# Discrete Math

Exercise 1

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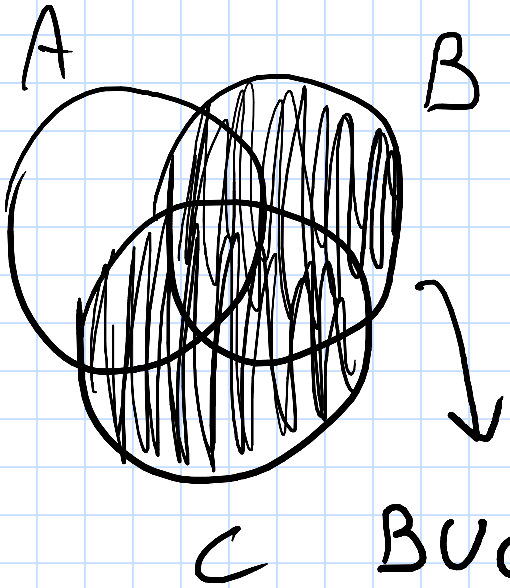
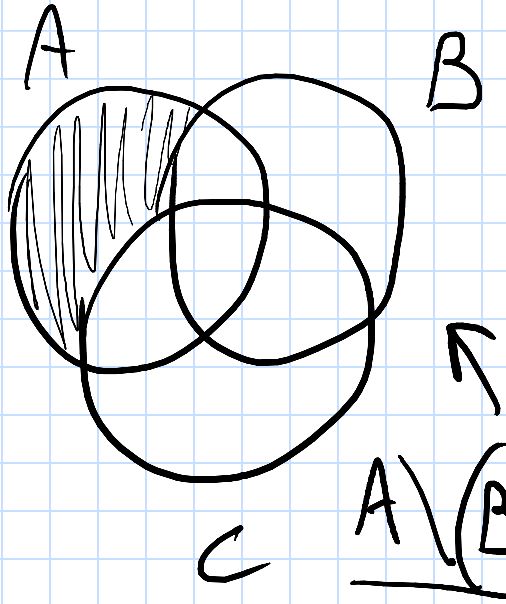



$\underline{B \cup C}$

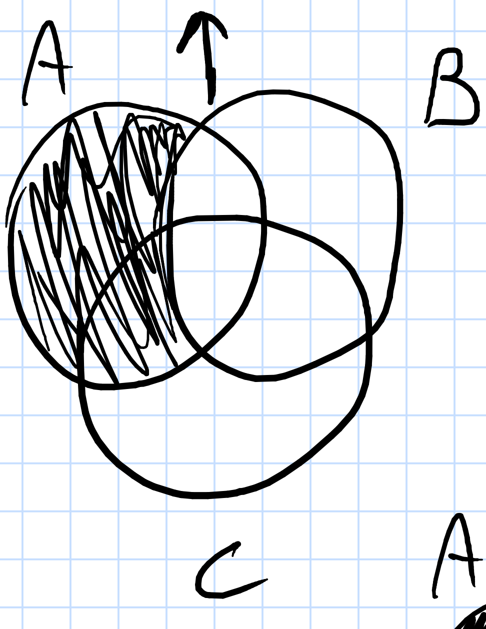


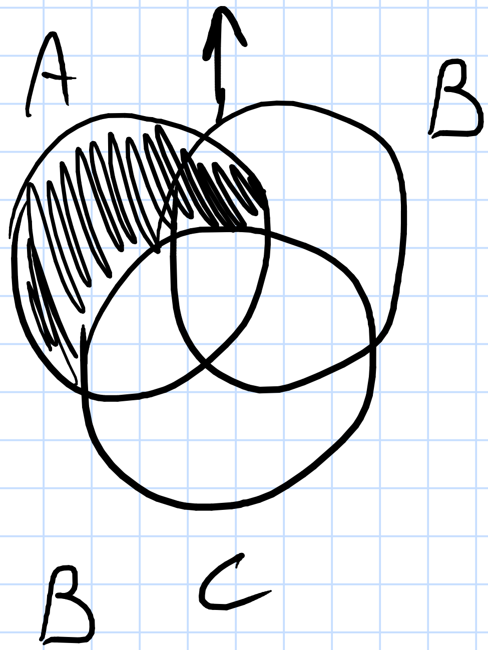

$\underline{A \setminus (B \cup C)}$

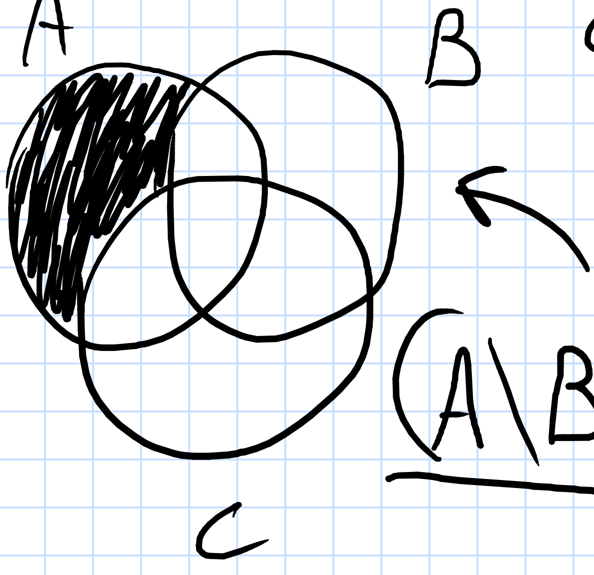
K1

$\underline{A \setminus B}$

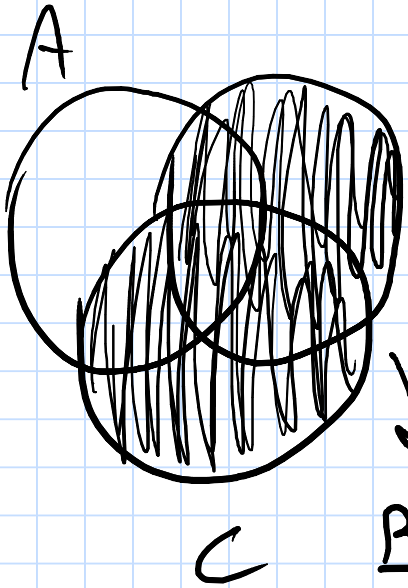
$\underline{A \setminus C}$



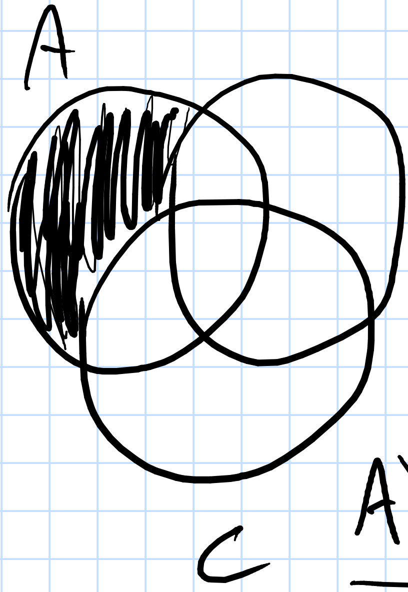




$\underline{(A \setminus B) \cap (A \setminus C)}$




$B \cup C$




$A \setminus (B \cup C)$

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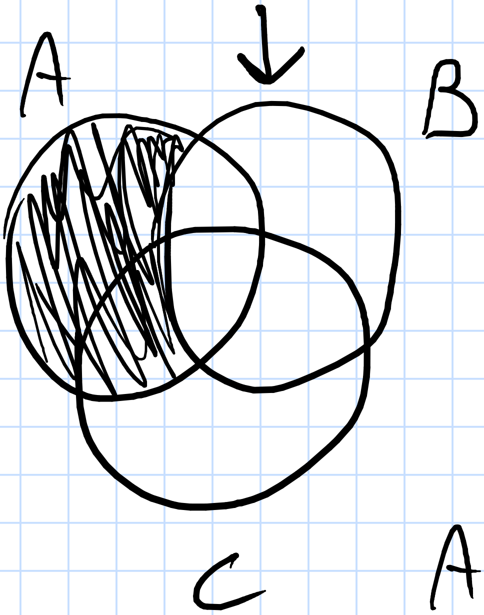
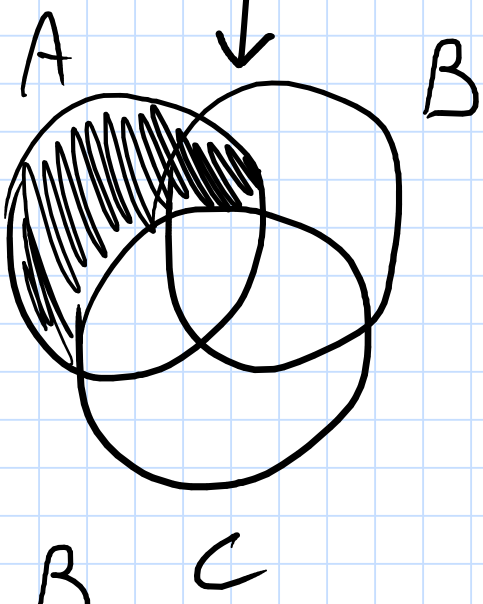
$A \setminus B$




$A \setminus C$





$(A \setminus B) \cup (A \setminus C)$

We can see that:

$A \setminus (B \cup C) \subset (A \setminus B) \cup (A \setminus C)$

## 2

This doesn't apply for every group of sets $A, B, C$. To prove that, let's take:

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

$$B = \{3, 4, 5, 6\}$$

$$C = \{2, 4, 6, 7\}$$

Let's create a new group, $D$, such that:

$$D = A \backslash (B \cap C) = A \backslash \{4, 5, 6\} = \{1, 2, 3\}$$

And create a new group, $E$, such that:

$$E = (A \cup B) \backslash C = \{1, 2, 3, 4, 5, 6\} \backslash C = \{1, 3, 5\}$$

We can see that $D \not\subset E$, and that $E \not\subset D$.

$$\blacksquare$$

# 3 Build a truth table for $P \to (\neg Q \land R)$:

| $P$ | $Q$ | $\neg Q$ | $R$ | $\neg Q \land R$ | $P \to (\neg Q \land R)$ |
|---|---|---|---|---|---|
| T | T | F | T | F | F |
| T | T | F | F | F | F |
| T | F | T | T | T | T |
| T | F | T | F | F | F |
| F | T | F | T | F | T |
| F | T | F | F | F | T |
| F | F | T | T | T | T |
| F | F | T | F | F | T |

# 4 Check if $A \iff B$

P.S I will never build LaTeX tables again, that's just horrible.

## 4.1

We can notice that $A$ and $B$ are not equal.

| $P$ | $Q$ | $R$ | $P \Leftrightarrow Q$ | $(P \Leftrightarrow Q) \wedge R$ [**A**] | $P \wedge R$ | $Q \wedge R$ | $P \wedge R \Leftrightarrow Q \wedge R$ [**B**] |
|---|---|---|---|---|---|---|---|
| T | T | T | T | T | T | T | T |
| T | T | F | T | F | F | F | T |
| T | F | T | F | F | T | F | F |
| T | F | F | F | F | F | F | T |
| F | T | T | F | F | F | T | F |
| F | T | F | F | F | F | F | T |
| F | F | T | T | T | F | F | T |
| F | F | F | T | F | F | F | T |

## 4.2

We can notice that $A$ and $B$ are equal.

| $P$ | $Q$ | $R$ | $P \Leftrightarrow Q$ | $(P \Leftrightarrow Q) \vee R$ [**A**] | $P \vee R$ | $Q \vee R$ | $P \vee R \Leftrightarrow Q \vee R$ [**B**] |
|---|---|---|---|---|---|---|---|
| T | T | T | T | T | T | T | T |
| T | T | F | T | T | T | T | T |
| T | F | T | F | T | T | T | T |
| T | F | F | F | F | T | F | F |
| F | T | T | F | T | T | T | T |
| F | T | F | F | F | F | T | F |
| F | F | T | T | T | T | T | T |
| F | F | F | T | T | F | F | T |

# 5 Is the statement correct?

## 5.1 No, contradictory example: $x = 5$

## 5.2 Yes, for example: $x = 9$

## 5.3 Yes, for example: $x = 6$

## 5.4 No, contradictory example: $x = 4$

# 6 $A = \{1, 2, 3\}$ $B = \{3, 4, 5, 6\}$

## 6.1 $\underline{\forall x \in A\ \exists y \in B\ x + y < 7}$

This statement is true.

## 6.2 $\underline{\exists x \in A\ \forall y \in B\ x + y < 7}$

This statement is false. For example, $1 + 6 \not< 7$.