Author: Naga Karthik

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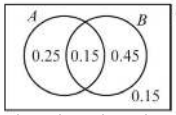
2-3: Conditional probabilities in Venn diagrams

(1)



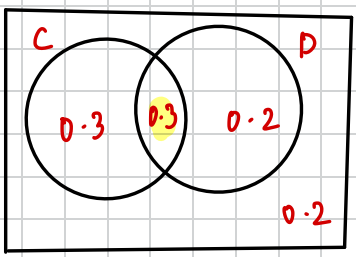
a) $P(A \cup B) = 0.25 + 0.15 + 0.45 = 0.85$

b) $P(A|B) = \frac{0.15}{0.6} = 0.25$

c) $P(B'|A) = \frac{0.25}{0.4} = 0.625$

d) $P(B|A \cup B) = \frac{0.6}{0.85} = \frac{12}{17}$

(2) a)



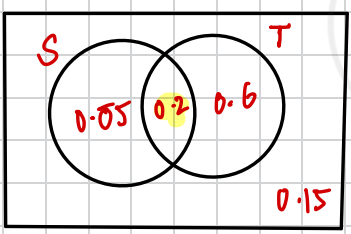
& b) i) $P(C \cup D) = 0.3 + 0.3 + 0.2 = 0.8$

ii) $P(C|D) = \frac{0.3}{0.5} = 0.6$

iii) $P(D|C') = \frac{0.2}{0.4} = 0.5$

iv) $P(D'|C) = \frac{0.3}{0.6} = 0.5$

(3) a)



S & T are independent $\Rightarrow P(S) \times P(T) = P(S \cap T)$

$\Rightarrow 0.25 \times 0.8 = P(S \cap T) = 0.2$

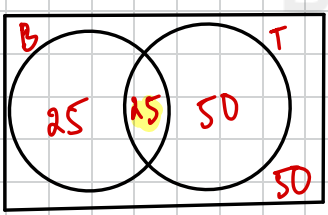
b) i) $P(S \cap T) = 0.2$

ii) $P(S|T') = \frac{0.05}{0.2} = 0.25$

iii) $P(T|S) = \frac{0.2}{0.25} = 0.8$

iv) $P(S' \cup T'|T) = \frac{0.8}{0.8} = 1$

(4)



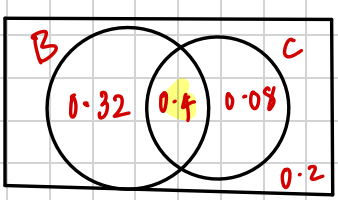
a) $P(B' \cap T) = \frac{50}{150} = \frac{1}{3}$

b) $P(T|B) = \frac{25}{50} = \frac{1}{2}$

c) $P(B|T') = \frac{25}{75} = \frac{1}{3}$

d) $P(B|B \cup T) = \frac{50}{100} = \frac{1}{2}$

(5)



a) $P(B \cap C) = 1.4 - 1 = 0.4$

b) $P(C|B) = \frac{0.4}{0.72} = \frac{5}{9}$

c) $P(B|C) = \frac{0.4}{0.48} = \frac{5}{6}$

d) $P(B'|C') = \frac{0.2}{0.52} = \frac{5}{13}$

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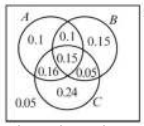

a) $P(A|B) = \frac{0.1+0.15}{2(0.15)+0.15} = \frac{0.25}{0.45} = \frac{5}{9}$

b) $P(B'|C) = \frac{0.16+0.24}{0.31+0.29} = \frac{0.4}{0.6} = \frac{2}{3}$

c) $P(A \cup C|B') = \frac{0.1+0.16+0.24}{0.55} = \frac{10}{11}$

d) $P(A|B' \cap C') = \frac{0.1}{0.15} = \frac{2}{3}$

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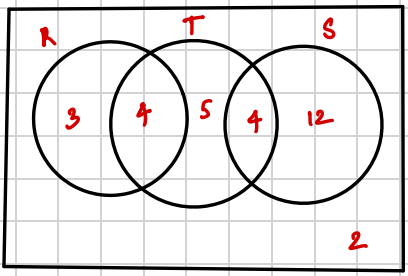
a)



b) $\frac{3}{20}$

c) $P(S \cap T) = P(S) \times P(T)$

$4 \neq 13 \times 16$, So S and T are not independent.

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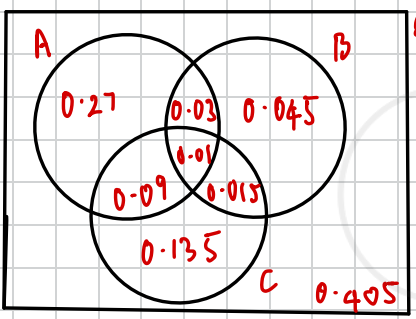

$P(A \cap B) = P(A) \times P(B) = 0.4 \times 0.1 = 0.04$

$P(B \cap C) = P(B) \times P(C) = 0.1 \times 0.25 = 0.025$

$P(A \cap C) = P(A) \times P(C) = 0.4 \times 0.25 = 0.1$

b) i) $P(A|C) = \frac{0.1}{0.25} = \frac{2}{5} = 0.4$

ii) $P(B'|A') = \frac{0.135+0.405}{0.6} = \frac{9}{10} = 0.9$

iii) $P(C|A \cup B) = \frac{0.09+0.01+0.015}{0.46} = \frac{0.115}{0.46} = 0.25$

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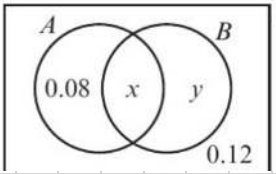

$P(A|B) = P(A) \Rightarrow P(A|B) = \frac{x}{x+y} \Rightarrow P(A) = 0.08 + x$

$\Rightarrow \frac{x}{x+y} = 0.08 + x \Rightarrow 0.08 + 0.12 + x + y = 1$

$x + y = 0.8$

$y = 0.8 - x$

$\Rightarrow \frac{x}{x - x + 0.8} = 0.08 + x \Rightarrow x = 0.064 + 0.8x$

$\Rightarrow 0.2x = 0.064$

$\Rightarrow x = 0.32$

$\Rightarrow y = 0.8 - 0.32 = 0.48$

$x = 0.32$; $y = 0.48$