Questions

Q1.

(a) State in words the relationship between two events R and S when $P(R \cap S) = 0$

(1)

The events A and B are independent with $P(A) = \frac{1}{4}$ and $P(A \cup B) = \frac{2}{3}$

Find

(b) $P(B)$

(4)

(c) $P(A' \cap B)$

(2)

(d) $P(B'|A)$

(2)

(Total 9 marks)

Q2.

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.
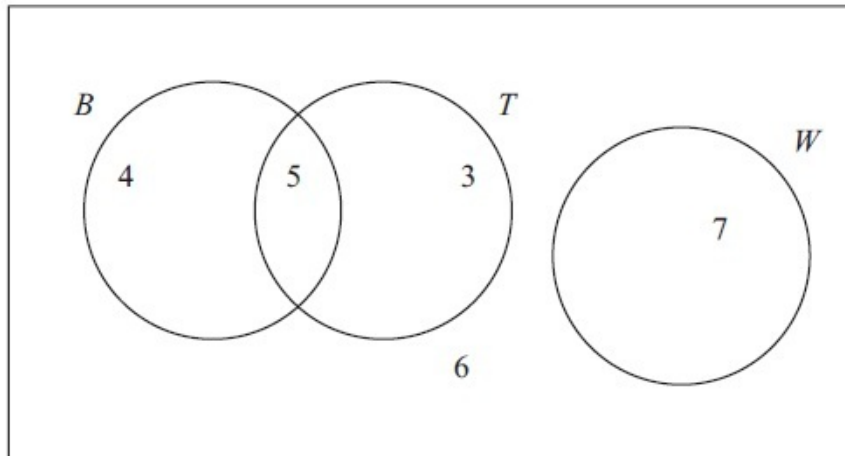
(3)

(Total 13 marks)

Q3.

Figure 1

Figure 1 shows how 25 people travelled to work.

Their travel to work is represented by the events

B bicycle

T train

W walk

(a) Write down 2 of these events that are mutually exclusive. Give a reason for your answer.

(2)

(b) Determine whether or not *B* and *T* are independent events.

One person is chosen at random.

Find the probability that this person

(c) walks to work,

(1)

(d) travels to work by bicycle and train.

(1)

(e) Given that this person travels to work by bicycle, find the probability that they will also take the train.

(2)

(Total 9 marks)

Q4.

Jake and Kamil are sometimes late for school.
The events J and K are defined as follows

J = the event that Jake is late for school

K = the event that Jake is late for school

P(J) = 0.25, P($J \cap K$) = 0.15 and P(J ' $\cap K'$) = 0.7

On a randomly selected day, find the probability that

(a) at least one of Jake or Kamil are late for school,

(1)

(b) Kamil is late for school.

(2)

Given that Jake is late for school,

(c) find the probability that Kamil is late.

(3)

The teacher suspects that Jake being late for school and Kamil being late for school are linked in some way.

(d) Determine whether or not J and K are statistically independent.

(2)

(e) Comment on the teacher's suspicion in the light of your calculation in (d).

(1)

(Total 9 marks)

Q5.

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*.
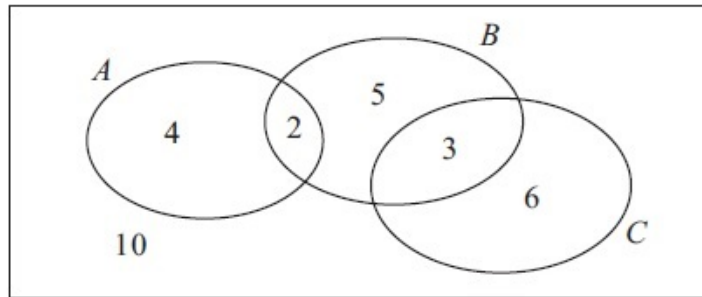

Figure 1

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)

(Total 10 marks)

Q6.

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)

(Total 9 marks)

Q7.

(a) Given that P(A) = a and P(B) = b express P(A ∪ B) in terms of a and b when

(i) A and B are mutually exclusive,

(ii) A and B are independent.

(2)

Two events R and Q are such that

P($R \cap Q'$) = 0.15,   P(Q) = 0.35 and P($R|Q$) = 0.1

Find the value of

(b) P($R \cup Q$),

(1)

(c) P($R \cap Q$),

(2)

(d) P(R).

(2)

(Total 7 marks)

Q8.

Given that

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

find ($A \cup B$)

(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)

Tom invites Avisha to play a game with these dice.

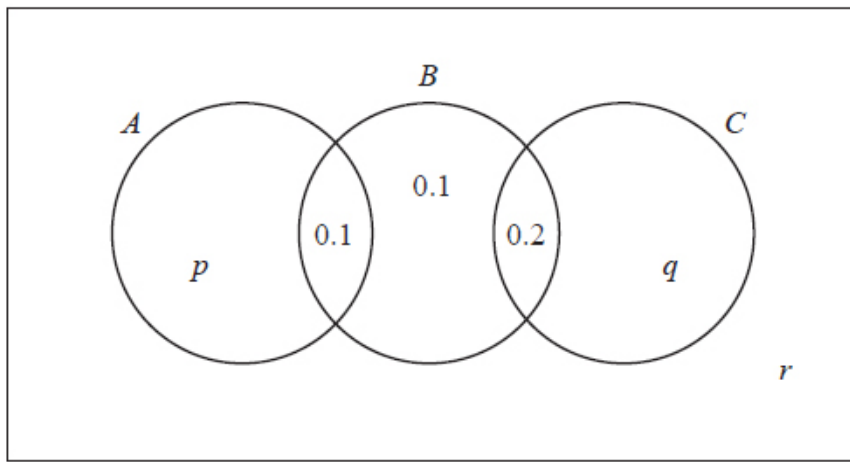(e) Find P($[B \cup C]'$)

(2)

(Total 12 marks)

Q9.

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 $P(B \mid C) = \dfrac{5}{11}$

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

(4)

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

(2)

(Total 9 marks)

Q10.

For the events A and B,

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

(a) Find P(A).

(1)

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

(1)

Given that P(A | B) = 0.6

(c) find P(A ∩ B).

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

(Total 7 marks)

Q11.

A and *B* are two events such that

$$P(B) = \tfrac{1}{2} \qquad P(A \mid B) = \tfrac{2}{5} \qquad P(A \cup B) = \tfrac{13}{20}$$

(a) Find P(*A* ∩ *B*).

(2)

(b) Draw a Venn diagram to show the events *A*, *B* and all the associated probabilities.

(3)

Find

(c) P(*A*)

(1)

(d) P(*B* | *A*)

(2)

(e) P(*A*' ∩ *B*)

(1)

(Total 9 marks)

Q12.

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)

(Total for question = 13 marks)

Q13.

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)

(Total 10 marks)

Q14.

The following shows the results of a wine tasting survey of 100 people.

96 like wine A,
93 like wine B,
96 like wine C,
92 like A and B,
91 like B and C,
93 like A and C,
90 like all three wines.

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

Find the probability that a randomly selected person from the survey likes

(b) none of the three wines,

(1)

(c) wine A but not wine B,

(2)

(d) any wine in the survey except wine C,

(2)

(e) exactly two of the three kinds of wine.

(2)

Given that a person from the survey likes wine A,

(f) find the probability that the person likes wine C.

(3)

(Total 16 marks)

Q15.

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) 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,

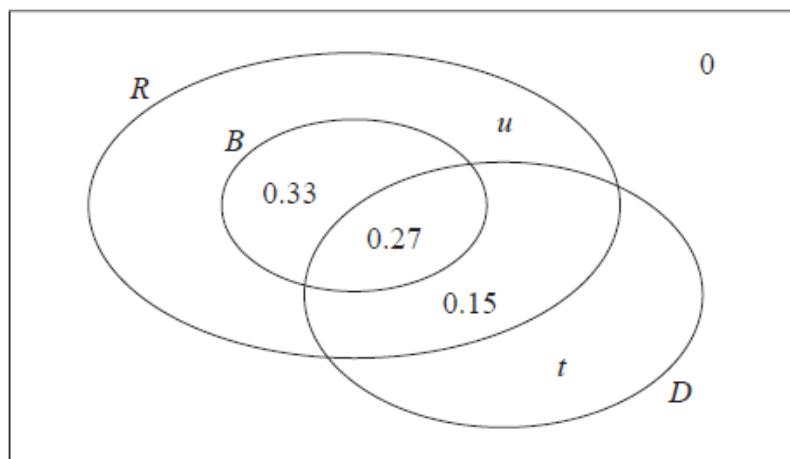(c) find the probability that this student only reads quality newspapers.

(3)

Q16.

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* ∩ *B*)

(ii) P(*D*|*R* ∩ *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)

(Total for question = 13 marks)