STA237H1F TUTORIAL 1 PROBLEMS (Sept 20-21, 2023)

1. In week 1, we learned some important results for set operations such as De Morgan's Law. Another useful result is the ***distributive law***, which states the following:

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$
$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

    a. Draw Venn diagrams to illustrate these results.

    b. Suppose $\Omega=\{1,2,3,4,5,6\}$ and let $A=\{1,2,4,5\}, B=\{1,3,5\}$ and $C=\{2,4,6\}$. Use this example to verify the two results in the distributive law.

2. In R, write R code to simulate rolling a fair six-sided die once, 10 times, 100 times, and 1000 times.

    a. Estimate the probability of rolling a 3 or higher based on 1000 simulated dice rolls.

    b. If you were to repeat your simulation, would you end up with the same estimate? Why or why not.

3. Consider the word 'STATISTICS'. Is the number of unique arrangements of the letters in 'STATISTICS' $10!$? Justify your answer and compute the probability that a random rearrangement of the letters in 'STATISTICS' will spell the word 'STATISTICS'.

4. Assume birthdays are equally likely to occur in each of the 12 months of the year. What is the probability that at least two people in a group of three students have birth months in common? Be sure to show your steps.