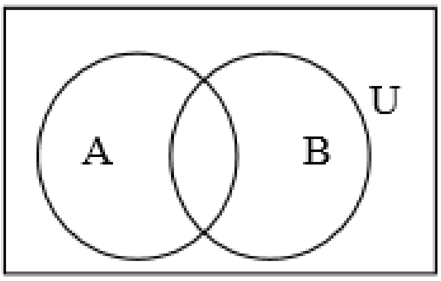
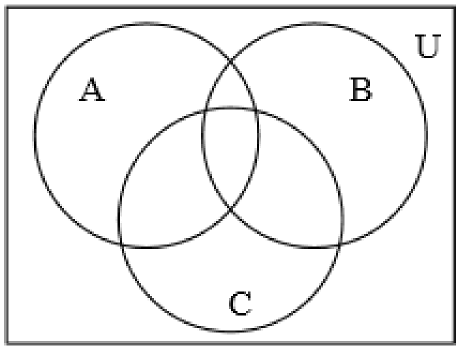
The **Universal set** is the set of interest in a particular discussion.

A **Venn diagram** is a visual representation of sets.
They look like:



Universe

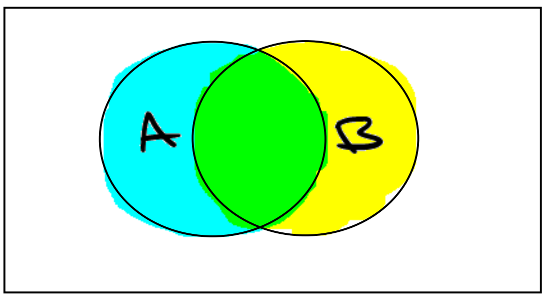


Set Operations "OR"

Let A and B be two sets. The set of all elements that that belong to either A *or* B or both is called the **Union** of A and B (denoted A ∪ B).

In set builder notation $A \cup B = \{x \mid x \in A \text{ or } x \in B \text{ or both}\}$

Set Union in a Venn diagram looks like:



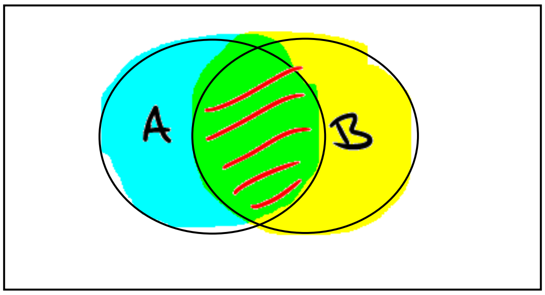
A ∪ B = Anything Shaded

Math 1313 Section 5.1 "AND"

Let A and B be two sets. The set of all elements in common with both sets A *and* B is called the **Intersection** of A and B (denoted $A \cap B$).

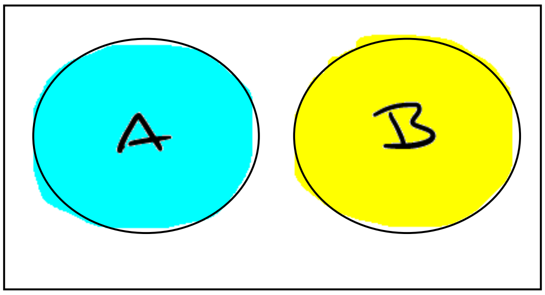
In **set-builder notation** $A \cap B = \{x \mid x \in A \text{ and } x \in B\}$

Set Intersection in a Venn diagram looks like:



$A \cap B =$

If $A \cap B = \emptyset$, then we say the intersection is the **null intersection** and that A and B are **disjoint**.

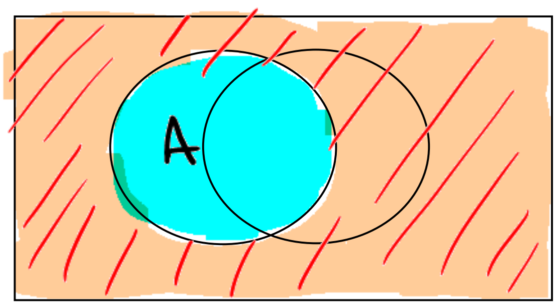


Let U be a universal set and $A \subseteq U$. The set of all elements in U that are not in A is called the

Complement of A. (denoted A^C)

In **set-builder notation** $A^c = \{x \mid x \in U, x \notin A\}$

Set Complementation in a Venn diagram looks like:



$A^c =$

Math 1313 Section 5.1

Set Operations

Let U be a universal set and A and B be subset of U

$U^c = \emptyset$ $\emptyset^c = U$ $(A^c)^c = A$

$A \cup A^c = U$ $A \cap A^c = \emptyset$

$A \cup B = B \cup A$ $A \cap B = B \cap A$

DeMorgan's Laws To Reduce # of complements

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

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

Example 3: Let U={1,2,3,4,5,6,7,8,9,10}

A={1,3,5,7,9}

B={2,4,6,8,10}

C={1,2,4,5,8}

Find the given sets.

a. $(A \cup B)$ $\{1,3,5,7,9\} \cup \{2,4,6,8,10\}$

"OR" Merger

$= \{1-10\}$

b. $(B \cap C)$ $\{2,4,6,8,10\} \cap \{1,2,4,5,8\}$

Intersection

"In Common"

$= \{2,4,8\}$

c. $(B \cap C^c)$ $\{2,4,6,8,10\} \cap \{3,6,7,9,10\}$

In Common

$= \{6,10\}$

d. $(A \cup B \cup C)^c$ $\left(\{1,3,5,7,9\} \cup \{2,4,6,8,10\} \cup \{1,3,4,5,8\}\right)^c$

Merge

$\left(\underbrace{1,2,3,4,5,6,7,8,10}_{\text{Universe}}\right)^c$

$(\text{Universe})^c = \{\varnothing\}$

e. $A \cup (B^c \cap C)$

$\{1,3,5,7,9\} \cup \left(\{\underline{1},3,\underline{5},7,9\} \cap \{\underline{1},2,4,\underline{5},8\}\right)$

$\{1,3,5,7,9\} \cup (1,5)$

$= \{1,3,5,7,9\}$

f. $(A^c \cap B^c) \cup C$ Apply DeMorgan's Law

$(A \cup B)^c \cup C$

$(1\text{–}10)^c \cup C$

$\{\varnothing\} \cup C = C = \{1,2,4,5,8\}$

Example 4: Let U denote the set of all employees at a certain Company.
Let T={x∈U| x likes to read Time magazine}, E={x∈U| x likes to read ESPN magazine} and C={x∈U| x likes to read Car and Driver}.

Part A. Describe the given set in words given statement in set notation.

i. T ∪ C = the set of all employees at this company that

like to read Time OR Car & Driver ... OR Both

ii. $(T^c \cap C) \cup E$ = the set of all employees at this company that

don't like to read Time "AND" "BUT" like to read Car & Driver ;

OR like to read ESPN

Part B. Describe the given statement in set notation.

i. The set of all employees at this company that like ESPN and do not like Car and Driver.

$E \cap C^c$

ii. The set of all employees at this company that do not like Time, ESPN or Car Driver.

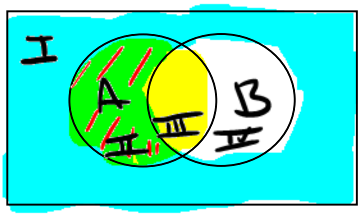
$(T \cup E \cup C)^c$

Another good example is example 8 and 9 in your book. Read through that example.

Example 5: Shade the portion of the Venn diagram that represents the given set.
(Assume the given sets are not disjoint.)

a. $(A \cap B^c)$ → strictly A

In Common



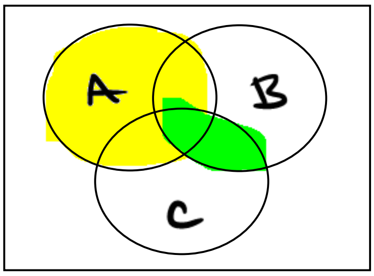
$\overset{A}{\{II, III\}} \cap \overset{B^c}{\{I, II\}}$

In Common

$\{II\}$

b. $A \cup (B \cap C)$

Union
"Merge"



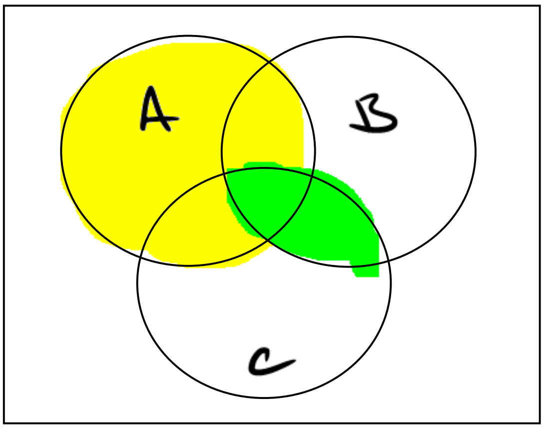
Answer = Anything Shaded

Popper 3: Given the following sets, find $A \cap B^C$.

$$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}, A = \{3, 4, 5, 7, 9, 10\} \text{ and } B = \{2, 3, 5, 7\}$$

a. $\{2, 3, 4, 5, 7, 9, 10\}$
b. $\{3, 5, 7\}$
c. $\{1, 6, 8\}$
d. $\{4, 9, 10\}$
e. None of the above

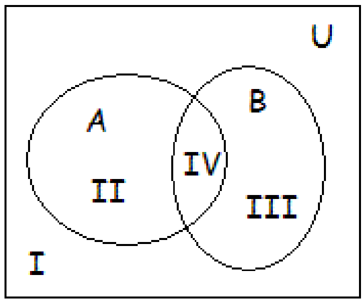
c. $(B \cap C)^c \cap A^c$ Apply DeMorgan's $\left((B \cap C) \cup A\right)^c$



(shaded Area)^c

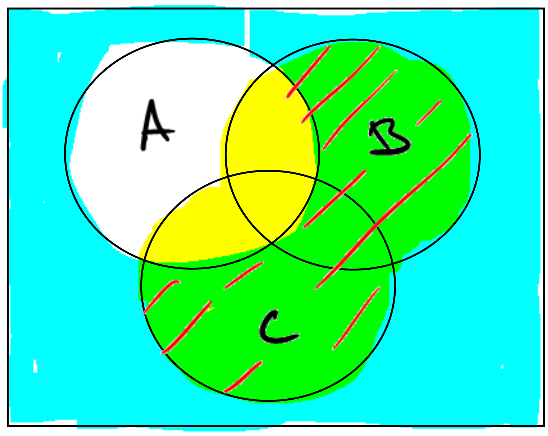
= Answer = White space

Popper 4: Given the following Venn diagram, which regions make up $A^c \cap B^c$

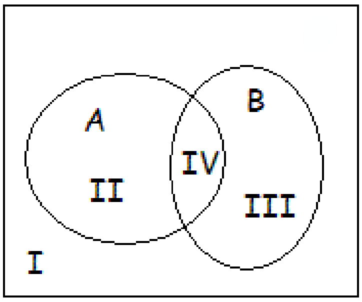


a. III and IV only.
b. I, II and IV only.
c. I only.
d. Ø

d. $A^c \cap (B \cup C)$ Outside of A But part of B or C



Popper 5: Given the following Venn diagram, which regions make up $A \cup B^c$



a. III and IV only.
b. I, II and IV only.
c. I only.
d. Ø

e. $(C^c \cup B^c \cup A^c)^c$ $= C \cap B \cap A$