1. Let \( S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\} \), \( A = \{1, 2, 3, 4, 5, 6\} \) and \( B = \{4, 5, 6, 7, 8, 9\} \). For each of the events listed below, write out the numbers that are members of the event.

(a) \( AB^c \cup A^cB \)
(b) \((A \cup B)^c\)
(c) \(A^cB^c\)
(d) \((AB)^c\)
(e) \(A^c \cup B^c\)
(f) the event that exactly 0 of the events, \(A\) and \(B\), occur
(g) the event that exactly 2 of the events, \(A\) and \(B\), occur
(h) the event that at least 0 of the events, \(A\) and \(B\), occur

2. A card may be selected at random from an ordinary deck of 52 playing cards. Consider the events:

\[ A = \{\text{card is a heart}\} \]
\[ B = \{\text{card is a face card}\} \]

Compute \(P[A \cup B]\) and \(P[AB]\).

3. A box contains two white socks and two blue socks. Two socks are drawn at random. What is the probability they are a match?

4. Five horses are in a race. Joe picks two of the horses at random, and bets on them. What is the probability that Joe picked the winner?

5. From a group of 5 women and 7 men, how many different committees consisting of 2 women and 3 men can be formed? What if 2 of the men are feuding and refuse to serve on the committee together?

6. In order to create a spam filter, one creates a list of words that are more likely to appear in spam than in normal messages (e.g. buy or brand of a drug). Suppose you have a specified list of words and that your data base consists of 5000 messages, 1700 of which are spam. Among the spam messages, 1343 contain words in the list. Of the 3300 normal messages, only 297 contain words in the list. Obtain the probability that a message is spam given that the message contains words in the list.

7. In the game of bridge, the entire deck of 52 cards is dealt out to 4 players. What is the probability that one of the players receives all 13 spades?

8. Prove that if \(E\) and \(F\) are independent events, then so are \(E\) and \(F^c\).