Jan 04

4. The events A and B are such that $P(A) = \frac{2}{5}$, $P(B) = \frac{1}{2}$ and $P(A \mid B') = \frac{4}{5}$.

(*a*) Find

(i) $P(A \cap B')$, $= \frac{2}{5}$

(ii) $P(A \cap B)$, $= 0$

(iii) $P(A \cup B)$, $= \frac{9}{10}$

(iv) $P(A \mid B)$. $= 0$

(7)

(*b*) State, with a reason, whether or not A and B are

(i) mutually exclusive, Yes since $P(A \cap B) = 0$

(2)

(ii) independent. See Below

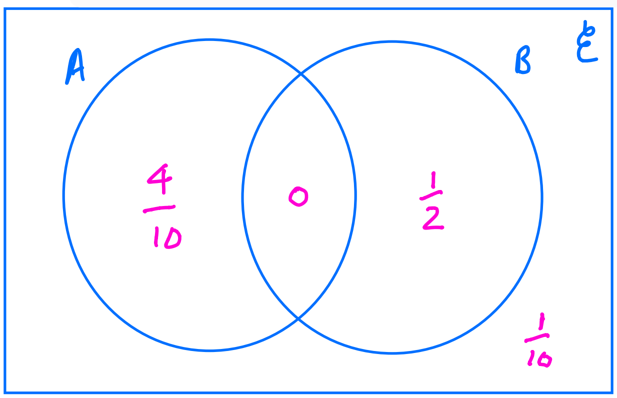
(2)

Independence

$$P(C) \times P(D) = P(C \cap D)$$

Conditional Probability

$$P(C \mid D) = \frac{P(C \cap D)}{P(D)}$$



$$P(A \mid B') = \frac{P(A \cap B')}{P(B')}$$

$$\frac{4}{5} = \frac{P(A \cap B')}{\frac{1}{2}}$$

$$\frac{4}{5} \times \frac{1}{2} = P(A \cap B')$$

$$\frac{4}{10} = P(A \cap B')$$

ii) $P(A) \times P(B) \neq P(A \cap B)$

$= \frac{4}{10} \times \frac{1}{2} \neq 0$

$\therefore$ not independent

Jan 06

6. For the events A and B,

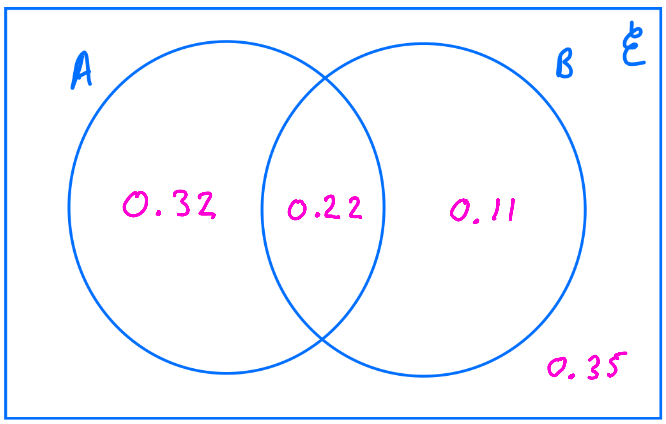
$$P(A \cap B') = 0.32,\ P(A' \cap B) = 0.11 \text{ and } P(A \cup B) = 0.65.$$

(*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 $P(A \mid B')$. **(2)**

(*d*) Determine whether or not A and B are independent. **(3)**



b) $P(A) = 0.54$

$P(B) = 0.33$

c) $P(A \mid B') = \dfrac{P(A \cap B')}{P(B')}$

$= \dfrac{0.32}{0.67} = \dfrac{32}{67}$

d) $P(A) \times P(B)$ $\qquad P(A \cap B)$

$= 0.54 \times 0.33$

$= 0.1782 \quad \neq \quad 0.22$

$P(A) \times P(B) \neq P(A \cap B)$ so not independent

May 02

3. For the events A and B,

(a) explain in words the meaning of the term $\mathrm{P}(B \mid A)$, **(2)**

(b) sketch a Venn diagram to illustrate the relationship $\mathrm{P}(B \mid A) = 0$. **(2)**

Three companies operate a bus service along a busy main road. Amber buses run 50% of the service and 2% of their buses are more than 5 minutes late. Blunder buses run 30% of the service and 10% of their buses are more than 5 minutes late. Clipper buses run the remainder of the service and only 1% of their buses run more than 5 minutes late.

Jean is waiting for a bus on the main road.

(c) Find the probability that the first bus to arrive is an Amber bus that is more than 5 minutes late. **(2)**

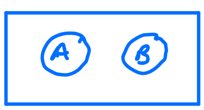
Let A, B and C denote the events that Jean catches an Amber bus, a Blunder bus and a Clipper bus respectively. Let L denote the event that Jean catches a bus that is more than 5 minutes late.

(d) Draw a Venn diagram to represent the events A, B, C and L. Calculate the probabilities associated with each region and write them in the appropriate places on the Venn diagram. **(4)**

(e) Find the probability that Jean catches a bus that is more than 5 minutes late. **(2)**

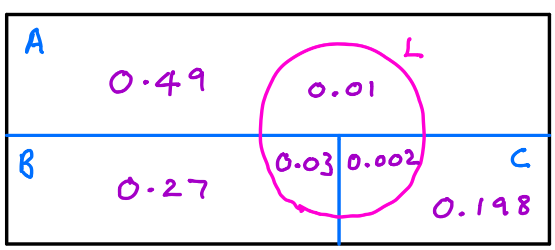
a) $P(B|A)$ means the probability B occurs given that A has occurred.

b)



c) $0.5 \times 0.02 = 0.01$

d)



e) $P(\text{Bus} > 5 \text{ min late}) = 0.01 + 0.03 + 0.002$

$= 0.042$