1. **2.4.2** By the definition of conditional probability,

\[ P(A|B) + P(B|A) = \frac{P(A \cap B)}{P(B)} + \frac{P(A \cap B)}{P(A)} = 0.75 \]

Therefore, \( P(A \cap B) \left( \frac{1}{0.4} + \frac{1}{0.2} \right) = 0.75 \), which gives

\[ P(A \cap B) = \frac{0.75}{\frac{1}{0.4} + \frac{1}{0.2}} = 0.1 \]

2. **2.4.3** Since \( P(A) \leq 1 \) and \( P(B) \leq 1 \), then by the definition of conditional probability,

\[ P(B|A) = \frac{P(A \cap B)}{P(A)} < \frac{P(A)P(A)}{P(B)} \leq P(B) \]

3. **2.4.7** (461 only)

\[ P(R_1 \cap R_2) = P(R_2|R_1)P(R_1) = \frac{31}{42} = \frac{3}{8} \]

4. **2.4.13** (461 only)

\[ P(\text{4 Aces} | \text{At least 3 Aces}) = \frac{\frac{1}{270725}}{\frac{1}{270725} + \frac{1}{270725}} = \frac{1}{193} \]

5. **2.4.28** Let \( A_1 = \text{Bell Meade} \), \( A_2 = \text{Oak Hill} \), and \( A_3 = \text{Antioch} \).

\[ P(\text{donation}) = \sum_{i=1}^{3} P(\text{donation}|A_i)P(A_i) = 0.6 \frac{1}{4} + 0.55 \frac{1}{4} + 0.35 \frac{1}{2} = 0.4625 \]
6. 2.4.31 Let $A$ = “a non-high-risk adult tests positive.” Then

$$P(A) = P(A|HIV+)P(HIV+) + P(A|HIV-)P(HIV-)$$

$$= 0.999(0.0001) + (1 - 0.9999)(1 - 0.0001) = 0.019989 \% \approx 0.02\%$$

7. 2.4.40 Let $A$ be the event that a white chip was transferred from urn I to urn II, and let $B$ be the even that a red chip is selected from urn II. From what is given in the problem, $P(B|A) = \frac{1}{2}$, $P(B|A^C) = \frac{2}{3}$, and $P(A) = \frac{2}{3}$. By Bayes’ Theorem,

$$P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|A^C)P(A^C)} = \frac{\frac{1}{2} \cdot \frac{2}{3}}{\frac{1}{2} \cdot \frac{2}{3} + \frac{2}{3} \cdot \frac{1}{3} + \frac{1}{4}} = \frac{4}{7}$$

8. 2.4.53 Let $A_i$ be the event that the $i$th drawer is selected, and $S$ that a silver coin is drawn from the selected drawer. Then

$$P(A_3|S) = \frac{P(S|A_3)P(A_3)}{\sum_i P(S|A_i)P(A_i)} = \frac{\frac{11}{2} \cdot \frac{1}{3}}{0 + \frac{1}{3} + \frac{11}{2} \cdot \frac{1}{3}} = \frac{1}{3}$$

9. 2.5.1 (a) No, because $P(A \cap B) = 0.2 \neq 0$.
   (b) No, because $P(A \cap B) = 0.2 \neq P(A)P(B) = (0.35)(0.4) = 0.14$.
   (c) $P(A^c \cup B^c) = P((A \cap B)^c) = 1 - P(A \cap B) = 1 - 0.2 = 0.8$.

10. 2.5.2 Let $A$ be that he passes chemistry, $B$ he passes mathematics.
   (a) No, because $P(A \cap B) = 0.12 \neq P(A)P(B) = (0.35)(0.4) = 0.14$.
   (b) $P($fails both$) = P((A \cup B)^c) = 1 - P(A \cup B) = 1 - (P(A) + P(B) - P(A \cap B))$

   $$= 1 - (0.35 + 0.4 - 0.12) = 0.37$$

11. 2.5.7 (a.1) $\frac{1}{4} + \frac{1}{8} = \frac{3}{8}$
   (a.2) $P(A) + P(B) - P(A)P(B) = \frac{1}{4} + \frac{1}{8} - \frac{11}{4} = \frac{11}{32}$
   (b.1) $P(A|B) = P(A \cap B)/P(B) = 0$
   (b.2) $P(A|B) = P(A \cap B)/P(B) = P(A) = \frac{1}{4}$