

b Estimate the probability that a baby chosen at random has a mass less than 3.75 kg.

(3 marks)



- 5 A study was made of a group of 150 children to determine which of three cartoons they watch on television. The following results were obtained:

35 watch Toontime

14 watch Porky and Skellingtons

54 watch Porky

12 watch Toontime and Skellingtons

62 watch Skellingtons

4 watch Toontime, Porky and Skellingtons

9 watch Toontime and Porky

a Draw a Venn diagram to represent this data.

(4 marks)

b Find the probability that a randomly selected child from the study watches:

i none of the three cartoons

(2 marks)

ii no more than one of the cartoons.

(2 marks)

- 6 The events A and B are such that $P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{4}$. $P(A \text{ or } B \text{ or both}) = \frac{1}{2}$.

a Represent these probabilities on a Venn diagram.

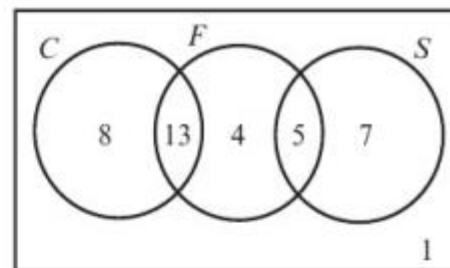
b Show that A and B are independent.

Chapter Exercises

- 7 The Venn diagram shows the number of students who like either cricket (C), football (F) or swimming (S).

a Which two sports are mutually exclusive? (1 mark)

b Determine whether the events 'likes cricket' and 'likes football' are independent. (3 marks)



- 8 For events J and K , $P(J \text{ or } K \text{ or both}) = 0.5$, $P(K \text{ but not } J) = 0.2$ and $P(J \text{ but not } K) = 0.25$.

a Draw a Venn diagram to represent events J and K and the sample space S . (3 marks)

b Determine whether events J and K are independent. (3 marks)

- 9 A survey of a group of students revealed that 85% have a mobile phone, 60% have an MP3 player and 5% have neither phone nor MP3 player.

a Find the proportion of students who have both gadgets. (2 marks)

b Draw a Venn diagram to represent this information. (3 marks)

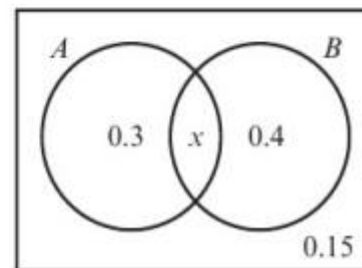
c A student is chosen at random. Find the probability that they only own a mobile phone. (2 marks)

d Are the events 'own a mobile phone' and 'own an MP3 player' independent? Justify your answer. (3 marks)

- 10 The Venn diagram shows the probabilities that a group of children like cake (A) or crisps (B).

Determine whether the events 'like cake' and 'like crisps' are independent.

(3 marks)



Chapter Exercises

- 11 A computer game has three levels and one of the objectives of every level is to collect a diamond. The probability that Becca collects a diamond on the first level is $\frac{4}{5}$, the second level is $\frac{2}{3}$ and the third level is $\frac{1}{2}$. The events are independent.
- a Draw a tree diagram to represent Becca collecting diamonds on the three levels of the game. **(4 marks)**
 - b Find the probability that Becca:
 - i collects all three diamonds **(2 marks)**
 - ii collects only one diamond. **(3 marks)**
 - c Find the probability that she collects at least two diamonds each time she plays. **(3 marks)**
- 12 In a factory, machines A , B and C produce electronic components. Machine A produces 16% of the components, machine B produces 50% of the components and machine C produces the rest. Some of the components are defective. Machine A produces 4%, machine B 3% and machine C 7% defective components.
- a Draw a tree diagram to represent this information.
 - b Find the probability that a randomly selected component is:
 - i produced by machine B and is defective
 - ii defective.

Challenge

The members of a cycling club are married couples. For any married couple in the club, the probability that the husband is retired is 0.7 and the probability that the wife is retired 0.4. Given that the wife is retired, the probability that the husband is retired is 0.8.

Two married couples are chosen at random.

Find the probability that only one of the two husbands and only one of the two wives is retired.

Chapter Answers

1 a $\frac{392}{3375}$

b $\frac{14}{75}$

2 a 0.0397

b 0.286

c 0.714

3 a $\frac{64}{125}$

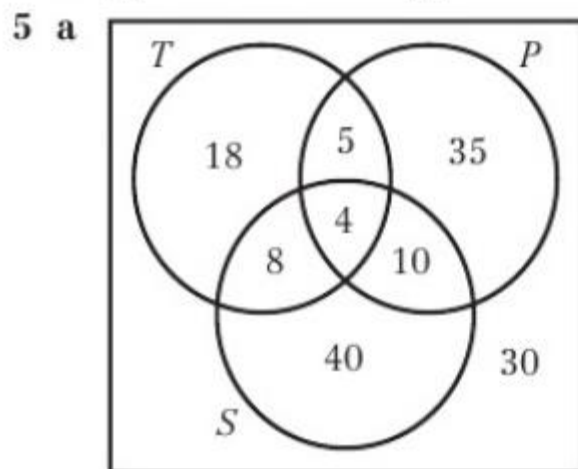
b $\frac{8}{25}$

c $\frac{33}{250}$

d $\frac{74}{125}$, using interpolation and assuming uniform distribution of scores

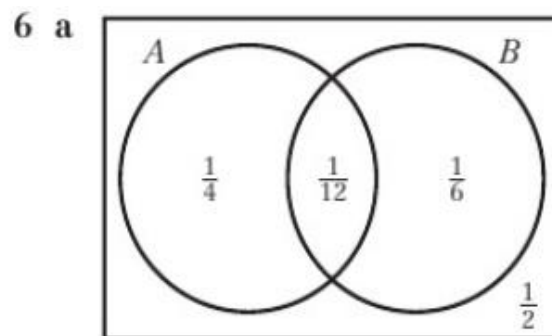
4 a $\frac{44}{50}$

b $\frac{77}{100}$



b i 0.2

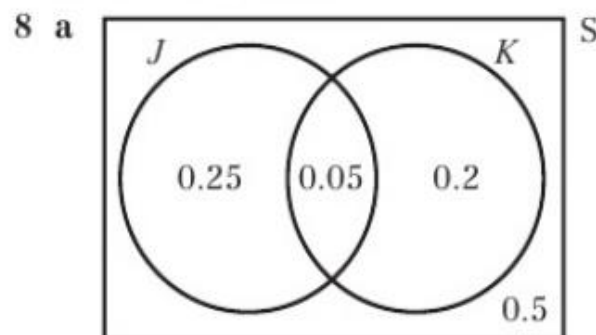
ii 0.82



b $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{4}$, $P(A \text{ and } B) = \frac{1}{12}$
 $P(A) \times P(B) = P(A \text{ and } B)$, so A and B are independent.

7 a Cricket and swimming

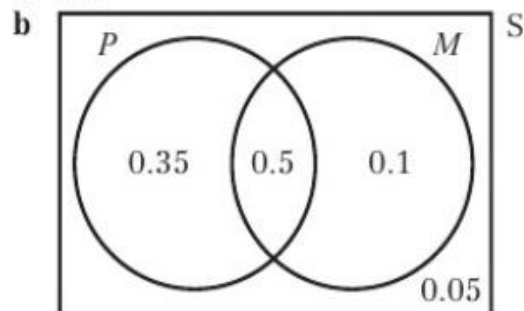
b Not independent



b $P(J) = 0.3$, $P(K) = 0.25$, $P(J \text{ and } K) = 0.05$
 $P(J) \times P(K) = 0.075 \neq P(J \text{ and } K)$, so J and K are not independent.

Chapter Answers

9 a 0.5

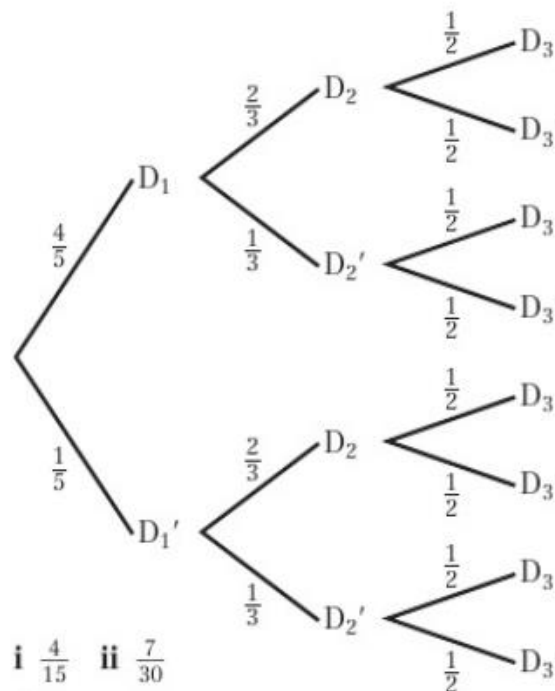


c 0.35

d No. $P(P) = 0.85$ and $P(M) = 0.6$, so $P(P) \times P(M) = 0.51 \neq P(P \text{ and } M)$

10 Not independent

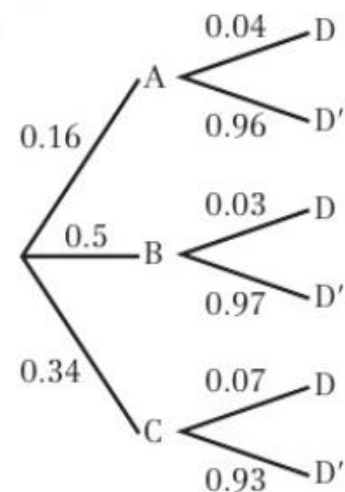
11 a



b i $\frac{4}{15}$ ii $\frac{7}{30}$

c $\frac{11}{15}$

12 a



b i 0.015

ii 0.0452

Challenge
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