HW1

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Question 1

$$\begin{aligned} p(A) &= 0.2 \\ p(B) &= 0.5 \\ p(A \cup B) &= 0.4 \\ p(A \cap B) &= p(A) + p(B) - P(A \cap B) = 0 \\ p(A|B) &= \frac{p(A \cap B)}{p(B)} = 0 \end{aligned}$$

Question 2: not independent

$$\begin{aligned} p(A) &= 0.3 \\ p(B) &= 0.1 \\ p(A \cup B) &= 1 - 0.35 = 0.65 \\ p(A \cap B) &= 0.05 \\ p(A)p(B) &= 0.001 \end{aligned}$$

Question 3

$$\begin{aligned} p(A \cup B) &= p \\ p(A \cup B) - p(A \cap B) &= q \\ p(A') + p(B') &= 1 - p(A) + 1 - p(B) \\ &= 2 - (p(A) + p(B)) \\ &= 2 - (p(A \cup B) + p(A \cap B)) \\ &= 2 - (p + p - q) \\ &= 2 - (2p - q) \end{aligned}$$

Question 4

$$\begin{aligned} p(A)p(B) &= p(A \cap B) \\ p(A) &= 0.8 \\ p(A \cup B) - p(A \cap B) &= 0.5 \\ &= (p(A) + p(B)) - 2p(A \cap B) \\ &= 0.8 + p(B) - 2 \times 0.8p(B) \\ 0.6p(B) &= 0.3 \\ p(B) &= 0.5 \end{aligned}$$

Question 5

$$\begin{aligned} p(A) &= 0.4 \\ p(B) &= 0.3 \\ p(C) &= 0.3 \\ p(d|A) &= 0.04 \\ p(d|B) &= 0.04 \\ p(d|C) &= 0.05 \\ p(d) &= 0.4 \times 0.04 + 0.3 \times 0.04 + 0.3 \times 0.05 \\ &= 0.045 \\ p(A|d) &= \frac{p(d|A)p(A)}{p(d)} \\ &= \frac{0.04 \times 0.4}{0.045} \\ &= 0.0355 \end{aligned}$$

Question 6

$$\begin{aligned} p(accept) &= \frac{\binom{95}{4}}{\binom{100}{4}} \\ &= \frac{95 \times 94 \times 93 \times 92}{100 \times 99 \times 98 \times 97} \\ &= 0.81 \end{aligned}$$