1. Shade the appropriate regions in a Venn diagram that correspond to each of the following sets.

(a) \( A \cup (B^c \cap C) \)

(b) \( (A \cup C)^c \cup B^c \)

(c) \( A^c \cap (B \cap C)^c \)
2. In a survey of 175 people, it was found that 86 had ordered pizza from Papa John’s in the past month, 96 had not ordered pizza from Pizza Hut in the past month, and 138 had ordered pizza from at least one of the two. Fill in the Venn diagram below with the correct number of people in each region.

![Venn Diagram](image)

Calculate:

(a) \( n(PH \cap PJ) \)

(b) \( n(PH^c \cap PJ) \)

(c) the number of people who ordered Papa Johns or did not order Pizza Hut.

3. A survey was done of 250 people about whether they have visited Europe, Africa, or South America. The following information was found.

45 people have only been to Europe.
107 people have been to South America.
21 people have been to Europe and South America, but not Africa.
95 people have been to exactly 1 of these three continents.
\( n(A \cap Ec \cap Sc) = 20 \)
67 people have been to Africa or South America, but not Europe.
66 people have been to Europe and Africa.

![Venn Diagram](image)

(a) How many people have been to Europe or South America?

(b) How many people have been to exactly 2 of the three?
4. A survey of college students was done about what kind of games (Monopoly, Connect Four, & Guess Who) they played growing up. The results are given below.

75 students played Monopoly but not Guess Who.
\[ n((M \cup C)^c) = 44 \]
73 students played only Guess Who or only Monopoly.
96 students did not play Monopoly.
\[ n(M \cap G \cap C^c) = 17 \]
64 students played at least two of these three games.
107 students played Guess Who or Connect Four, but not both of them.
21 students played none of these games.

(a) How many students played Monopoly and at least one of the other two games?

(b) Calculate \( n((G \cap C)^c) \) and describe in words what it represents.

(c) Calculate \( n(G \cup C^c) \) and describe in words what it represents.

5. Write sample spaces for the following experiments.

(a) A card is drawn at random from a standard deck of cards and the suit of the card is recorded.

(b) Two fair 5-sided dice are rolled and the sum of the numbers rolled is recorded.

(c) A coin is tossed, noting the side that lands up. If the coin lands heads, it is tossed once more. Otherwise the experiment ends.
6. An experiment consists of randomly selecting a card from a standard deck and noting the color of the card. If a black card is chosen, a coin is tossed noting the side that lands up. If a red card is chosen, a fair 6-sided die is rolled observing the number rolled.

(a) What is the sample space $S$ for this experiment.

(b) What is the event $E$ that a black card is chosen?

(c) What is the event $F$ that an even number is rolled?

(d) Are $E$ and $F$ mutually exclusive?

7. An experiment consists of tossing a coin and observing the side that lands up and then randomly selecting a marble from a jar filled with 3 red, 3 blue, and 3 green marbles and noting the color.

(a) What is the sample space for this experiment?

(b) Determine the event $E$ that a red marble is drawn.

(c) Determine the event $F$ that a tail is tossed or a green marble is drawn.

(d) Are $E$ and $F$ mutually exclusive events?

(e) Assuming this is a uniform sample space (it is), calculate $P(F)$. 
8. A card is drawn from a standard deck of cards. Calculate the probability of the following events.
   (a) A black face card is drawn.
   
   (b) A red 3 is drawn.
   
   (c) A King is not drawn.

9. Two fair 4-sided dice (one red, one blue) are rolled and the numbers shown are observed.
   (a) What is the sample space for this experiment?
   
   (b) Write the event $E$ that a 3 is rolled.
   
   (c) What is the probability that the sum of the dice is more than 5.
   
   (d) Find the probability distribution for the PRODUCT of the numbers rolled on the dice.
10. A bag of Skittles contains 13 yellow, 11 green, 9 orange, 6 red, and 5 purple. I reach in and pull out one Skittle. (Assume each Skittle is equally likely to be chosen.)

(a) Find the probability distribution for the color of the Skittle pulled.

(b) Calculate the probability that I will get a green or an orange.

(c) Calculate the probability that I will not get a purple.

11. A certain business counted the number of e-mails sent by its employees on a given day. The results are given in the table below.

<table>
<thead>
<tr>
<th>Number of E-mails</th>
<th>0-10</th>
<th>11-20</th>
<th>21-30</th>
<th>31-40</th>
<th>More than 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Employees</td>
<td>10</td>
<td>19</td>
<td>33</td>
<td>25</td>
<td>15</td>
</tr>
</tbody>
</table>

(a) What is the empirical probability that an employee who works for this company will send more than 30 emails on a given day?

(b) What is the empirical probability that an employee who works for this company will send at most 40 emails on a given day?

(c) Find the empirical probability distribution for the number of emails sent by an employee of this company.