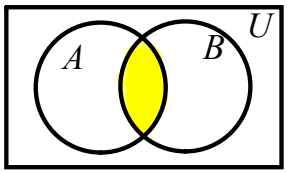
2.3: Other Set Operations

Definition: If A and B are sets, the intersection of A and B, denoted $A \cap B$, is the set of elements that are in **both** A **and** B. That is,
$A \cap B = \{x \mid x \in A \text{ and } x \in B\}$.

An intersection can be thought of in the following manner. The shaded region is $A \cap B$:



Examples:

$\{1, 2, 3, 4\} \cap \{2, 4, 6, 8\} =$ $\{2, 4\}$

$\{x^2 \mid x \in \mathbb{Z}\} \cap \{1, 2, ..., 20\} =$ $\{1, 4, 9, 16\}$

$\{0, 1, 4, 9, 16, 25, \ldots\}$

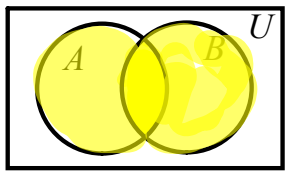
$\{1, 2\} \cap \{1, 2, 3\} =$ $\{1, 2\}$

$\{1, 2\} \cap \{3, 4\} =$ $\emptyset$ $\{\}$

$\emptyset \cap \{1,2\} =$ $\emptyset$ $\{\}$

Definition: If A and B are sets, the union of A and B, denoted $A \cup B$, is the set of elements that are in **either** A **or** B. That is,
$A \cup B = \{x \mid x \in A \text{ or } x \in B\}$.

A union can be thought of in the following manner. The shaded region is $A \cup B$:



Examples:

$\{1, 2, 3, 4\} \cup \{2, 4, 6, 8\} =$ $\{1, 2, 3, 4, 6, 8\}$

$\{x^2 \mid x \in \mathbb{Z}\} \cup \{1, 2, ..., 20\} =$ $\{0, 1, 2, 3, 4, \ldots, 20, 25, 36, 49, \ldots\}$

$\{0, 1, 4, 9, 16, 25, 36, \ldots\}$

$\{1, 2\} \cup \{1, 2, 3\} =$ $\{1, 2, 3\}$

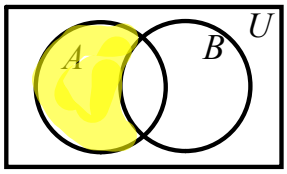
$\{1, 2\} \cup \{3, 4\} =$ $\{1, 2, 3, 4\}$

$\emptyset \cup \{1,2\} =$ $\{1, 2\}$

Definition: If A and B are sets, the set difference of B and A (or relative complement of A relative to B), denoted $A - B$ and read "A set minus B", is the set of elements that are in A but not in B. That is,

$$A - B = \{x \mid x \in A \text{ and } x \notin B\}.$$

A set difference can be thought of in the following manner. The shaded region is $A - B$:



Examples:

$\{1, 2, 3, 4\} - \{2, 4, 6, 8\} = \{1, 3\}$

$\{1, 2, \ldots, 20\} - \{x^2 \mid x \in \mathbb{Z}\} = \{2, 3, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20\}$

$\{0, 1, 4, 9, 16, 25, \ldots\}$

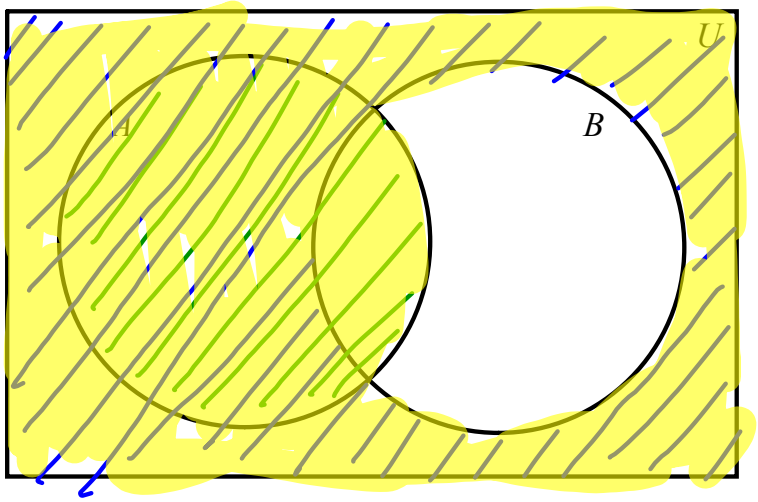
$\{1, 2\} - \{1, 2, 3\} = \emptyset$

$\{1, 2\} - \{3, 4\} = \{1, 2\}$

$\emptyset - \{1,2\} = \emptyset$

Example: Draw the Venn Diagram for $A \cup \overline{B}$.

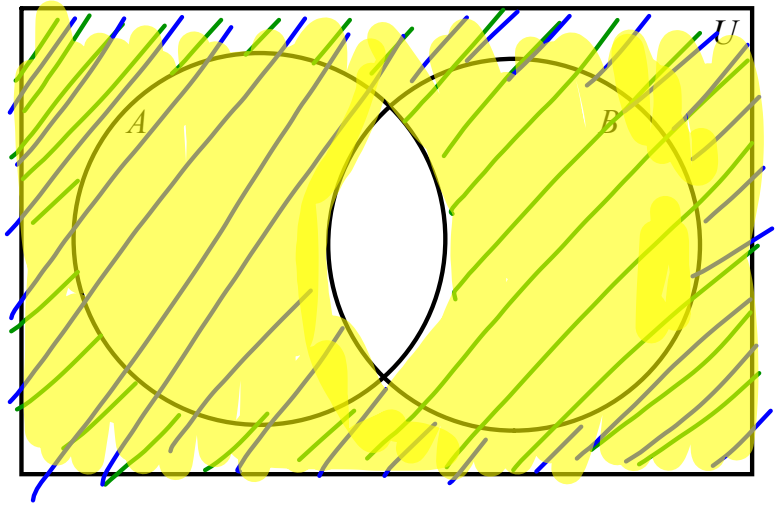
Union: Draw same direction, and highlight



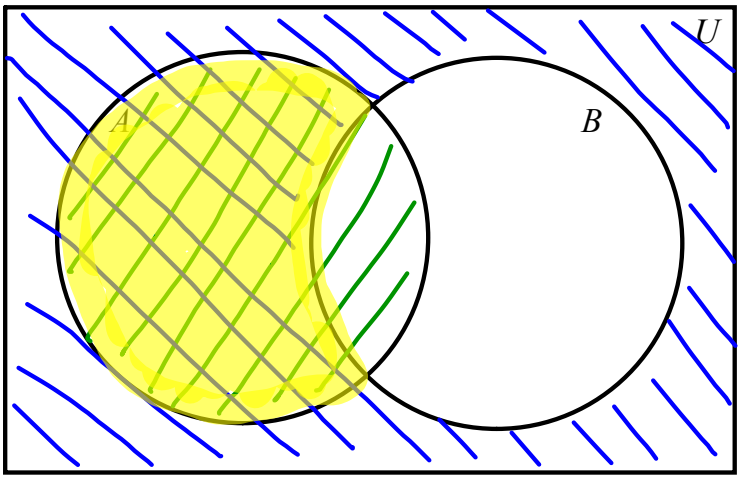
everything shaded.

2.3 Completed Notes

Example: Draw the Venn Diagram for $\overline{A} \cup \overline{B}$.

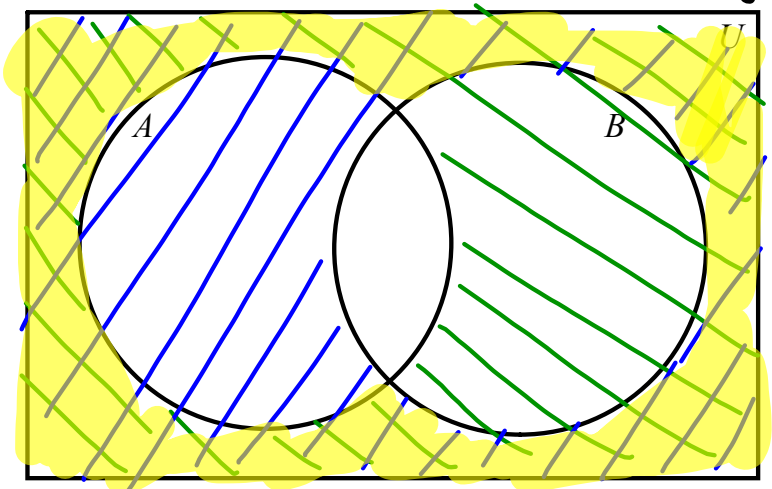


Example: Draw the Venn Diagram for $A' \cap \overline{B}$.



Example: Draw the Venn Diagram for $\overline{A} \cap \overline{B}$.

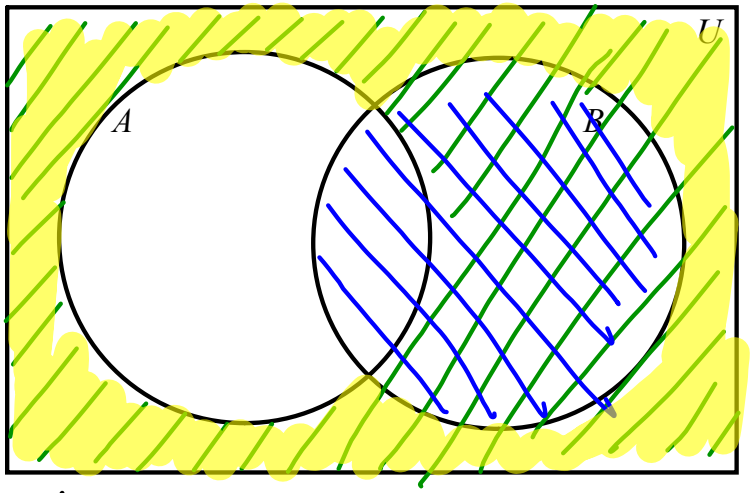
Intersection: Shade opposite ways. Highlight where



the lines intersect.

Example: Draw the Venn Diagram for $\overline{A} - B$.

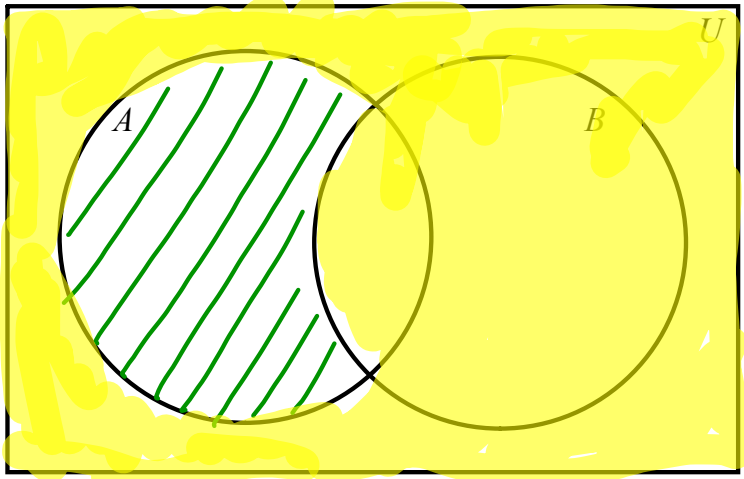
Set Minus: Shade opposite ways. Highlight what



was shaded for only the first set.

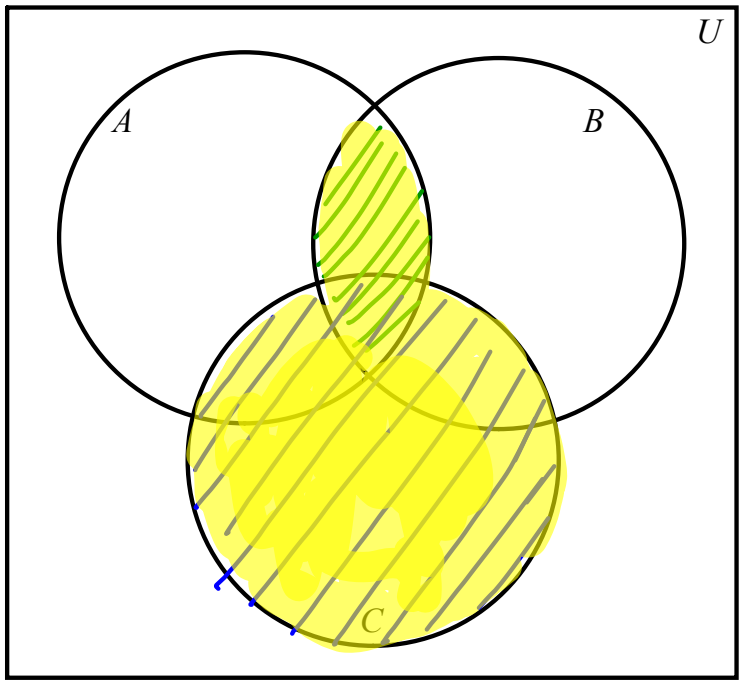
Example: Draw the Venn Diagram for $\overline{A - B}$.

Complement over whole thing: Shade what's



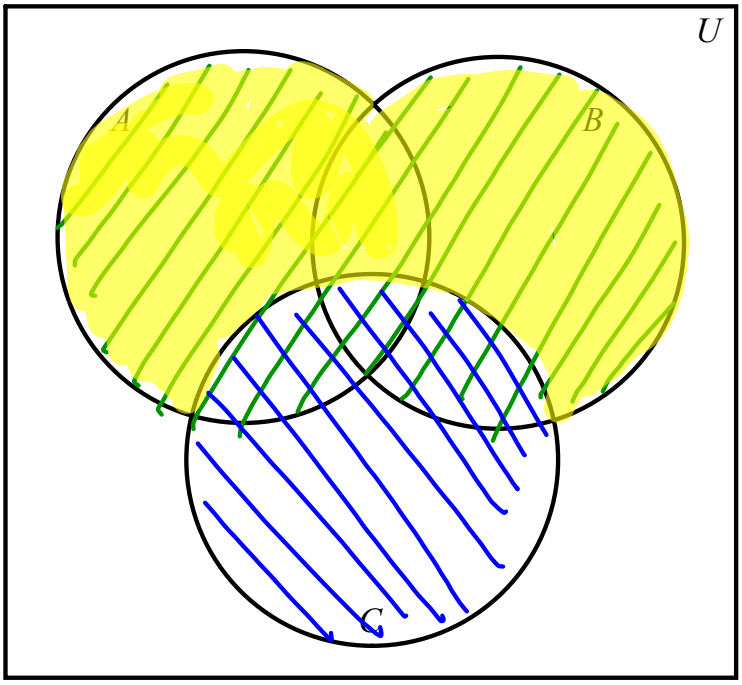
underneath, then highlight everything not shaded

Example: Draw the Venn Diagram for $(A \cap B) \cup C'$.

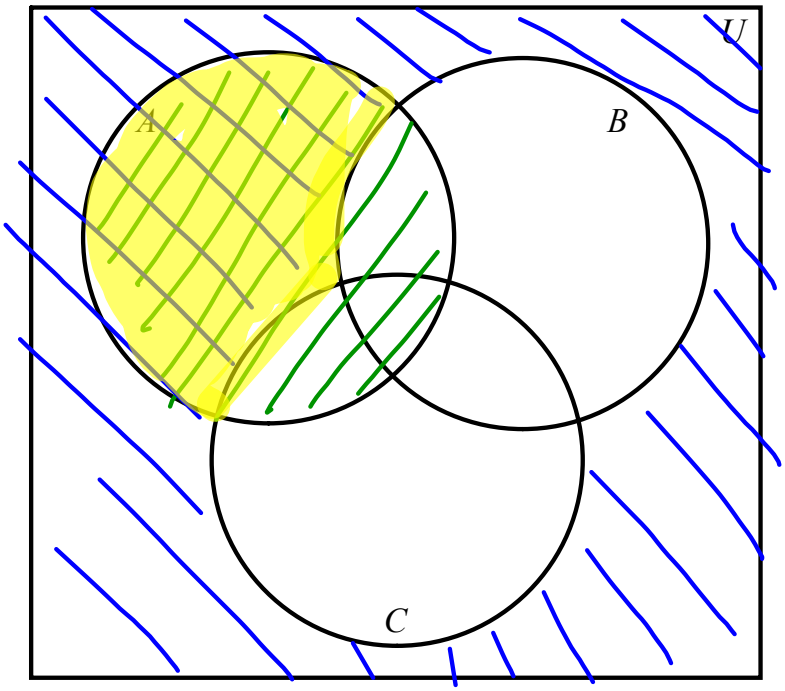


2.3 Completed Notes

Example: Draw the Venn Diagram for $(A \cup B) - C$

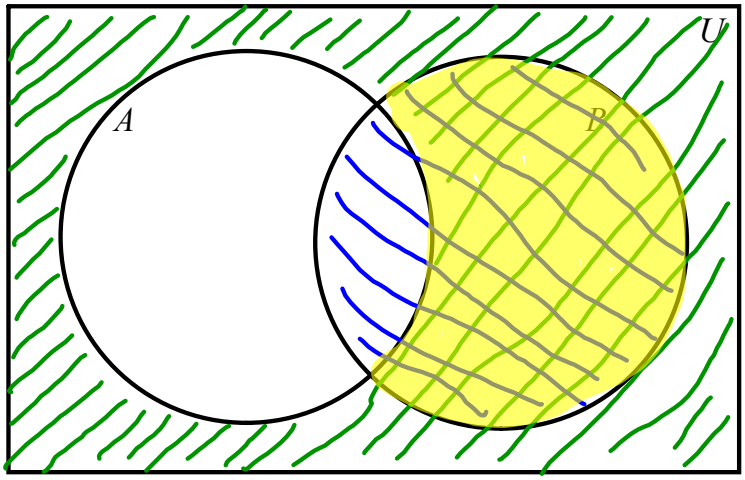


Example: Draw the Venn Diagram for $A \cap (\overline{B \cup C})$

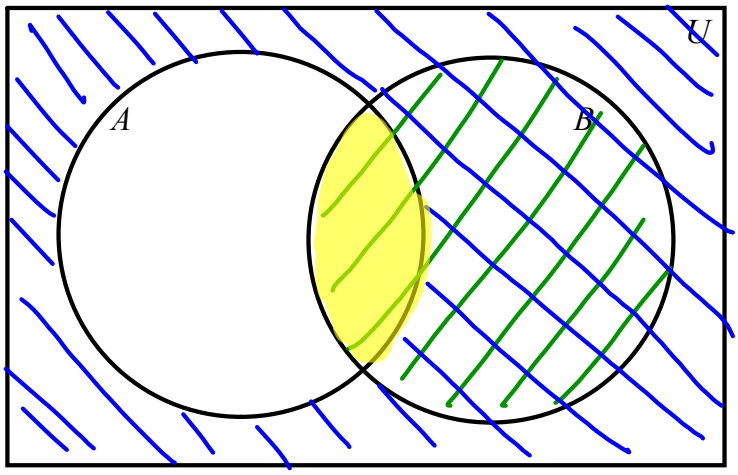


2.3 Completed Notes

Problem 1: Draw the Venn Diagram for $\overline{A} \cap B$

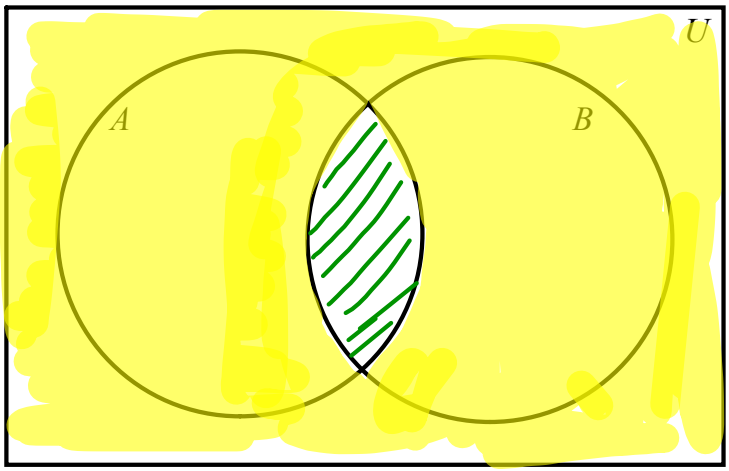


Problem 2: Draw the Venn Diagram for $B - \overline{A}$.

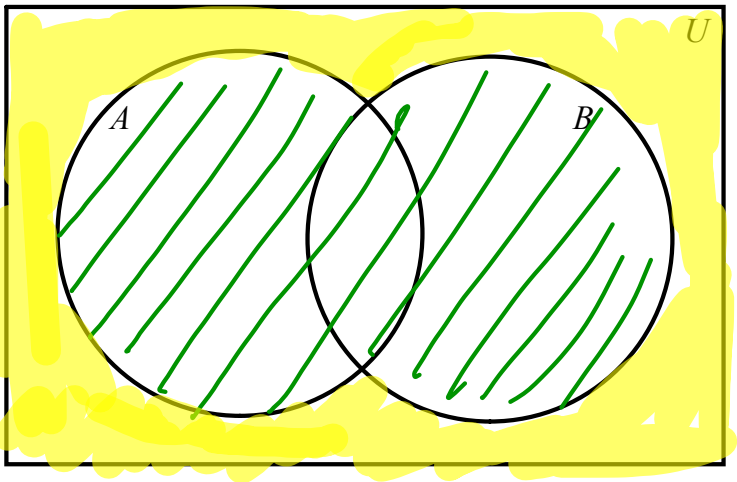


2.3 Completed Notes

Problem 3: Draw the Venn Diagram for $\overline{A \cap B}$ $= \bar{A} \cup \bar{B}$

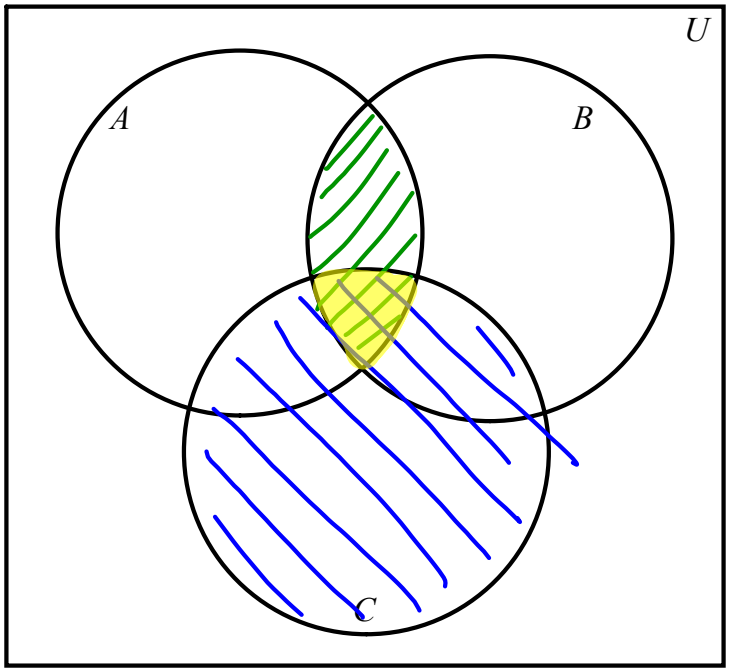


Problem 4: Draw the Venn Diagram for $\overline{A \cup B}$.

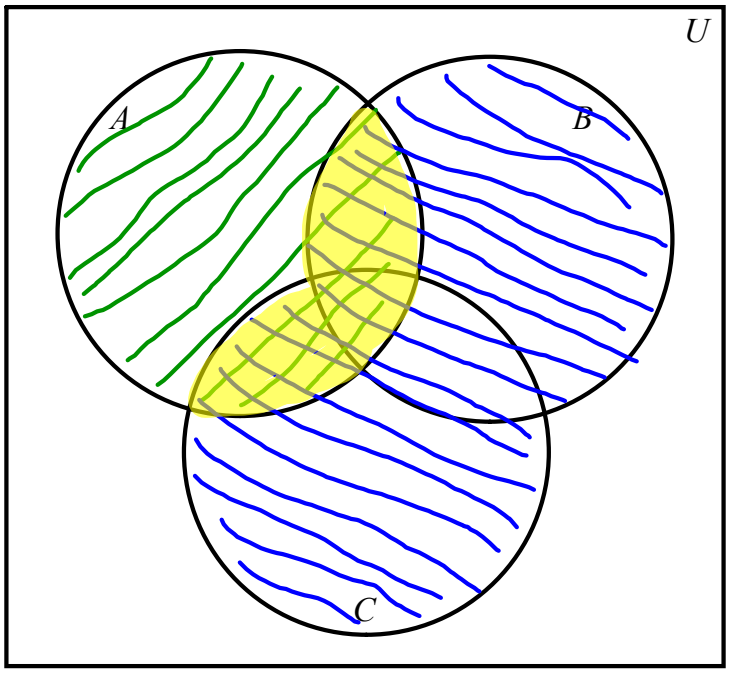


2.3 Completed Notes

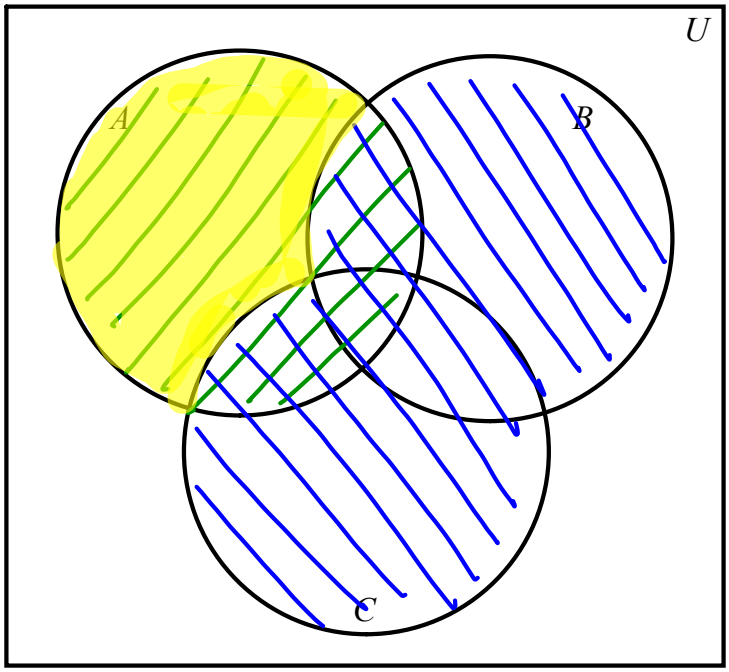
Problem 5: Draw the Venn Diagram for $(A \cap B) \cap C$.



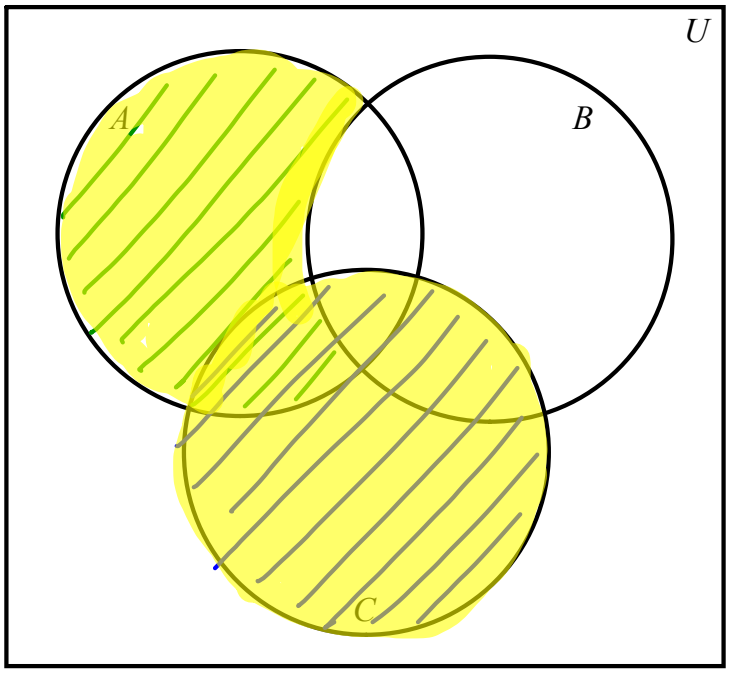
Problem 6: Draw the Venn Diagram for $A \cap (B \cup C)$.



Problem 7: Draw the Venn Diagram for $A - (B \cup C)$

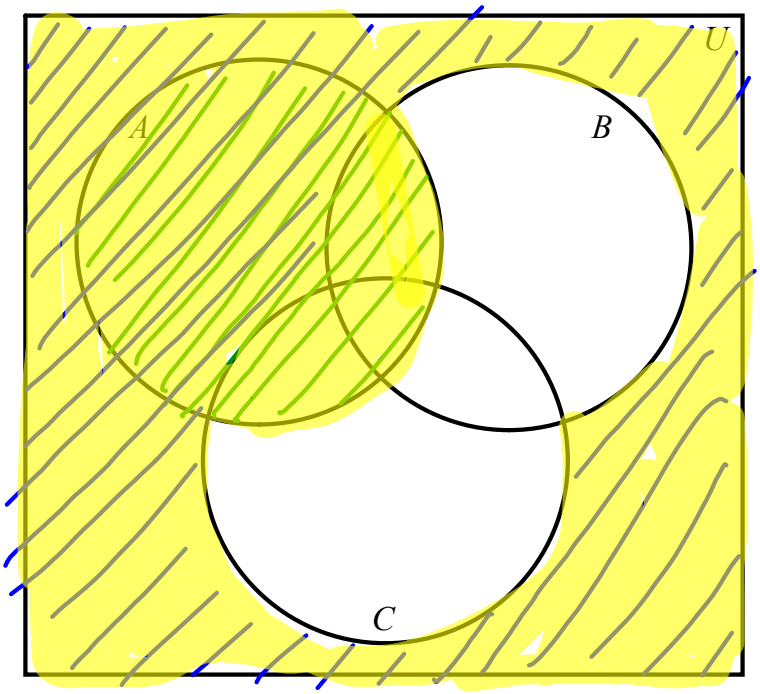


Problem 8: Draw the Venn Diagram for $(A - B) \cup C$

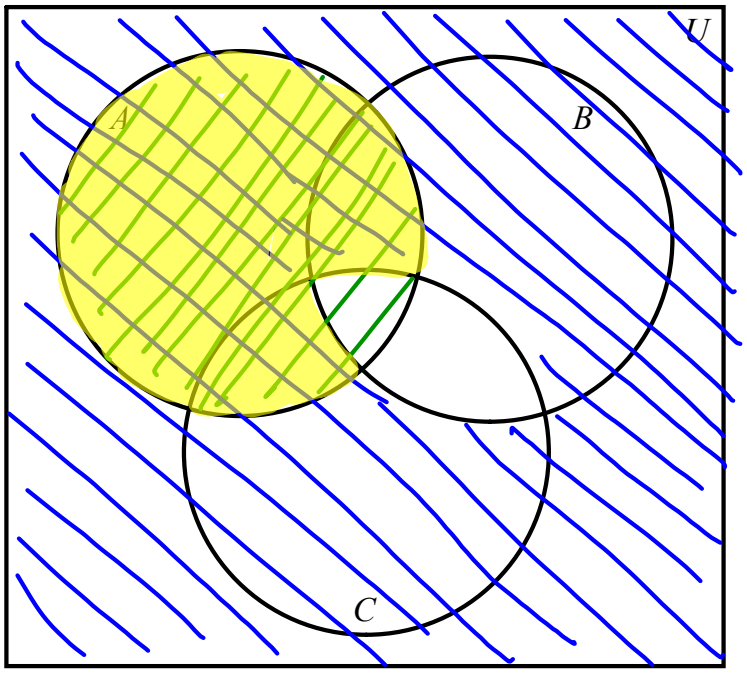


2.3 Completed Notes

Problem 9: Draw the Venn Diagram for $A \cup \overline{(B \cup C)}$.



Problem 10: Draw the Venn Diagram for $A \cap \overline{(B \cap C)}$.



You have an average of 70 on 5 quizzes, and you may drop your lowest quiz grade of 50. What is your new average?

$$70 = \frac{q_1 + q_2 + q_3 + q_4 + 50}{5}$$

$350 = q_1 + q_2 + q_3 + q_4 + 50$ $(70 \times 5 = 350)$

$300 = q_1 + q_2 + q_3 + q_4$

New average: $\frac{300}{4} = 75$

$(4n+1)2 \times n$

(4n+1): sum of one side; 2: two sides of a sheet; n: sheets; last page number

$2n(4n+1)$

Problem Solving #1

$$S = \frac{n(n+1)}{2}$$

#2

Find the sum

$$1+4+7+10+13+16+19+22+25=S$$
$$25+22+19+16+13+10+7+4+1=S$$

$$26+26+26+26+26+26+26+26+26=25$$

$$25=9\times26=234$$

$$S=\frac{234}{2}=\boxed{117}$$

Andrew, Danny, Heather, and Michael went to an undisclosed location to conduct the secret business of deciding what to eat for lunch the next day. They arrived at 9:55 PM, 10:00 PM, 10:10 PM, and 10:15 PM. Using the clues below, determine who arrived at each time.

- Danny thought he was being followed, so he circled around the block several times and ended up arriving at 10:10 PM.
- Heather arrived 15 minutes before Michael.

	9:55	10:00	10:10	10:15
A	O	X	X	X
D	X	X	O	X
H	X	O	X	X
M	X	X	X	O

Andrew: 9:55, Danny: 10:10,
Heather: 10:00, Michael: 10:15