

Consider the seven sided die (with sides 0, 1, 2, 3, 4, 5 and 6) from your reading questions. You roll this die once. Let:

- A be the event that a given roll yields an even number.
  - B be the event that a given roll is greater than or equal to three.
  - C be the event that the number appears in the phrase “Stat 20”.
1. Find  $P(A)$ ,  $P(B)$  and  $P(C)$

2. Find  $P(A \cup B)$ .

3. Find  $P(B \cap C)$

4. Find  $P(A \cap B^C)$ .

One ticket will be drawn at random from each of the two boxes below:

$$A : \boxed{\begin{array}{|c|c|c|} \hline 1 & 2 & 3 \\ \hline \end{array}} \quad B : \boxed{\begin{array}{|c|c|c|c|} \hline 1 & 2 & 3 & 4 \\ \hline \end{array}}$$

5. What is the probability the number drawn from  $A$  is greater than the one drawn from  $B$ ?

6. What is the probability that the number drawn from  $A$  is equal to the one drawn from  $B$ ?

7. What is the probability the number drawn from  $A$  is smaller than the one drawn from  $B$ ?

Consider an outcome space  $\Omega$  with events  $A, B$  that are *not* mutually exclusive. Let  $P(A) = 0.5, P(B) = 0.7$  and  $P(A \cap B) = .4$ .

8. Draw a Venn Diagram containing two circles, one representing  $A$  and the other  $B$ .
  
9. Shade in the space in the diagram above corresponding to event  $A$ .
10. Shade in the space in the diagram above corresponding to event  $B$  in a way that is different than the way you shaded in the space for event  $A$ .
11. Based on your shading, calculate the probability  $P(A \cup B)$ . Explain why you cannot add  $P(A)$  and  $P(B)$  directly to obtain this answer.

Return to the example of the seven-sided die from your reading questions and earlier in this problem set. Write code in R (and write the code below) to:

12. Simulate rolling the seven-sided die once.
  
13. Simulate rolling the seven-sided die seven times.
  
14. Render a Quarto document with parts 1 and 2 such that you receive the same sample each time you run the code. You can just provide the line of code which is responsible for this behavior.

Examine the following code.

```
# First create a vector with the possible sums of a pair of dice
dice <- seq(from = 2, by = 1, to = 12)
# Then sample once from these sums
sample(x = dice, size = 1)
```

15. If we want to simulate rolling a pair of dice and summing the spots (for say, playing Monopoly), will the following code do this correctly? Explain.
  
16. If you said that the code is incorrect, modify the following code to simulate this process correctly. *Hint: you may want to use `sample()` more than once.*