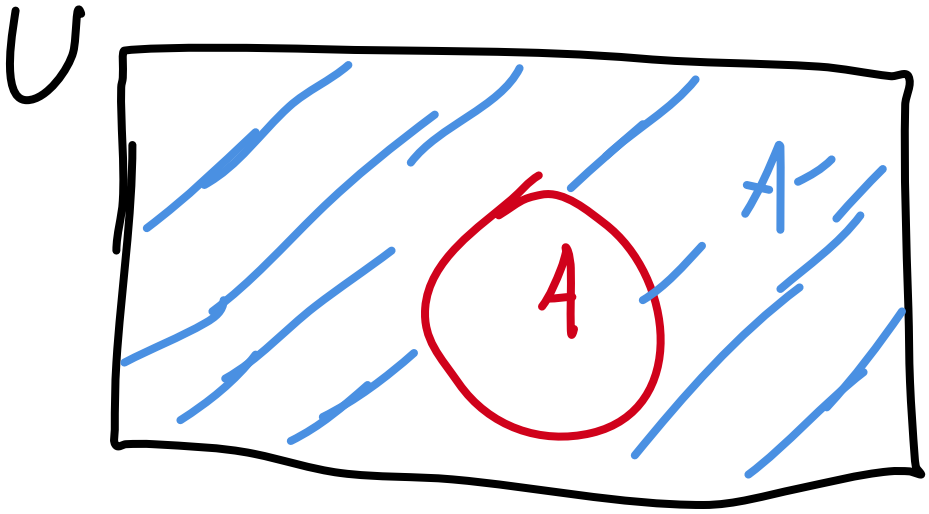
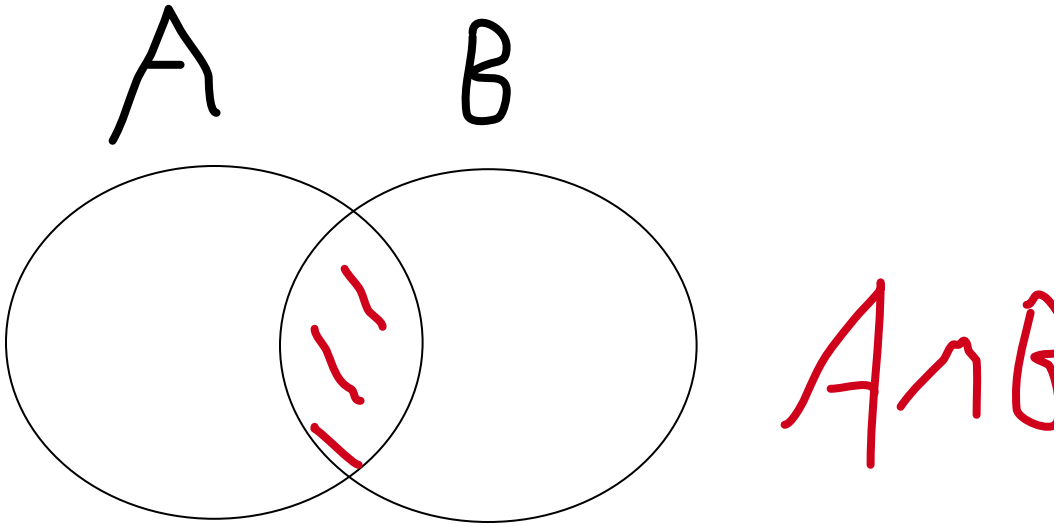
Sets Lesson 3: Venn Diagrams

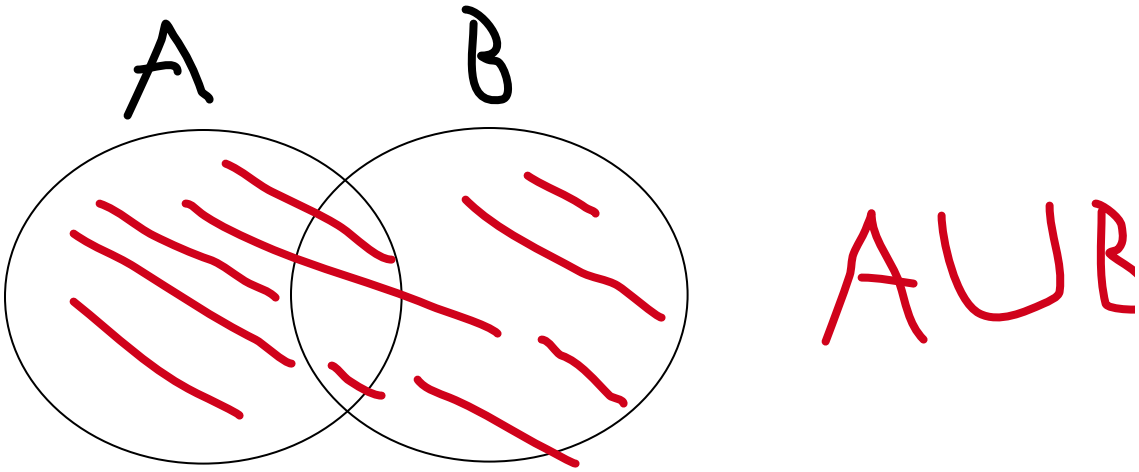
11/30

Venn Diagrams help us picutre an expression sets, and prove to be a useful tool when finding certain results about particular sets

Representing Complements, Intersections, and Unions







Example 3.2 (page 26-27)

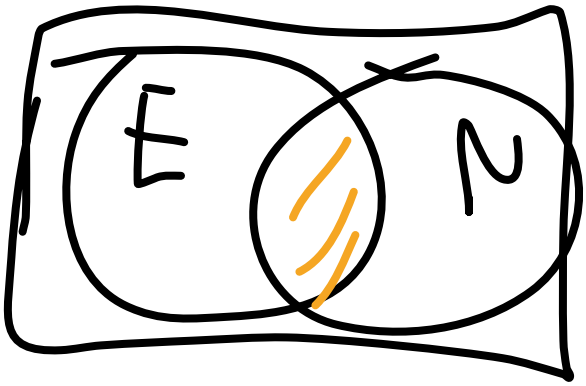
Describe the shaded region using set builder notation

$U =$ the set of integers

$E = \{x | x \text{ is even}\}$

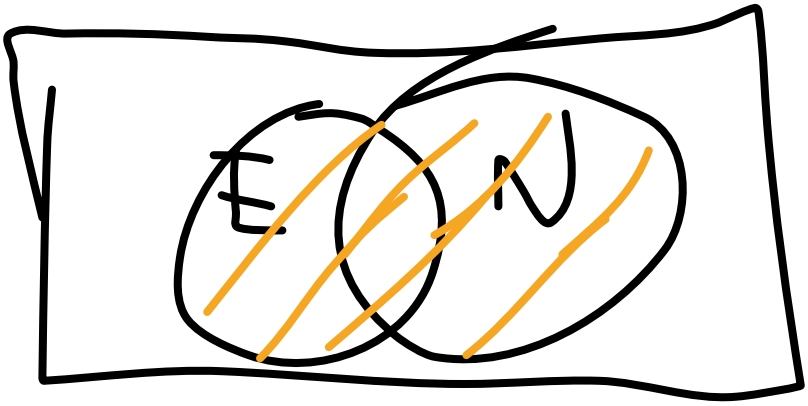
$N = \{x | x \text{ is negative}\}$

(4)



We find the orange region is $E \cap N = \{x | x \text{ is an even negative number}\} = \{-2, -4, -6, \ldots\}$

(5)



We find the orange region is

$E \cup N = \{x | x \text{ is either even or negative}\} = \{2, 4, 6, \ldots\} \cup \{-1, -2, \ldots\}$

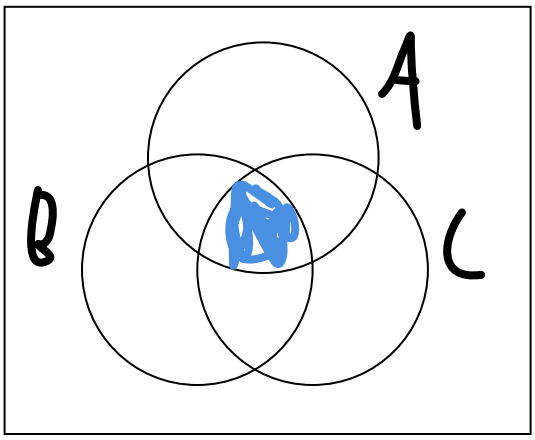
We find the orange region is

$(E \cup N)' = \{x | x \text{ is neither even nor negative}\} = \{x | x \text{ is odd and positive}\} = \{1, 3, 5, \ldots\}$

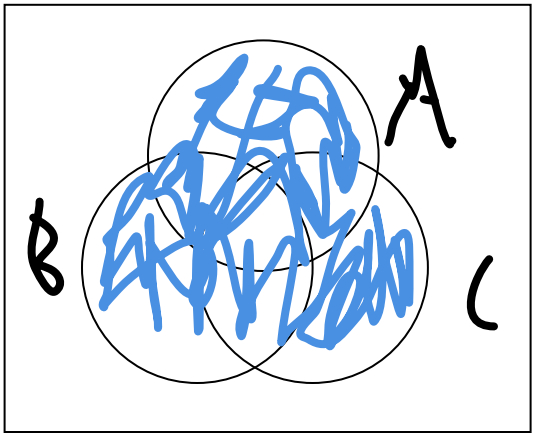
Representing Complex Set Expressions

How do we deal with multiple set operations when drawing sets (in particular, when we draw three sets)

For example $A \cap B \cap C$
When we draw the intersection multiple sets, the shaded region ends up being everything that overlaps with all the diagrams



Another example is $A \cup B \cup C$. The shaded region ends up being the total area of all the sets A, B, C combined

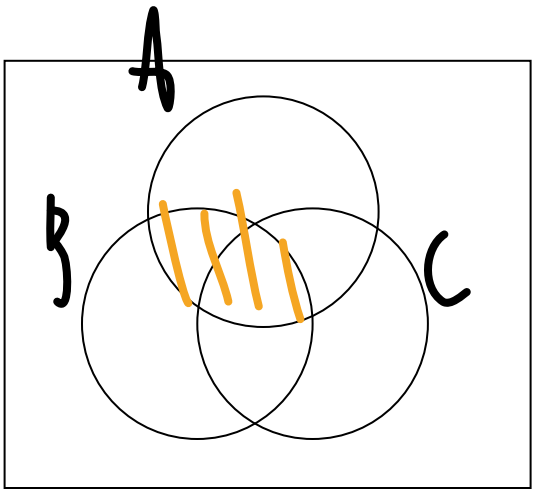


But what if we have a situation where it isn't as clear intuitively, like $(A \cap B) \cup C$ or $(A \cup B)' \cap C$, what do we do. For this we have a general process, which is as follows

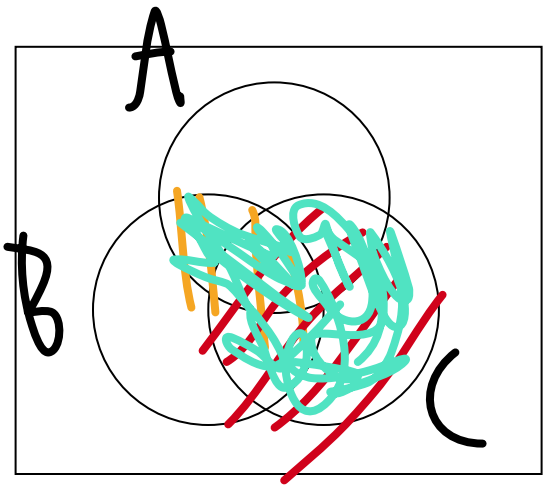
General Process:

1. Follow the order of operations and find which operations go first
2. Shade the region in that given step, determined through any given region, or regions determined in the previous step.
3. If there are no regions that we need to combine through an operation, then the final region is determined.

So using this process, let's do $(A \cap B) \cup C$. First, we find the region determined by $A \cap B$ (since it's in parentheses). Now that we have $A \cap B$, we can take that shaded region, and apply the union operation between $A \cap B$ and C



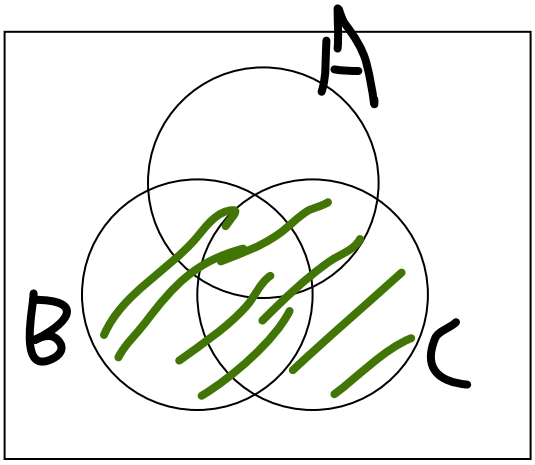
$A \cap B$



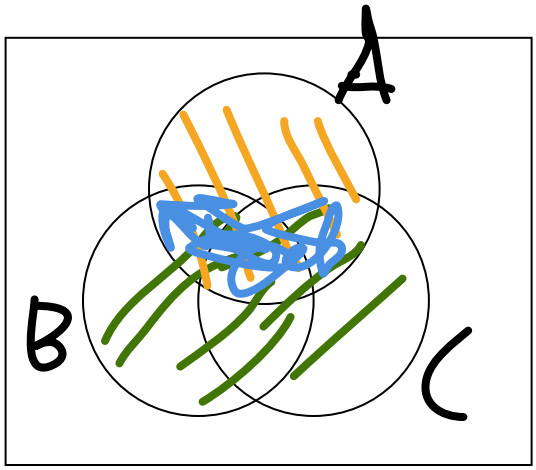
$(A \cap B) \cup C$

Example 3.4. page 30 Draw the Venn Diagram to represent $A \cap (B \cup C)$

We begin by following the order of operations, so going to the parentheses, and shading $B \cup C$



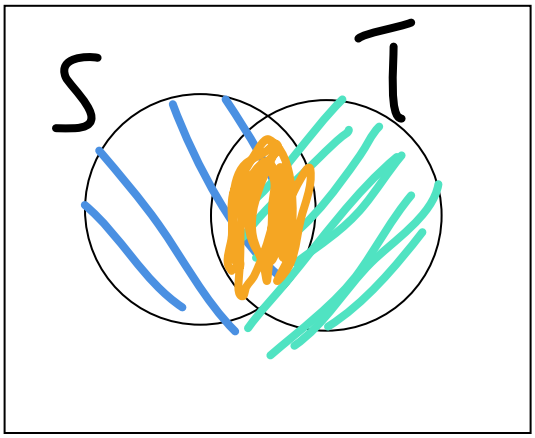
Next, we intersect A with $B \cup C$ by taking the overlap as follows:



and we have found our shaded region for $A \cap (B \cup C)$.

Example 3.5 (page 30) Draw the Venn Diagram representing $(S \cap T)'$

We start by looking at the parentheses, so we find $S \cap T$



We then take the complement of $S \cap T$, which includes everything BUT the shaded region of $S \cap T$, which gives us

$S \cap T$

$(S \cap T)'$

Homework 3 Questions