

Statistics 10 – All Probability Rules

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

Section 1 – Review of previous topics. Please **complete** all questions.

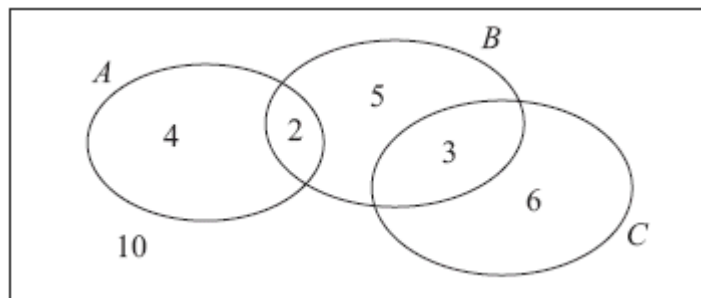
1. A ball is projected vertically upwards with speed 21 m s^{-1} from a point A , which is 1.5 m above the ground. After projection, the ball moves freely under gravity until it reaches the ground. Modelling the ball as a particle, find
- (a) the greatest height above A reached by the ball, (3)
 - (b) the speed of the ball as it reaches the ground, (3)
 - (c) the time between the instant when the ball is projected from A and the instant when the ball reaches the ground. (4)
- Jan 2007**
2. A car is moving along a straight horizontal road. At time $t = 0$, the car passes a point A with speed 25 m s^{-1} . The car moves with constant speed 25 m s^{-1} until $t = 10 \text{ s}$. The car then decelerates uniformly for 8 s . At time $t = 18 \text{ s}$, the speed of the car is $V \text{ m s}^{-1}$ and this speed is maintained until the car reaches the point B at time $t = 30 \text{ s}$.
- (a) Sketch a speed–time graph to show the motion of the car from A to B . (3)
- Given that $AB = 526 \text{ m}$, find
- (b) the value of V , (5)
 - (c) the deceleration of the car between $t = 10 \text{ s}$ and $t = 18 \text{ s}$. (3)
- June 2007**
3. A car moves along a horizontal straight road, passing two points A and B . At A the speed of the car is 15 m s^{-1} . When the driver passes A , he sees a warning sign W ahead of him, 120 m away. He immediately applies the brakes and the car decelerates with uniform deceleration, reaching W with speed 5 m s^{-1} . At W , the driver sees that the road is clear. He then immediately accelerates the car with uniform acceleration for 16 s to reach a speed of $V \text{ m s}^{-1}$ ($V > 15$). He then maintains the car at a constant speed of $V \text{ m s}^{-1}$. Moving at this constant speed, the car passes B after a further 22 s .
- (a) Sketch a speed-time graph to show the motion of the car as it moves from A to B (3)
 - (b) Find the time taken for the car to move from A to B . (3)
- The distance from A to B is 1 km .
- (c) Find the value of V . (5)
- Jan 2008**

Section 2 – Consolidation of this week’s topic. Please complete all questions.

1. In a factory, three machines, J , K and L , are used to make biscuits.
 Machine J makes 25% of the biscuits.
 Machine K makes 45% of the biscuits.
 The rest of the biscuits are made by machine L .
 It is known that 2% of the biscuits made by machine J are broken, 3% of the biscuits made by machine K are broken and 5% of the biscuits made by machine L are broken.
- (a) Draw a tree diagram to illustrate all the possible outcomes and associated probabilities. (2)

A biscuit is selected at random.

- (b) Calculate the probability that the biscuit is made by machine J and is not broken. (2)
- (c) Calculate the probability that the biscuit is broken. (2)
- (d) Given that the biscuit is broken, find the probability that it was not made by machine K . (3)
2. The Venn diagram below shows the number of students in a class who read any of 3 popular magazines A , B and C .



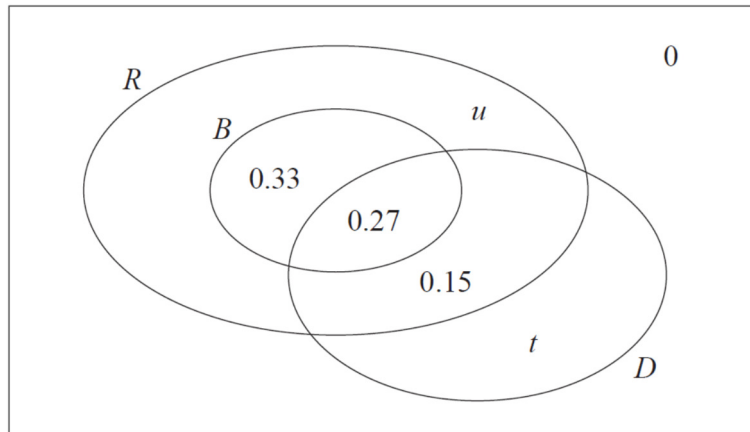
One of these students is selected at random.

Given that the student reads at least one of the magazines,

- (a) find the probability that the student reads C . (2)
- (b) Determine whether or not reading magazine B and reading magazine C are statistically independent. (3)
3. For the events A and B ,
- $$P(A \cap B') = 0.32, \quad P(A' \cap B) = 0.11 \quad \text{and} \quad P(A \cup B) = 0.65$$
- (a) Draw a Venn diagram to illustrate the complete sample space for the events A and B . (3)
- (b) Write down the value of $P(A)$ and the value of $P(B)$. (3)
- (c) Find $P(A / B')$. (2)
- (d) Determine whether or not A and B are independent. (3)

4. A group of office workers were questioned for a health magazine and $\frac{2}{5}$ were found to take regular exercise. When questioned about their eating habits $\frac{2}{3}$ said they always eat breakfast and, of those who always eat breakfast $\frac{9}{25}$ also took regular exercise. Find the probability that a randomly selected member of the group
- (a) always eats breakfast and takes regular exercise, **(2)**
 - (b) does not always eat breakfast and does not take regular exercise. **(4)**
 - (c) Determine, giving your reason, whether or not always eating breakfast and taking regular exercise are statistically independent. **(2)**
5. In a school there are 148 students in Years 12 and 13 studying Science, Humanities or Arts subjects. Of these students, 89 wear glasses and the others do not. There are 30 Science students, of whom 18 wear glasses. The corresponding figures for the Humanities students are 68 and 44 respectively.
A student is chosen at random. Find the probability that this student
- (a) is studying Arts subjects, **(4)**
 - (b) does not wear glasses, given that the student is studying Arts subjects. **(2)**
- Amongst the Science students, 80% are right-handed. Corresponding percentages for Humanities and Arts students are 75% and 70% respectively.
A student is again chosen at random.
- (c) Find the probability that this student is right-handed. **(3)**
 - (d) Given that this student is right-handed, find the probability that the student is studying Science subjects. **(3)**

6. The Venn diagram shows the probabilities of customer bookings at Harry's hotel.
 R is the event that a customer books a room
 B is the event that a customer books breakfast
 D is the event that a customer books dinner
 u and t are probabilities.



- (a) Write down the probability that a customer books breakfast but does not book a room. (1)
- Given that the events B and D are independent,
- (b) find the value of t . (4)
- (c) Hence find the value of u . (2)
- (d) Find
- (i) $P(D|R \cap B)$,
- (ii) $P(D|R \cap B')$. (4)

A coach load of 77 customers arrive at Harry's hotel.
 Of these 77 customers

- 40 have booked a room and breakfast
 37 have booked a room without breakfast

- (e) Estimate how many of these 77 customers will book dinner. (2)

7. One of the objectives of a computer game is to collect keys. There are three stages to the game.
 The probability of collecting a key at the first stage is $\frac{2}{3}$, at the second stage is $\frac{1}{2}$, and at the third stage is $\frac{1}{4}$.

- (a) Draw a tree diagram to represent the 3 stages of the game. (4)
- (b) Find the probability of collecting all 3 keys. (2)
- (c) Find the probability of collecting exactly one key in a game. (5)
- (d) Calculate the probability that keys are not collected on at least 2 successive stages in a game. (5)

Total 74 marks