Read the Directions: Complete each of the following on a separate sheet of lined paper. This will be collected and checked for full completion.

1. You roll 2 far six-sided dice. Which of the following outcomes is most likely to occur? Explain your choice.
   A. Getting a sum of 7 = \( \frac{1}{36} \)
   B. Getting a sum of 5 or 6 = \( \frac{4}{36} + \frac{5}{36} = \frac{9}{36} \)
   C. They are equally likely

2. There are 12 boys and 15 girls in a Calculus class. You write all their names equal size pieces of paper and draw names with replacement. Calculate each of the following probabilities:
   a. the first girl occurs on the 2nd selection \( \frac{12}{27} \times \frac{15}{27} = \frac{240}{729} \)
   b. the first 3 selections are girls. \( \left( \frac{15}{27} \right)^3 \approx .171 \)
   c. the second girl occurs on the 5th selection (consider all possible arrangements)
   d. Exactly 2 of the first four selections are boys (consider all possible arrangements) \( \left( \frac{12}{27} \right)^2 \times \left( \frac{15}{27} \right)^2 \times 4 \times \frac{4!}{2!2!} \)
   e. At least one of the first four selections is a girl. \( 1 - \frac{40}{409} = .961 \)

3. Suppose 40% of cars in the Rochester area are manufactured in the US, 30% in Japan, 10% in Germany, and 20% from other countries. Find each of the following probabilities:
   a. A single car selected at random is not manufactured in the US. \( \frac{0.6}{0.7} \)
   b. A single car selected at random is German or Japanese. \( \frac{0.6}{0.7} \)
   c. Two cars selected at random are both Japanese. \( \left( \frac{0.30}{0.7} \right)^2 = .09 \)
   d. A single car selected at random is German and American. \( \frac{0.3}{0.7} \)
   e. At least one of 3 cars selected at random is manufactured in the US. \( 1 - \left( \frac{0.7}{0.7} \right)^3 = .784 \)

4. From a deck of cards, you pick a card and then replace it. This is repeated 2 more times (for a total of 3 selections). Find the probability that:
   a. That at least one is red. \( 1 - \left( \frac{1}{2} \right)^3 = .875 \)
   b. That at least one was a face card
   \( 1 - \left( \frac{40}{52} \right)^3 = .545 \)
5. You pick a single card at random from a standard deck of cards. State whether or not the events are disjoint and find the probability.
   a. \( P(\text{queen or king}) \) disjoint \( \frac{8}{52} \)
   b. \( P(\text{queen or club}) \) not disjoint \( \frac{4 + 13 - 1}{52} = \frac{16}{52} \)
   c. \( P(\text{ace or red}) \) not disjoint \( \frac{4 + 26 - 2}{52} = \frac{28}{52} \)
   d. \( P(\text{black or red}) \) disjoint \( \frac{26 + 26 - 6}{52} = \frac{52}{52} \)
   e. \( P(\text{numbered card or Ace}) \) disjoint \( \frac{36 + 4 - 6}{52} = \frac{40}{52} \)
   f. \( P(\text{heart or red}) \) not disjoint \( \frac{13 + 26 - 13}{52} = \frac{26}{52} \)

6. The probability that a student gets a 5 on the AP Stat exam is 14%. The probability that a student gets a 5 on the AP Psych exam is 21%. The probability that a student gets a 5 on both exams is 8%.
   a. What is the probability that a student gets a 5 on the Stat or Psych exam? \( .27 \)
   b. What is the probability that a student gets a 5 on the Stat exam but not the Psych exam? \( .16 \)
   c. What is the probability that a student gets a 5 on neither exam? \( 1 - .27 = .73 \)

7. Unfortunately, you woke up this morning and the power was out. All of your socks are in the clean laundry basket in your room. You are wearing black pants today, so you are hoping to pull 2 black socks from the basket. You know the basket has 12 white athletic socks, 6 funky colored socks, and 8 black socks. Calculate each of the following probabilities. (Keep in mind that as you pick each sock, you not replacing it because you are going to wear it).
   a. You pick two black socks. \( \frac{8}{26} \times \frac{7}{25} = .08 \)
   b. You pick one black and one white. \( \left( \frac{8}{26} \times \frac{12}{25} \right) \times 2 = .295 \)
   c. You actually pick two socks that match. \( \frac{8}{26} + \frac{WW}{26} + \frac{FF}{26} = .335 \)

8. A poll of 120 Ithacans found that 30 had visited the new Best Buy, and that 80 had visited the new Home Depot.
   a. If it appeared that going to the Home Depot and going to Best Buy were independent events, how many of those polled had been to both? \( \frac{30}{120} = \frac{x}{120} \)
   b. Based upon your answer from part a, how many people have been to neither? \( \frac{80}{120} = \frac{x}{120} \)

9. Six Republicans and four Democrats have applied for two open positions on a planning committee. Since all the applicants are qualified to serve, the city council decides to pick the two new members randomly. What is the probability that both positions are filled by democrats? (Think combinations) \( \frac{4}{10} \times \frac{3}{9} = .133 \)
10. 58% of the members at a local gym are male, 67% of the members at the same gym are under the age of 35. Of all the members, 36% are males under the age of the 35. Use this information to fill in the table below. Represent your values as decimals.

<table>
<thead>
<tr>
<th></th>
<th>Under 35</th>
<th>Over 35</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>.36</td>
<td>.22</td>
<td>.58</td>
</tr>
<tr>
<td>Female</td>
<td>.31</td>
<td>.11</td>
<td>.42</td>
</tr>
<tr>
<td>Total</td>
<td>.67</td>
<td>.33</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Imagine a member is chosen at random. Calculate each of the following probabilities:

a. \( P(\text{female}) = .42 \)

b. \( P(\text{female and over 35}) = .11 \)

c. \( P(\text{male or over 35}) = .58 + .33 - .22 = .69 \)

d. \( P(\text{female or under 35}) = .42 + .67 - .31 = .78 \)

e. \( P(\text{female | under 35}) = \frac{.31}{.67} = .463 \)

f. \( P(\text{under 35 | female}) = \frac{.31}{.42} = .738 \)

g. Is gender independent of age for members at this gym?

\[ P(\text{female}) \neq P(\text{female | under 35}) \quad \text{not independent}. \]

11. The voters of a large city are 40% white, 40% African American and 20% Hispanic. An African American candidate for Mayor anticipates attracting about 30% of the white votes, 90% of the African American vote, and 50% of the Hispanic vote.

a. Draw a tree diagram that represents this scenario.

b. What percent of the overall vote does the candidate expect to get?

c. Given that a randomly chosen voter voted for this candidate, what is the probability that he/she is Hispanic?

12. 6.4 MATCHING PROBABILITIES Probability is a measure of how likely an event is to occur. Match one of the probabilities that follow with each statement about an event. (The probability is usually a much more exact measure of likelihood than is the verbal statement.)

\[ 0, 0.01, 0.3, 0.6, 0.99, 1 \]

(a) This event is impossible. It can never occur.

(b) This event is certain. It will occur on every trial of the random phenomenon.

(c) This event is very unlikely, but it will occur once in a while in a long sequence of trials.

(d) This event will occur more often than not.
\[ a = .12 + .36 + .10 = .58 - p(\text{vote yes}) \]

\[ b = p(H\text{Hispanic} | \text{vote yes}) = \frac{.10}{.58} \approx .172 \]