1. Problem 2.34.
(a) \[ \binom{25}{5} = C_{5,25} = \frac{25!}{5!20!} = 53130. \]
(b) \[ P = \frac{\binom{6}{2} \binom{19}{3}}{\binom{25}{5}} = \frac{14535}{53130} = 0.2736. \]
(c) \[ P = \frac{(\binom{19}{1})^6}{\binom{25}{5}} + \frac{(\binom{19}{1})^6}{\binom{25}{5}} = \frac{34884}{53130} = 0.6566. \]

2. Problem 2.39.
(a) \[ P = \frac{\binom{4}{2} \binom{11}{1}}{\binom{15}{3}} = 0.1451. \]
(b) \[ P = \frac{\binom{4}{3} + \binom{5}{3} + \binom{6}{3}}{\binom{15}{3}} = 0.0701. \]
(c) \[ P = \frac{(\binom{4}{1})^6 + (\binom{5}{1})^6}{\binom{15}{3}} = 0.2473. \]
(d) \[ P = \frac{\binom{11}{5}}{\binom{15}{3}} = 0.1538. \]

3. Problem 2.48.
(a) \[ P(A_2|A_1) = \frac{P(A_1 \cap A_2)}{P(A_1)} = 0.12 + 0.07 - 0.13 \quad \frac{0.12}{0.12} = 0.5. \]
(b) \[ P(A_1 \cap A_2 \cap A_3|A_1) = \frac{P(A_1 \cap A_2 \cap A_3)}{P(A_1)} = \frac{0.01}{0.12} = 0.0833. \]
(c) \[ P(A_1|A_1 \cup A_2 \cup A_3) = \frac{P(A_1)}{P(A_1 \cup A_2 \cup A_3)} = \frac{0.12}{0.14} = 0.8571. \]
(d) \[ P(A_3'|A_1 \cap A_2) = 1 - P(A_3|A_1 \cap A_2) = 1 - \frac{P(A_1 \cap A_2 \cap A_3)}{P(A_1 \cap A_2)} = 1 - \frac{0.01}{0.06} = 0.8333. \]

4. Problem 2.59. Let \( B \) be the event of filling tanks. Note that \( A_1, A_2, \) and \( A_3 \) form a partition. We can use the law of total probability and Bayes’s Theorem. By the condition, we have \( P(A_1) = 0.4, \)
\( P(A_2) = 0.35, \) \( P(A_3) = 0.25, \) \( P(B|A_1) = 0.3, \) \( P(B|A_2) = 0.6, \) and \( P(B|A_3) = 0.5. \)
6. Problem 2.63.

(a) 
\[ P(A_1 \cap B) = P(B|A_2)P(A_2) = 0.6 \times 0.35 = 0.21. \]

(b) By the total probability, we have

\[ P(B) = P(B|A_1)P(A_1) + P(B|A_2)P(A_2) + P(B|A_3)P(A_3) \]
\[ = 0.12 + 0.21 + 0.125 \]
\[ = 0.455. \]

(c) 
\[ P(A_1|B) = \frac{0.12}{0.455} = 0.2637. \]
\[ P(A_2|B) = \frac{0.21}{0.455} = 0.4615. \]
\[ P(A_3|B) = \frac{0.125}{0.455} = 0.2747. \]

5. Problem 2.60. Let \( A \) be the set of the aircraft being discovered, \( B \) be the set of the aircraft with an emergency locator. Then, \( P(A) = 0.7 \), \( P(B|A) = 0.6 \) and \( P(B'|A') = 0.10 \).

(a) It is equivalent to find the probability of \( A \) given \( B \), that is

\[ P(A'|B) = \frac{P(A' \cap B)}{P(B)} = \frac{P(B|A')P(A')}{P(B|A)P(A) + P(B|A')P(A')} = \frac{0.3 \cdot 0.1}{0.6 \cdot 0.7 + 0.1 \cdot 0.3} = 0.0667. \]

(b) Similarly it is the probability of \( A \) given \( B' \), which is

\[ P(A|B') = \frac{P(B'|A)P(A)}{P(B'|A)P(A) + P(B'|A')P(A')} = \frac{0.4 \cdot 0.7}{0.4 \cdot 0.7 + 0.9 \cdot 0.3} = 0.5091. \]

6. Problem 2.63.

(a) Not shown.

(b) 
\[ P(A \cap B \cap C) = P(C|A \cap B)P(B|A)P(A) = 0.8 \times 0.9 \times 0.75 = 0.54. \]

(c) 
\[ P(B \cap C) = P(A \cap B \cap C) + P(A' \cap B \cap C) = 0.54 + P(C|A' \cap B)P(B|A')P(A') \]
\[ = 0.54 + 0.7 \times 0.8 \times 0.25 = 0.68. \]

(d) 
\[ P(C) = P(B \cap C) + P(B'| \cap C) = 0.68 + P(A \cap B' \cap C) + P(A' \cap B' \cap C) \]
\[ = 0.68 + P(C|B' \cap A)P(B'|A)P(A) + P(C|B' \cap A')P(B'|A')P(A') \]
\[ = 0.54 + 0.6 \times 0.1 \times 0.75 + 0.3 \times 0.2 \times 0.25 = 0.68 + 0.045 + 0.015 \]
\[ = 0.74. \]

(e) 
\[ P(A \cap B \cap C) = \frac{P(A \cap B \cap C)}{P(B \cap C)} = \frac{0.54}{0.68} = 0.7941. \]
7. Problem 2.68. Let $A_1, A_2, A_3$ be the probability for her to travel on airline #1, #2 or #3 respectively. Let $B$ and $C$ be the events for the flight to be late at D.C. and L.A. respectively. Then, we have

$$P(A_1) = 0.5, \ P(A_2) = 0.3, \ P(A_3) = 0.2,$$

$$P(B|A_1) = 0.3, \ P(B|A_2) = 0.25, \ P(B|A_3) = 0.4,$$

and

$$P(C|A_1) = 0.1, \ P(C|A_2) = 0.20, \ P(C|A_3) = 0.25.$$

Let $D$ be the event of late at exactly one destination. Then,

$$P(D|A_1) = P(B \cup C|A_1) - P(B \cap C|A_1) = P(B|A_1) + P(C|A_1) - 2P(B \cap C|A_1)$$

$$= P(B|A_1) + P(C|A_1) - 2P(B|A_1)P(C|A_1)$$

$$= 0.3 + 0.1 - 2 \times 0.3 \times 0.1 = 0.34.$$

Similarly, we have

$$P(D|A_2) = 0.25 + 0.2 - 2 \times 0.25 \times 0.2 = 0.35,$$

and

$$P(D|A_3) = 0.4 + 0.25 - 2 \times 0.4 \times 0.25 = 0.45.$$

Therefore,

$$P(A_1|D) = \frac{P(D|A_1)P(A_1)}{0.34 \times 0.5 = 0.17} = \frac{0.34 \times 0.5 + 0.35 \times 0.3 + 0.45 \times 0.2}{0.34 \times 0.5 + 0.35 \times 0.3 + 0.45 \times 0.2} = 0.4657.$$

Similarly, we have

$$P(A_2|D) = \frac{P(D|A_2)P(A_2)}{0.34 \times 0.5 + 0.35 \times 0.3 + 0.45 \times 0.2} = 0.2877,$$

and

$$P(A_3|D) = \frac{P(D|A_3)P(A_3)}{0.34 \times 0.5 + 0.35 \times 0.3 + 0.45 \times 0.2} = 0.2465.$$