

4. A large college produces three magazines.

One magazine is about green issues, one is about equality and one is about sports.

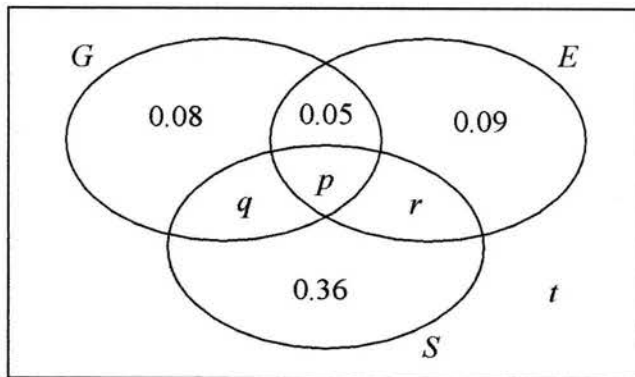
A student at the college is selected at random and the events G , E and S are defined as follows

G is the event that the student reads the magazine about green issues

E is the event that the student reads the magazine about equality

S is the event that the student reads the magazine about sports

The Venn diagram, where p , q , r and t are probabilities, gives the probability for each subset.



(d) contd

$$\begin{aligned}
 &P(S \cap E') \times P(G) \\
 &= 0.48 \times 0.25 \\
 &= 0.12 \\
 &= P(S \cap E' \cap G) \\
 &\text{so } S \cap E' \text{ \& } G \\
 &\text{are independent (1 mark)}
 \end{aligned}$$

- (a) Find the proportion of students in the college who read exactly one of these magazines.

(a) $0.08 + 0.09 + 0.36 = 0.53$ (1 mark)

(1)

No students read all three magazines and $P(G) = 0.25$

- (b) Find

(b) $0.08 + 0.05 + p + q = 0.25$ (1 mark)

- (i) the value of p

$\Rightarrow p + q = 0.25 - 0.05 - 0.08 = 0.12$

- (ii) the value of q

(b)(i) No students read all three magazines
 $\Rightarrow p = 0$ (1 mark)

(3)

Given that $P(S|E) = \frac{5}{12}$

(b)(ii) $p + q = 0.12 \Rightarrow q = 0.12 - p$
 $= 0.12 - 0$
 $= 0.12$ (1 mark)

- (c) find

- (i) the value of r

(c)(i) $P(S|E) = \frac{P(S \cap E)}{P(E)} = \frac{5}{12}$

- (ii) the value of t

$\frac{p+r}{0.05+0.09+p+r} = \frac{0+r}{0.14+t+r} = \frac{5}{12} \Rightarrow \frac{r}{0.14+t+r} = \frac{5}{12}$ (4)

- (d) Determine whether or not the events $(S \cap E')$ and G are independent.

Show your working clearly.

$\Rightarrow 12r = 0.7 + 5r$
 $\Rightarrow r = 0.10$ (3 marks)

(c)(ii) $t = 1 - 0.08 - 0.05 - 0.09 - 0.36 - q - r = 1 - 0.08 - 0.05 - 0.09 - 0.36 - 0.12 - 0.10 = 0.2$ (1 mark)

(3)

(d) $P(S \cap E' \cap G) = q = 0.12$, $P(S \cap E') = q + 0.36 = 0.12 + 0.36 = 0.48$,
 $P(G) = 0.08 + 0.05 + p + q = 0.08 + 0.05 + 0 + 0.12 = 0.25$ (2 marks)