

Conditional Probability and Venn Diagrams (From Edexcel 6683)**Q1, (Jun 2006, Q6)**

A group of 100 people produced the following information relating to three attributes. The attributes were wearing glasses, being left handed and having dark hair. Glasses were worn by 36 people, 28 were left handed and 36 had dark hair. There were 17 who wore glasses and were left handed, 19 who wore glasses and had dark hair and 15 who were left handed and had dark hair. Only 10 people wore glasses, were left handed and had dark hair.

(a) Represent these data on a Venn diagram. (6)

A person was selected at random from this group.

Find the probability that this person

(b) wore glasses but was not left handed and did not have dark hair, (1)

(c) did not wear glasses, was not left handed and did not have dark hair, (1)

(d) had only two of the attributes, (2)

(e) wore glasses given that they were left handed and had dark hair. (3)

Q2, (Jun 2008, Q5)

A person's blood group is determined by whether or not it contains any of 3 substances A , B and C .

A doctor surveyed 300 patients' blood and produced the table below.

Blood contains	No. of Patients
only C	100
A and C but not B	100
only A	30
B and C but not A	25
only B	12
A , B and C	10
A and B but not C	3

- (a) Draw a Venn diagram to represent this information. (4)
- (b) Find the probability that a randomly chosen patient's blood contains substance C . (2)

Harry is one of the patients. Given that his blood contains substance A ,

- (c) find the probability that his blood contains all 3 substances. (2)

Patients whose blood contains none of these substances are called universal blood donors.

- (d) Find the probability that a randomly chosen patient is a universal blood donor. (2)

Q3, (Jan 2010, Q4)

There are 180 students at a college following a general course in computing. Students on this course can choose to take up to three extra options.

- 112 take systems support,
- 70 take developing software,
- 81 take networking,
- 35 take developing software and systems support,
- 28 take networking and developing software,
- 40 take systems support and networking,
- 4 take all three extra options.

- (a) In the space below, draw a Venn diagram to represent this information. (5)

A student from the course is chosen at random.

Find the probability that this student takes

- (b) none of the three extra options, (1)
- (c) networking only. (1)

Students who want to become technicians take systems support and networking. Given that a randomly chosen student wants to become a technician,

- (d) find the probability that this student takes all three extra options. (2)
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Q4, (Jun 2010, Q4)

The Venn diagram in Figure 1 shows the number of students in a class who read any of 3 popular magazines A , B and C .

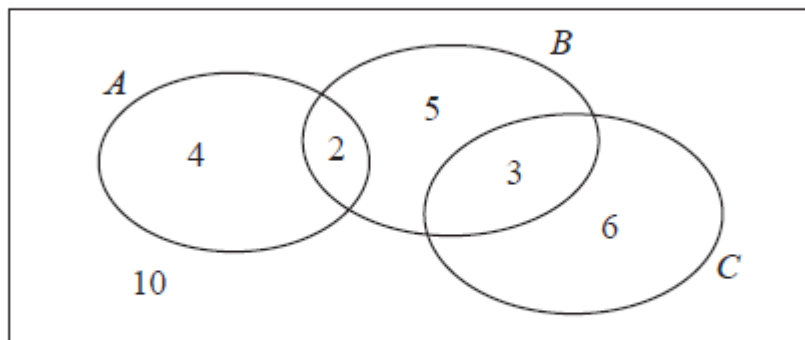


Figure 1

One of these students is selected at random.

(a) Show that the probability that the student reads more than one magazine is $\frac{1}{6}$. (2)

(b) Find the probability that the student reads A or B (or both). (2)

(c) Write down the probability that the student reads both A and C . (1)

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

(d) find the probability that the student reads C . (2)

(e) Determine whether or not reading magazine B and reading magazine C are statistically independent. (3)

Q5, (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)

Jason is one of the above group.
Given that Jason runs,

(e) find the probability that he swims but does not cycle. (3)

Q6, (Jun 2007, Q4)

A survey of the reading habits of some students revealed that, on a regular basis, 25% read quality newspapers, 45% read tabloid newspapers and 40% do not read newspapers at all.

(a) Find the proportion of students who read both quality and tabloid newspapers. (3)

(b) In the space on page 13 draw a Venn diagram to represent this information. (3)

A student is selected at random. Given that this student reads newspapers on a regular basis,

(c) find the probability that this student only reads quality newspapers. (3)

Q7, (Jan 2013, Q7) r

Given that

$$P(A) = 0.35, \quad P(B) = 0.45 \quad \text{and} \quad P(A \cap B) = 0.13$$

find

(a) $P(A \cup B)$ (2)

(b) $P(A' | B')$ (2)

The event C has $P(C) = 0.20$

The events A and C are mutually exclusive and the events B and C are independent.

(c) Find $P(B \cap C)$ (2)

(d) Draw a Venn diagram to illustrate the events A , B and C and the probabilities for each region. (4)

(e) Find $P([B \cup C]')$ (2)

Q8, (Jun 2014, Q8)

For the events A and B ,

$$P(A' \cap B) = 0.22 \quad \text{and} \quad P(A' \cap B') = 0.18$$

(a) Find $P(A)$. (1)

(b) Find $P(A \cup B)$. (1)

Given that $P(A | B) = 0.6$

(c) find $P(A \cap B)$. (3)

(d) Determine whether or not A and B are independent. (2)

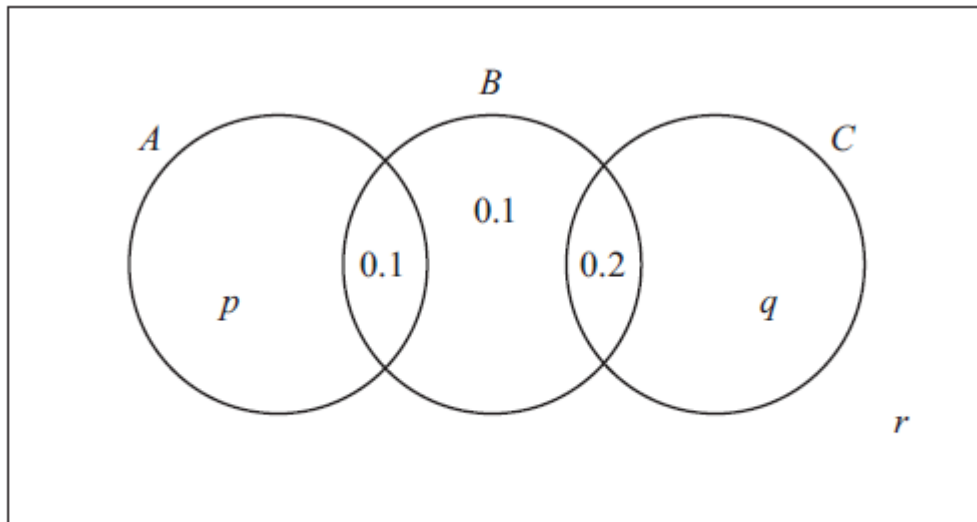


Figure 1

The Venn diagram in Figure 1 shows three events A , B and C and the probabilities associated with each region of B . The constants p , q and r each represent probabilities associated with the three separate regions outside B .

The events A and B are independent.

(a) Find the value of p . (3)

Given that $P(B|C) = \frac{5}{11}$

(b) find the value of q and the value of r . (4)

(c) Find $P(A \cup C | B)$. (2)

Q10, (Jun 2015, Q3)

A college has 80 students in Year 12.

20 students study Biology

28 students study Chemistry

30 students study Physics

7 students study both Biology and Chemistry

11 students study both Chemistry and Physics

5 students study both Physics and Biology

3 students study all 3 of these subjects

(a) Draw a Venn diagram to represent this information. (5)

A Year 12 student at the college is selected at random.

(b) Find the probability that the student studies Chemistry but not Biology or Physics. (1)

(c) Find the probability that the student studies Chemistry or Physics or both. (2)

Given that the student studies Chemistry or Physics or both,

(d) find the probability that the student does not study Biology. (2)

(e) Determine whether studying Biology and studying Chemistry are statistically independent. (3)

Q11, (Jun 2016, Q4)

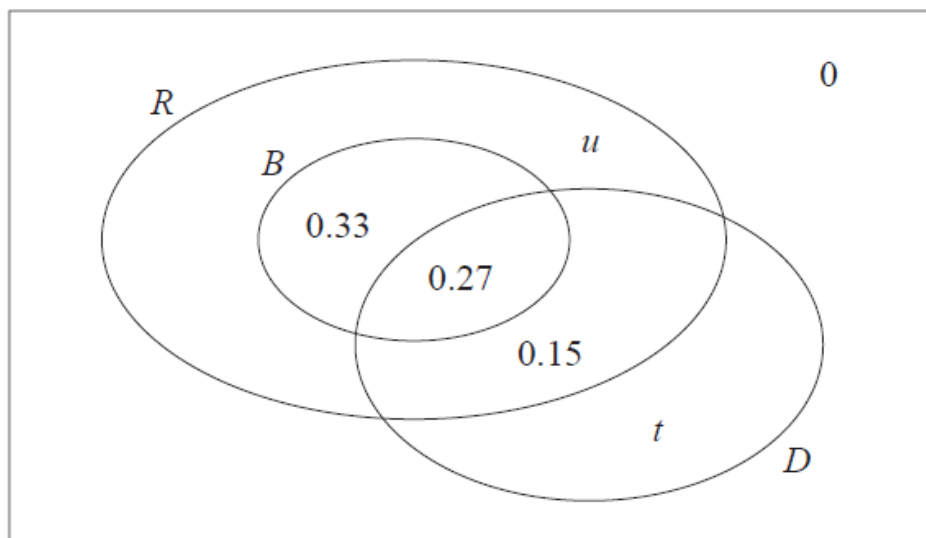
The Venn diagram shows the probabilities of customer bookings at Harry's hotel.

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)