1. Problem 2.13.

(a) 
\[ P(A_1 \cup A_2) = P(A_1) + P(A_2) - P(A_1 \cap A_2) = 0.22 + 0.25 - 0.11 = 0.36. \]

(b) 
\[ P(A'_1 \cap A'_2) = P((A_1 \cup A_2)') = 1 - P(A_1 \cup A_2) = 1 - 0.36 = 0.64. \]

(c) 
\[ P(A_1 \cup A_2 \cup A_3) = P(A_1) + P(A_2) + P(A_3) - P(A_1 \cap A_2) - P(A_2 \cap A_3) - P(A_1 \cap A_3) + P(A_1 \cap A_2 \cap A_3) \]
\[ = 0.22 + 0.25 + 0.28 - 0.11 - 0.05 - 0.07 + 0.01 = 0.53. \]

(d) 
\[ P(A'_1 \cap A'_2 \cap A'_3) = P((A_1 \cup A_2 \cup A_3)') = 1 - P(A_1 \cup A_2 \cup A - 3) \]
\[ = 1 - 0.53 = 0.47. \]

(e) 
\[ P(A'_1 \cap A'_2 \cap A_3) = P(A'_1 \cap A'_2) - P(A'_1 \cap A'_2 \cap A'_3) \]
\[ = 0.64 - 0.47 = 0.17. \]

(f) 
\[ P((A'_1 \cap A'_2) \cup A_3) = P(A'_1 \cap A'_2) + P(A_3) - P(A'_1 \cap A'_2 \cap A_3) \]
\[ = 0.64 + 0.28 - 0.17 = 0.75. \]

2. Problem 2.17.

(a) Because it is possible to have \((A \cup B)'\).

(b) \(P(A') = 1 - P(A) = 0.7.\)

(c) Since \(A \cap B = \phi\), \(P(A \cup B) = P(A) + P(B) = 0.8.\)

(d) \(P(A' \cap B') = 1 - P(A \cup B) = 0.2.\)

3. Problem 2.24. If \(A \subseteq B\), then \(B = A \cup (B \cap A')\) and \(A\) and \(B \cap A'\) are disjoint. Thus,
\[ P(B) = P(A) + P(B \cap A') \geq P(A) \]

by the axioms 3a and 1. For general \(A\) and \(B\), it means
\[ P(A \cap B) \leq P(A) \leq P(A \cup B). \]

4. Problem 2.25. It tells us that \(P(A) = 0.4, P(B) = 0.55, P(C) = 0.70, P(A \cup B) = 0.63, P(A \cup C) = 0.77, P(B \cup C) = 0.80\) and \(P(A \cup B \cup C) = 0.85.\)

(a) It is exactly
\[ P(A \cup B \cup C) = 0.85 \]

as it is given.
(b) None of selected is the complementary of at least one selected. Thus it is
\[ P((A \cup B \cup C)^c) = 1 - P(A \cup B \cup C) = 1 - 0.85 = 0.15. \]

(c) Only automatic means C but not A and B. Thus
\[
P(A' \cap B' \cap C) = P(A' \cap B') - P(A' \cap B' \cap C')
\]
\[
= [1 - P(A \cup B)] - [1 - P(A \cup B \cup C)]
\]
\[
= P(A \cup B \cup C) - P(A \cup B)
\]
\[
= 0.85 - 0.63 = 0.22.
\]

(d) Exactly one of the three is
\[
P(A \cap B' \cap C') + P(A' \cap B \cap C') + P(A' \cap B' \cap C)
\]
\[
= [P(A \cup B \cup C) - P(B \cup C)] + [P(A \cup B \cup C) - P(A \cup C)] + [P(A \cup B \cup C) - P(A \cup B)]
\]
\[
= 0.05 + 0.08 + 0.22 = 0.35.
\]


(a) The probability that the system does not have a type 1 defect is
\[ P(A'_1) = 1 - P(A_1) = 1 - 0.12 = 0.88. \]

(b) The probability that the system has both type 1 and type 2 defects is
\[ P(A_1 \cap A_2) = P(A_1) + P(A_2) - P(A_1 \cup A_2) = 0.12 + 0.07 - 0.13 = 0.06. \]

(c) The probability that the system has both type 1 and type 2 but not type 3 is
\[ P(A_1 \cap A_2 \cap A'_3) = P(A_1 \cap A_2) - P(A_1 \cap A_2 \cap A_3) = 0.06 - 0.01 = 0.05. \]

(d) The event that the system has at most two of these defects is the complement of the event that the system has all of the three defects. Thus, it is
\[ 1 - P(A_1 \cap A_2 \cap A_3) = 1 - 0.01 = 0.99. \]

6. Problem 2.33.

(a) It is \( P_{9, 15} = 1816214400. \)

(b) It is \( 9!P_{9, 15} = 659067881572000. \)

(c) It is \( P_{3, 5}P_{6, 10} = 9072000. \)

7. Problem 2.43.

(a) The probability that it will be a straight with high card 10 is
\[ P = \frac{4^5}{\binom{52}{5}} = 3.94 \times 10^{-4}. \]

The probability that it will be a straight is
\[ P = \frac{10 \times 4^5}{\binom{52}{5}} = 3.94 \times 10^{-3}. \]

The probability that it will be a straight flush is
\[ P = \frac{4 \times 10}{\binom{52}{5}} = 1.539 \times 10^{-5}. \]