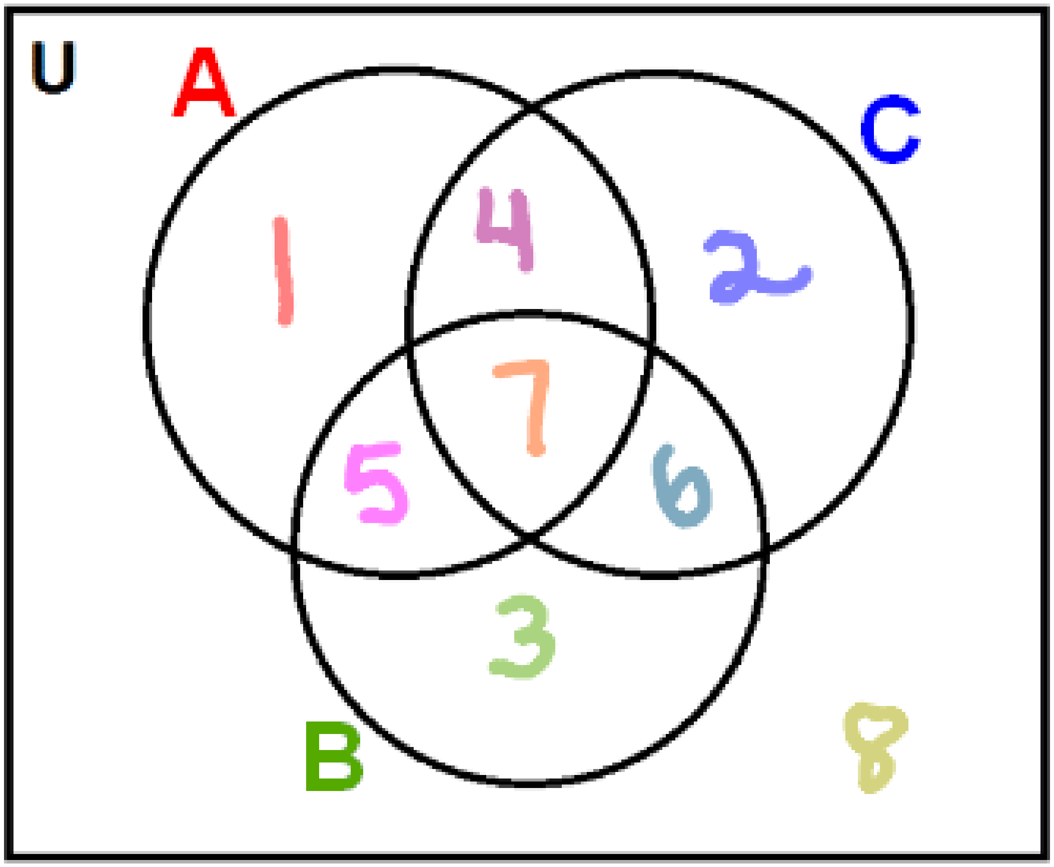
3.4 Applications of Set Theory

Learning Targets - day 1:

1. Understanding what the regions of a 3-set Venn diagram represent.
2. Interpreting information from a 3-set Venn diagram.

A Venn diagram involving **three** non-disjoint sets has a very consistent look:

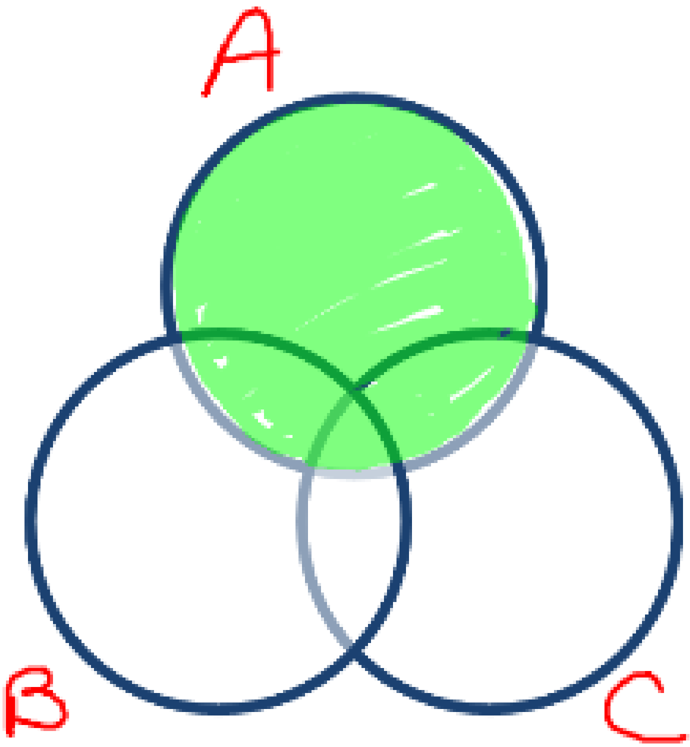


There are **8** main regions that will contain elements.

The following diagrams will illustrate all of the single regions and multiple regions that make up the different sets that we will be referencing in the 3-set Venn diagram.

For the sake of reducing the number of drawings, none of the complements will be illustrated.

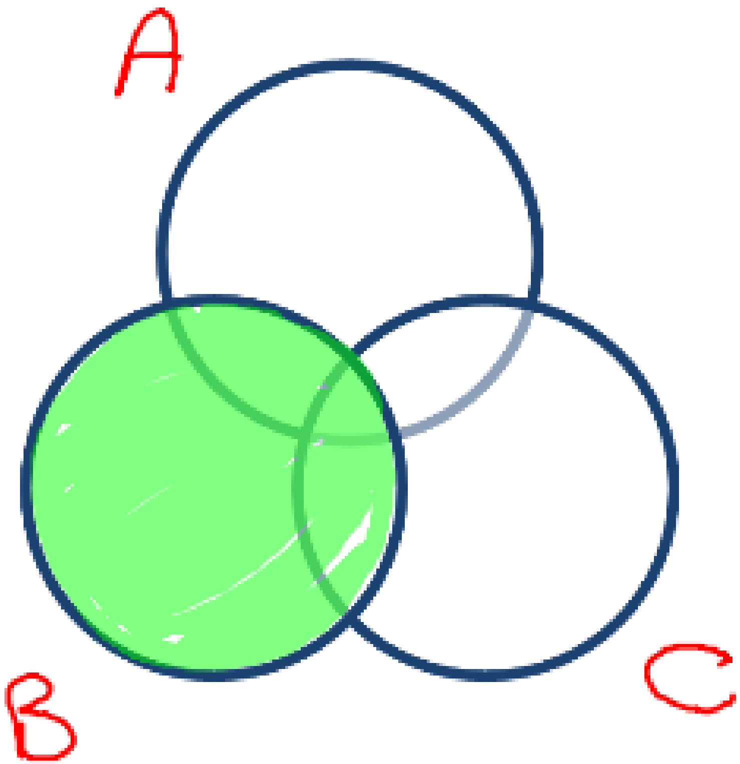
3-Circle Venn diagrams – what do all the regions mean?



Set A

notation: A

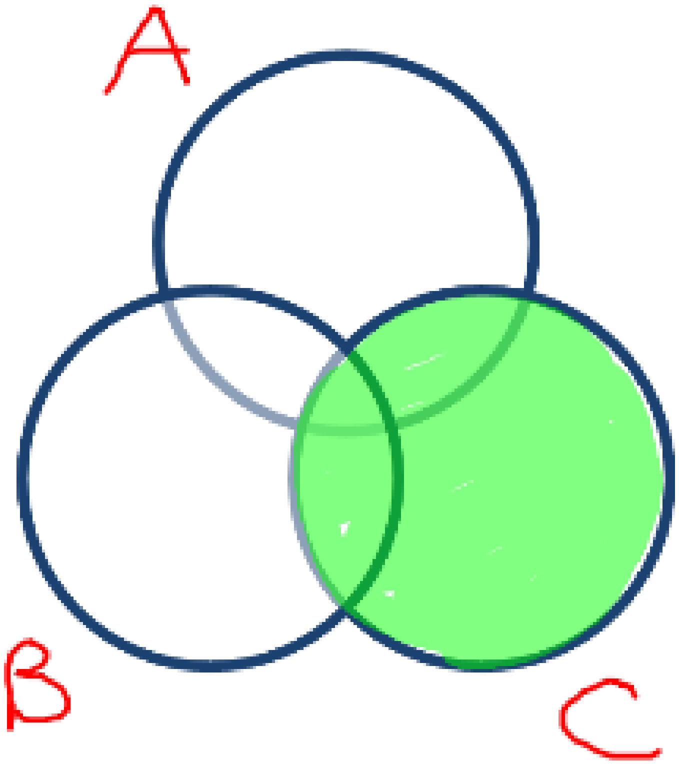
3-Circle Venn diagrams – what do all the regions mean?



Set B

notation: B

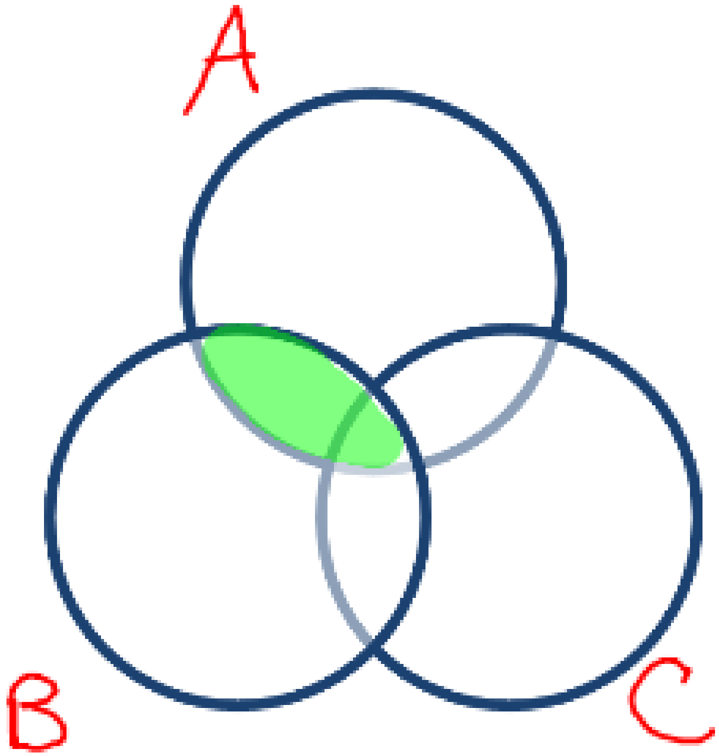
3-Circle Venn diagrams – what do all the regions mean?



Set C

notation: C

3-Circle Venn diagrams – what do all the regions mean?

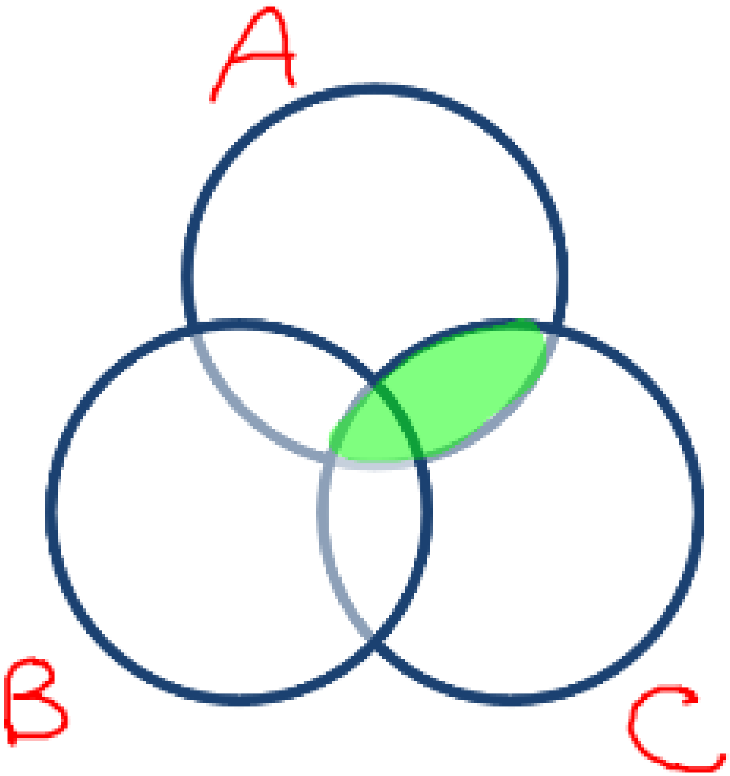


Set A and Set B

(the intersection of the 2 sets)

notation: $A \cap B$

3-Circle Venn diagrams – what do all the regions mean?



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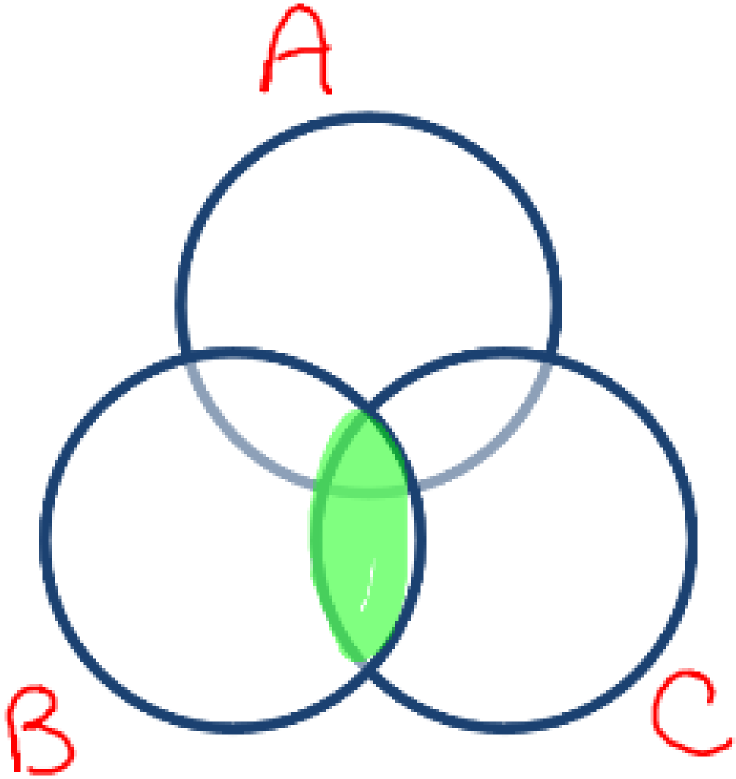
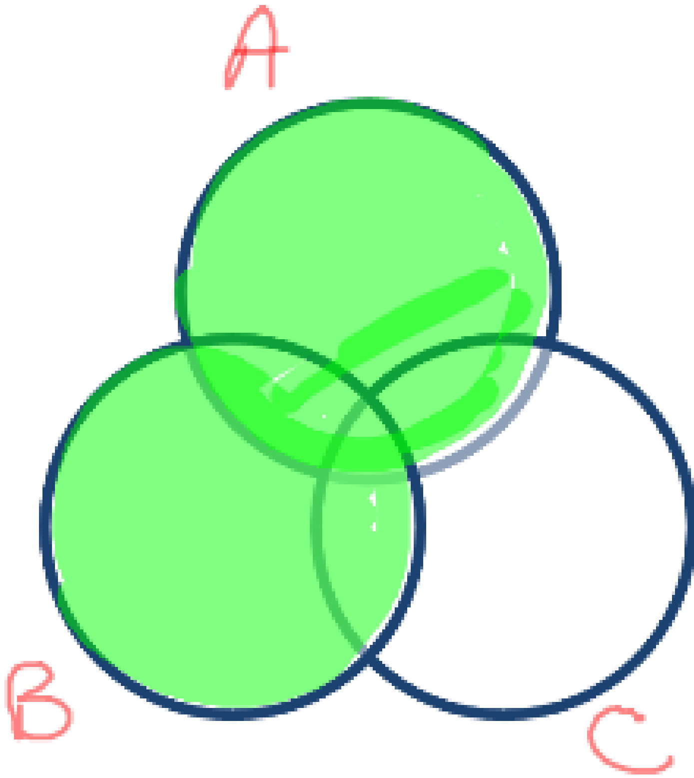


Set B and Set C

(the intersection of the 2 sets)

notation: $B \cap C$

3-Circle Venn diagrams – what do all the regions mean?

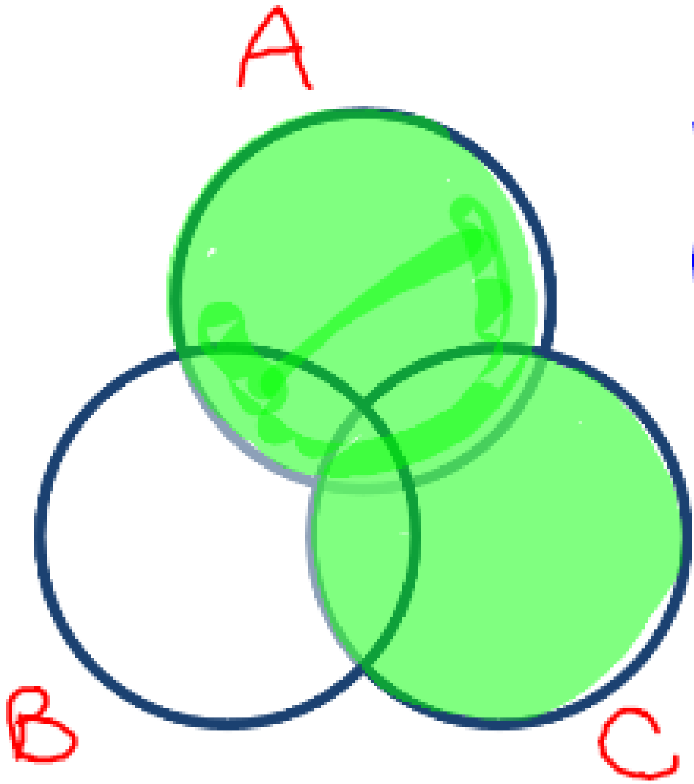


Set A or Set B

(the union of the 2 sets)

notation: $A \cup B$

3-Circle Venn diagrams – what do all the regions mean?

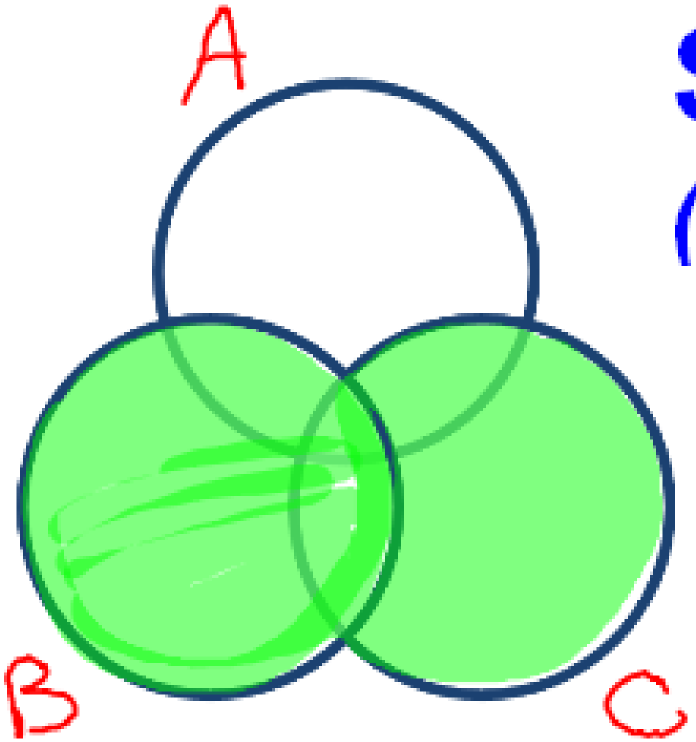


Set A or Set C

(the union of the 2 sets)

notation: A⋃C

3-Circle Venn diagrams – what do all the regions mean?

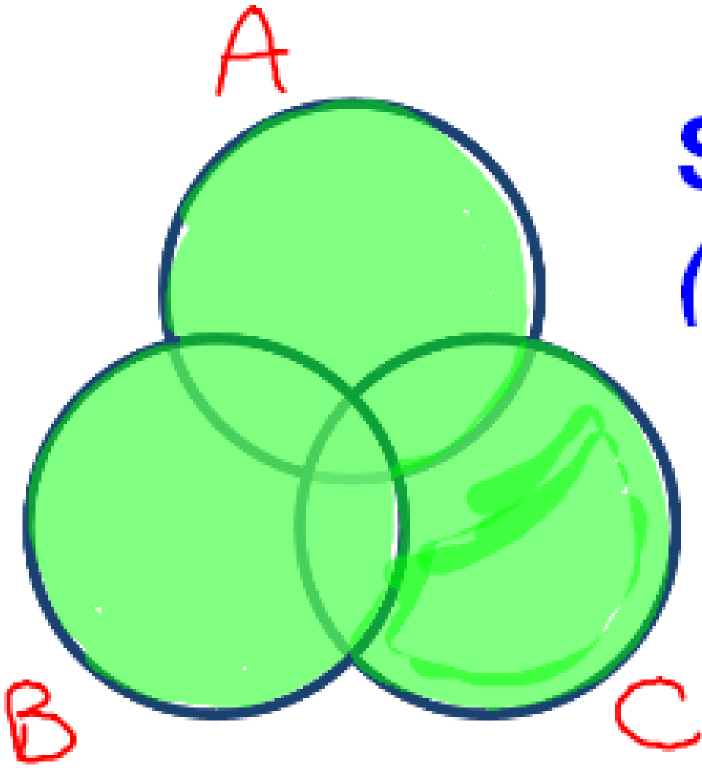


Set B or Set C

(the union of the 2 sets)

notation: $B \cup C$

3-Circle Venn diagrams – what do all the regions mean?

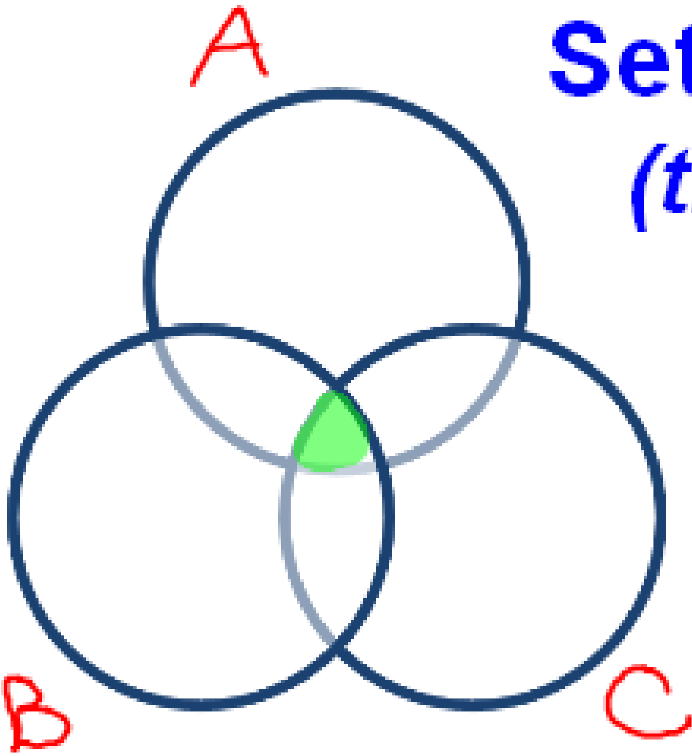


Set A or Set B or Set C

(the union of all 3 sets)

notation: $A \cup B \cup C$

3-Circle Venn diagrams – what do all the regions mean?

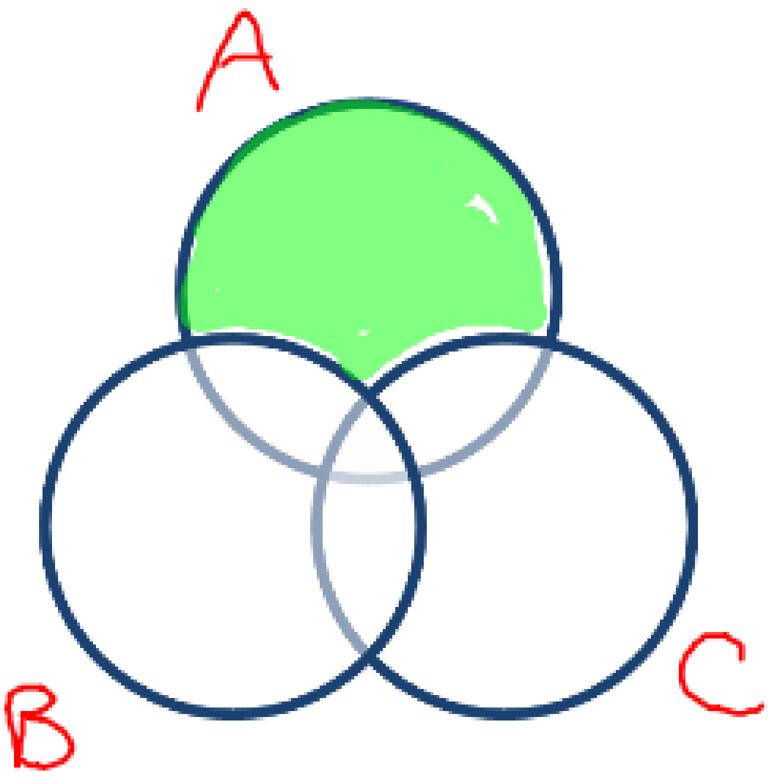


Set A and Set B and Set C

(the intersection of all 3 sets)

notation: $A \cap B \cap C$

3-Circle Venn diagrams – what do all the regions mean?

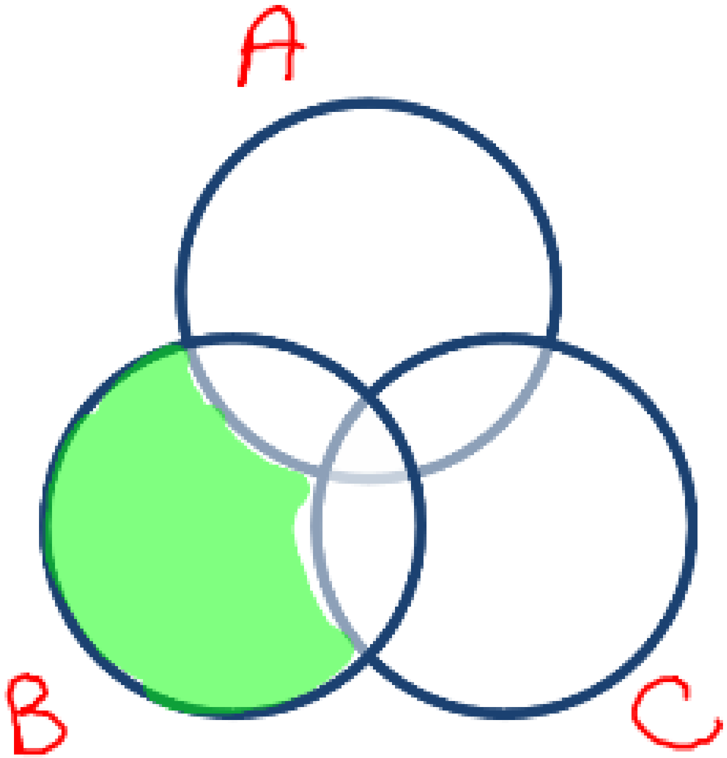


Set A only

"set A but not Set B and not Set C"

notation: A \ B \ C

3-Circle Venn diagrams – what do all the regions mean?

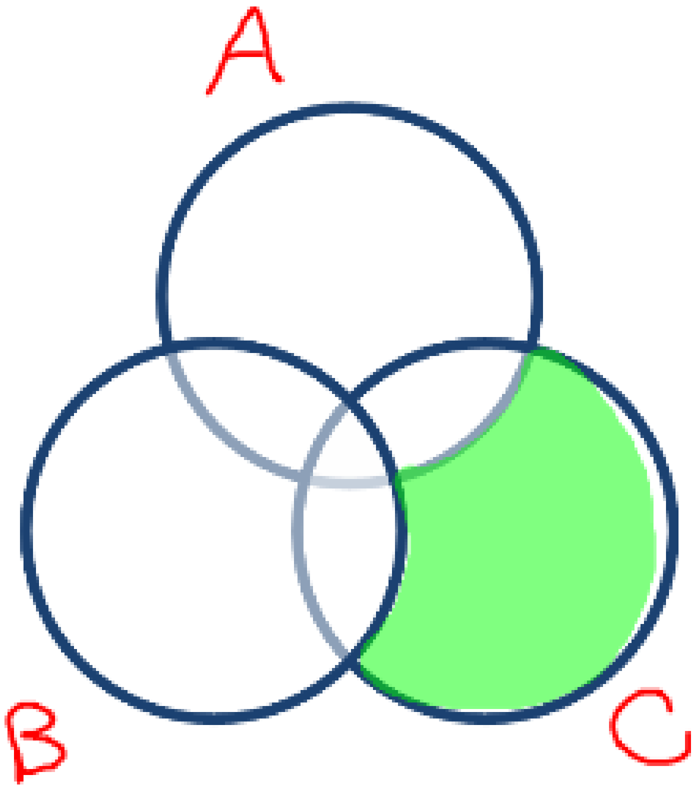


Set B only

"set B but not Set A and not Set C"

notation: B \ A \ C

3-Circle Venn diagrams – what do all the regions mean?

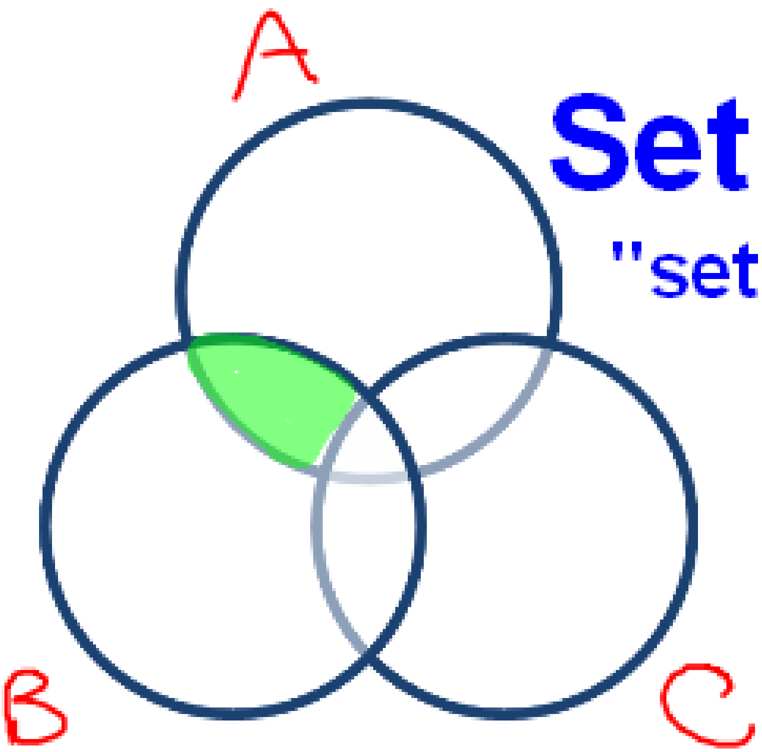


Set C only

"set C but not Set A and not Set B"

notation: C \ A \ B

3-Circle Venn diagrams – what do all the regions mean?

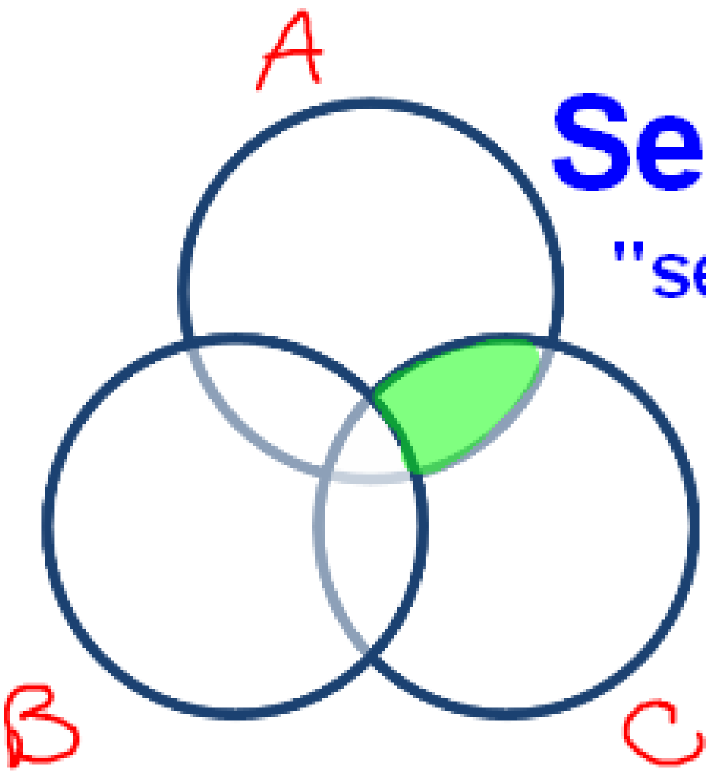


Set A and Set B only

"set A and set B but not set C"

notation: $(A \cap B) \setminus C$

3-Circle Venn diagrams – what do all the regions mean?

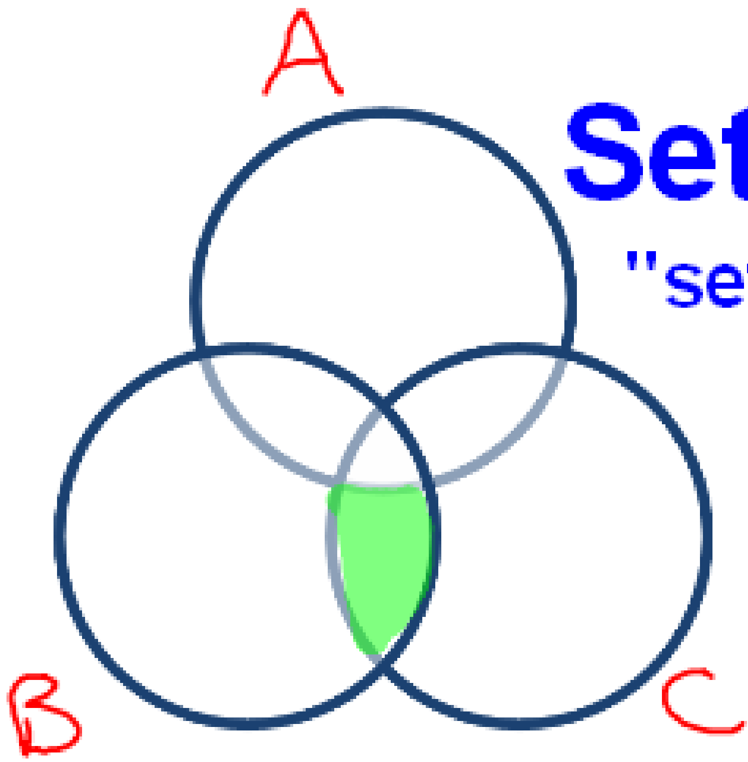


Set A and Set C only

"set A and set C but not set B"

notation: $(A \cap C) \setminus B$

3-Circle Venn diagrams – what do all the regions mean?

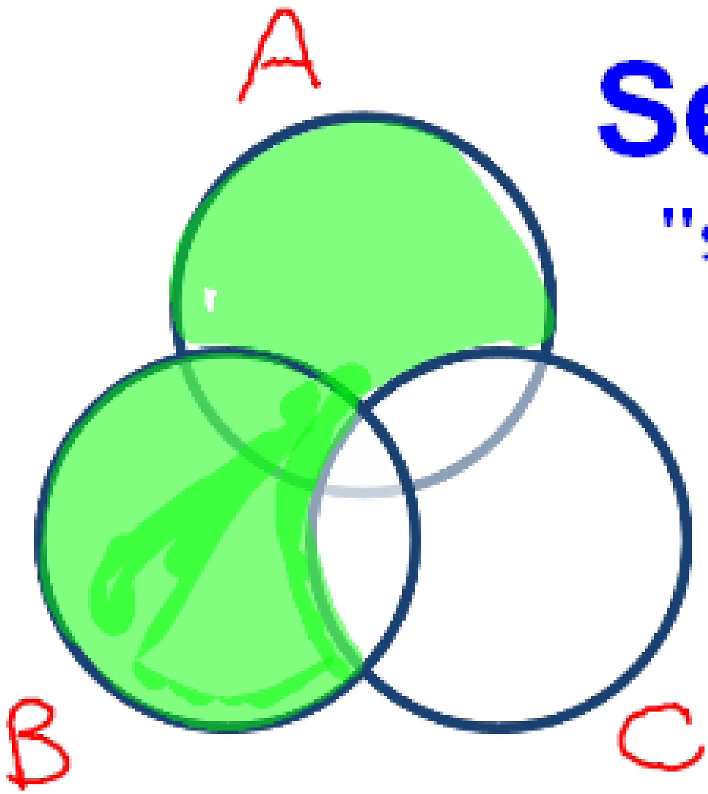


Set B and Set C only

"set B and set C but not set A"

notation: $(B \cap C) \setminus A$

3-Circle Venn diagrams – what do all the regions mean?

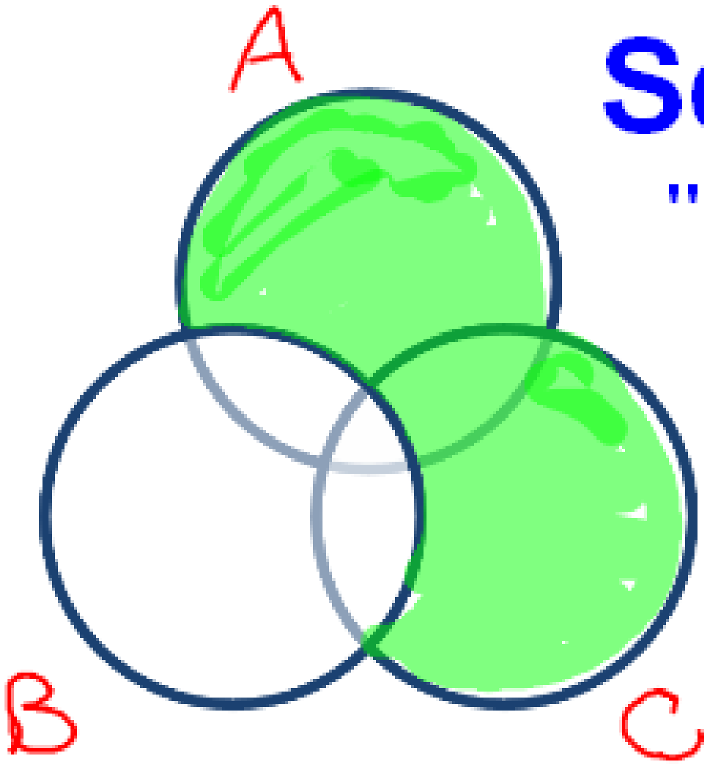


Set A or Set B only

"set A or set B but not set C"

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

3-Circle Venn diagrams – what do all the regions mean?



Set A or Set C only

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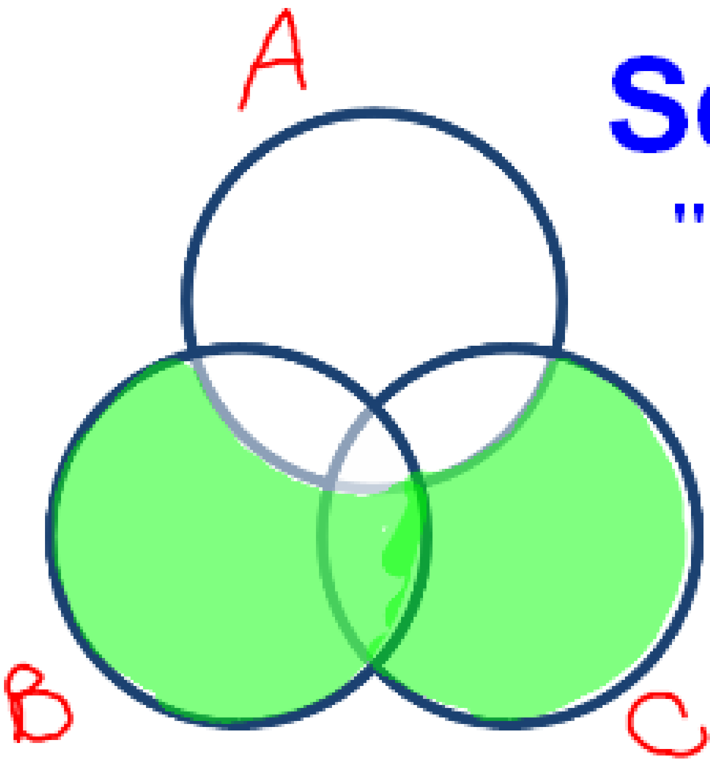
3-Circle Venn diagrams – what do all the regions mean?

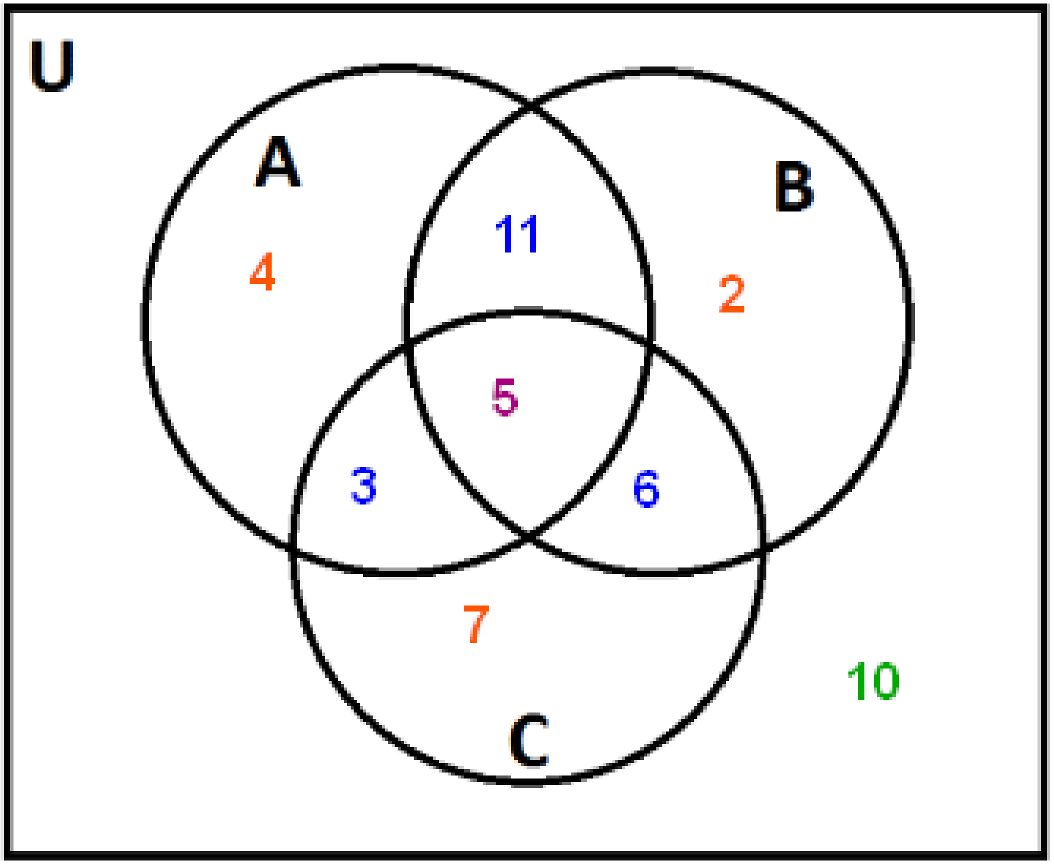


Set B or Set C only

"set B or set C but not set A"

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

Example #1:



n(A) = 23

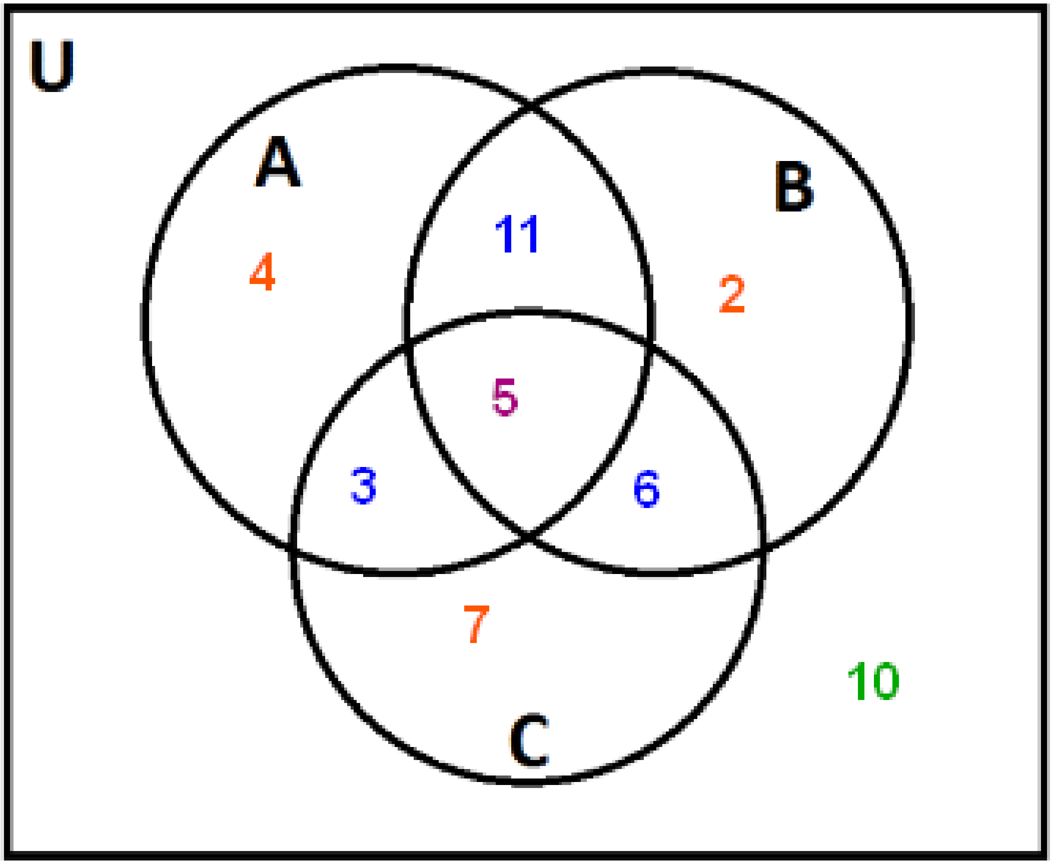
n(B ∪ C) =

n(A ∩ C) =

n(B \ C \ A) =

n(A ∪ B ∪ C) =

Example #1:



$n(A) = 23$

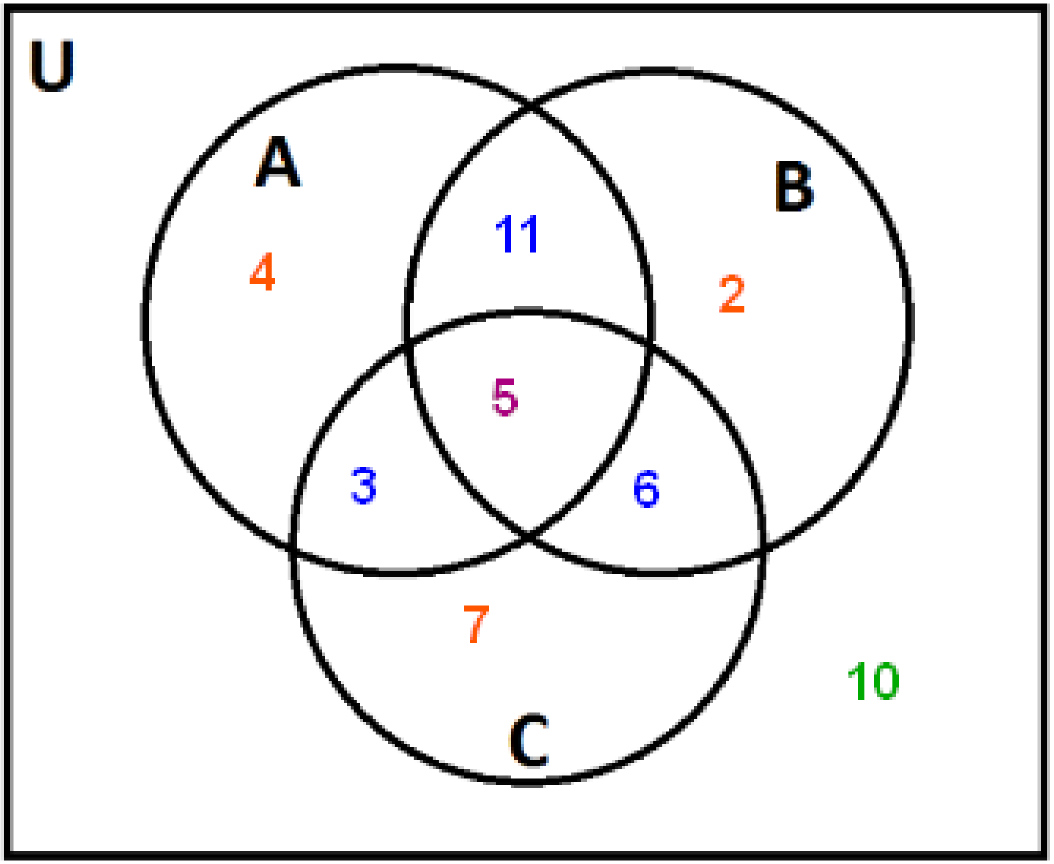
$n(B \cup C) =$

$n(A \cap C) =$

$n(B \cap C \cap A) =$

$n(A \cup B \cup C) =$

Example #1:



n(A) = 23

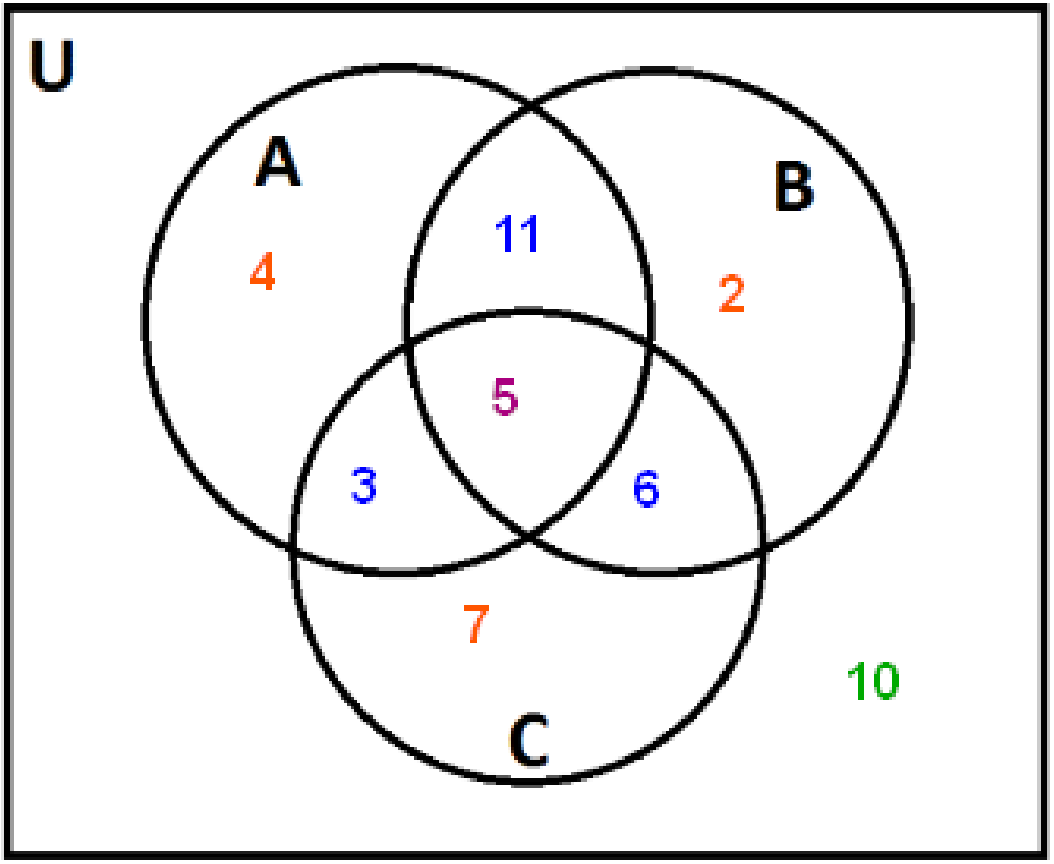
n(B ∪ C) = 34

n(A ∩ C) = 8

n(B \ C \ A) =

n(A ∪ B ∪ C) =

Example #1:



n(A) = 23

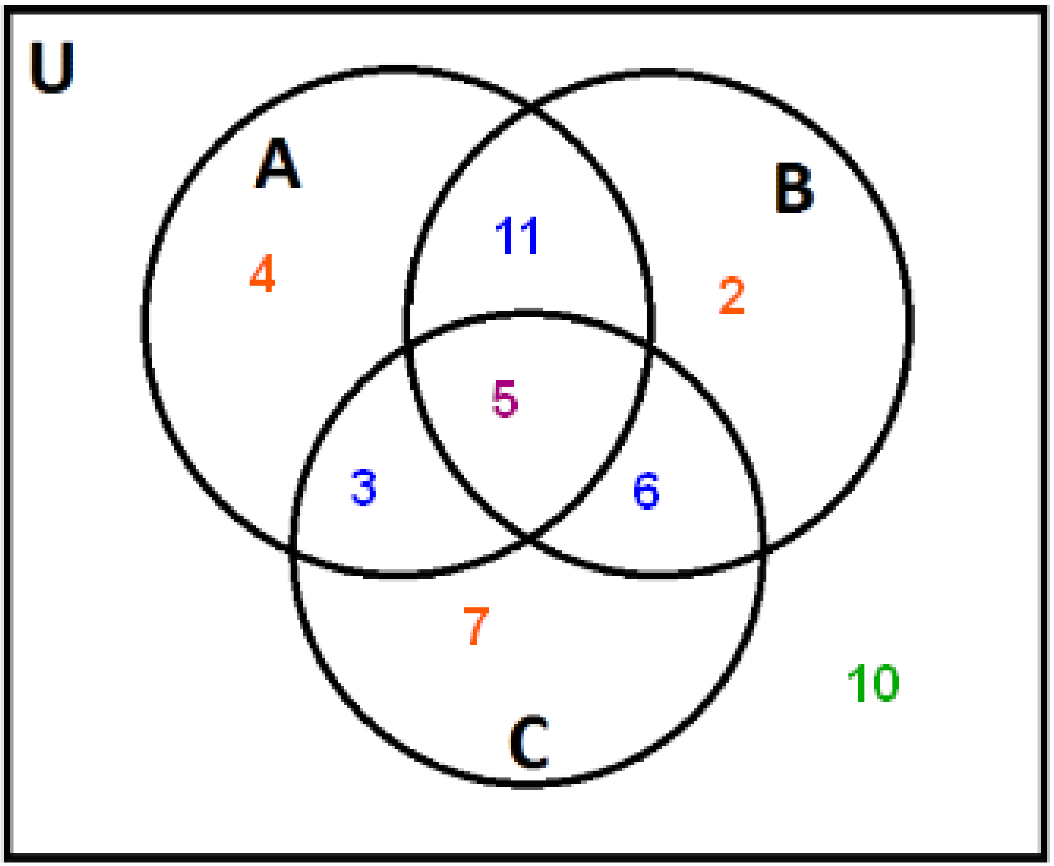
$n(B \cup C) = 34$

$n(A \cap C) = 8$

$n(B \setminus C \setminus A) =$

$n(A \cup B \cup C) =$

Example #1:



$n(A) = 23$

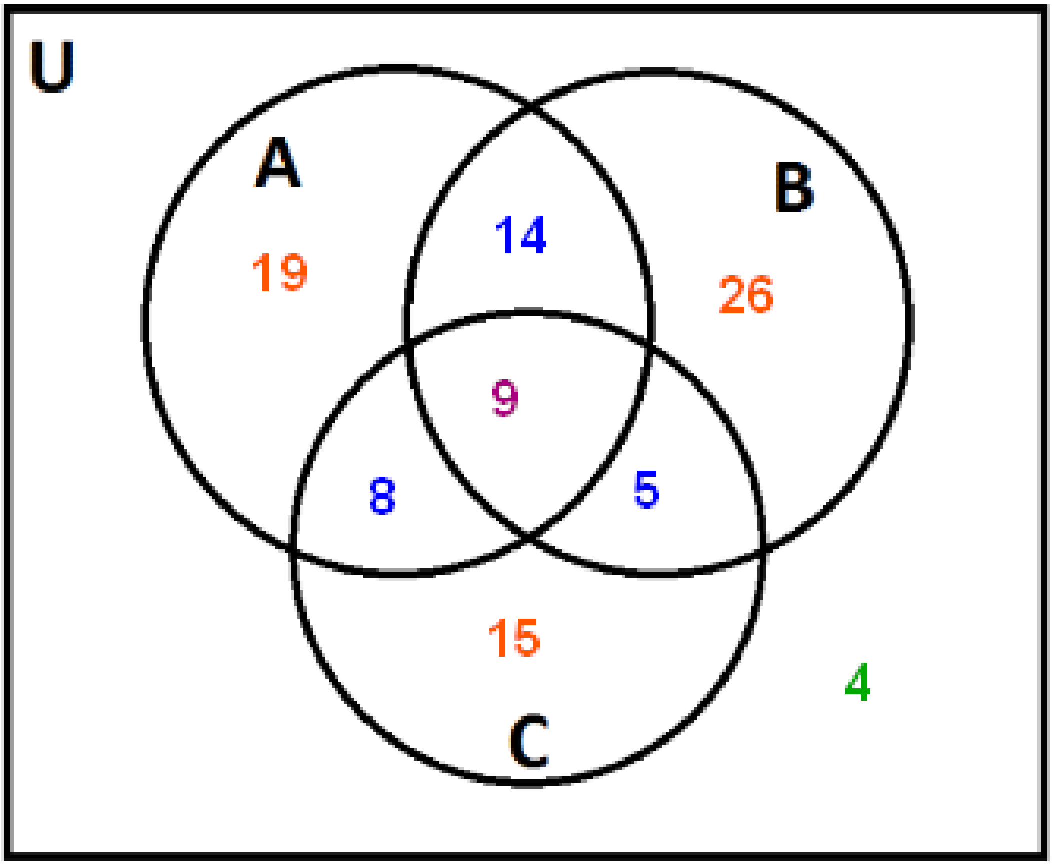
$n(B \cup C) = 34$

$n(A \cap C) = 8$

$n(B \setminus C \setminus A) = 2$

$n(A \cup B \cup C) = 38$

Example #2:



$n(U) =$

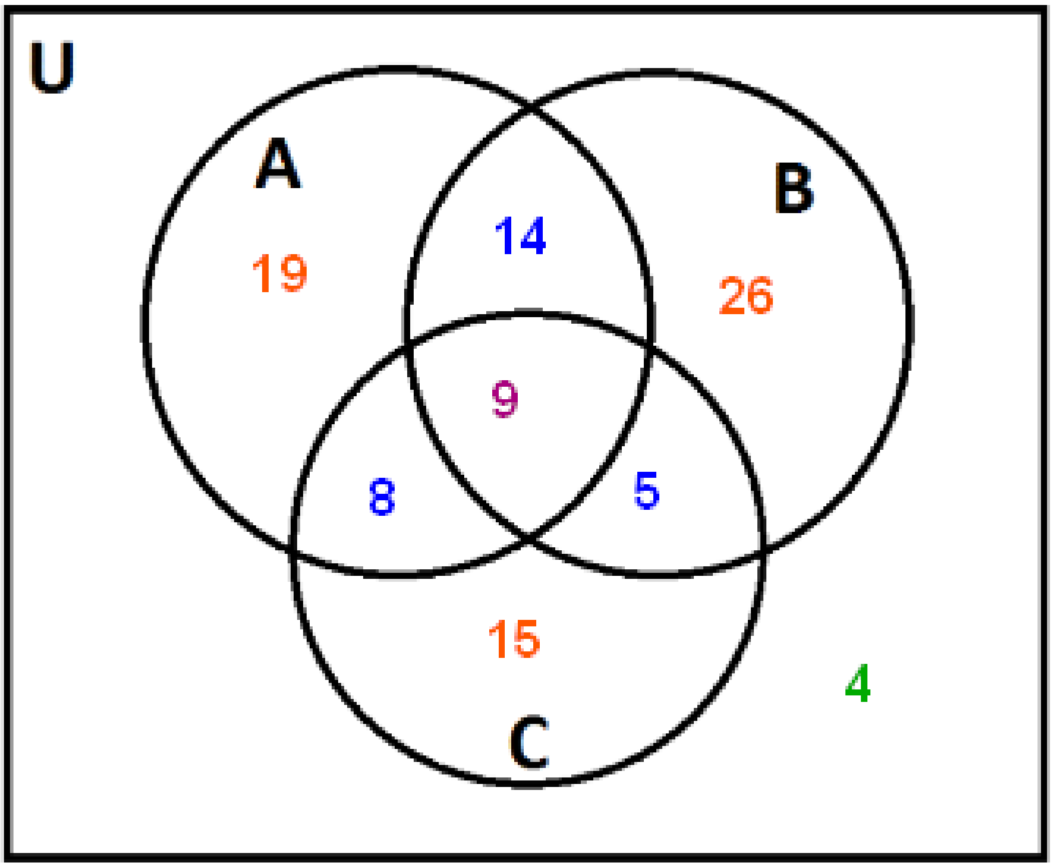
$n[(A \cap B) \setminus C] =$

$n(A \cup B \cup C)' =$

$n(A \cup B \cup C) =$

$n[(B \cup C) \setminus A] =$

Example #2:



$n(U) = 100$

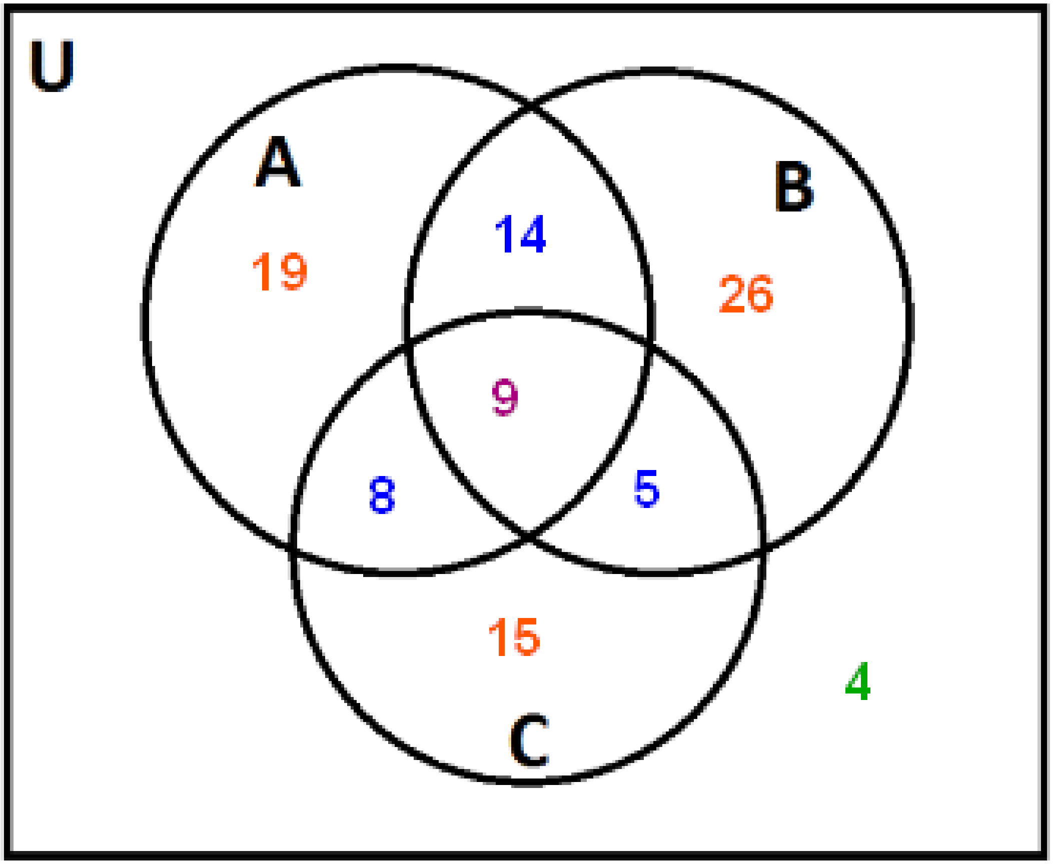
$n[(A \cap B) \setminus C] =$

$n(A \cup B \cup C)' =$

$n(A \cup B \cup C) =$

$n[(B \cup C) \setminus A] =$

Example #2:



$n(U) = 100$

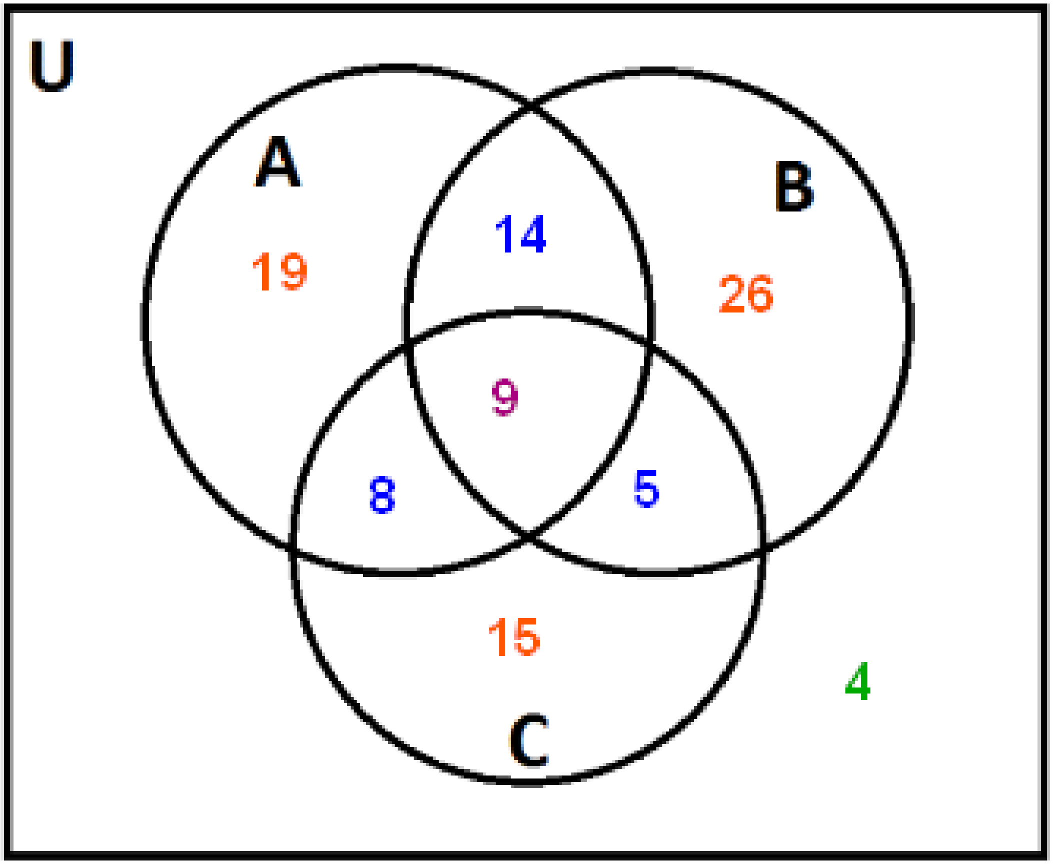
$n[(A \cap B) \setminus C] = 14$

$n(A \cup B \cup C)' =$

$n(A \cup B \cup C) =$

$n[(B \cup C) \setminus A] =$

Example #2:



n(U) = 100

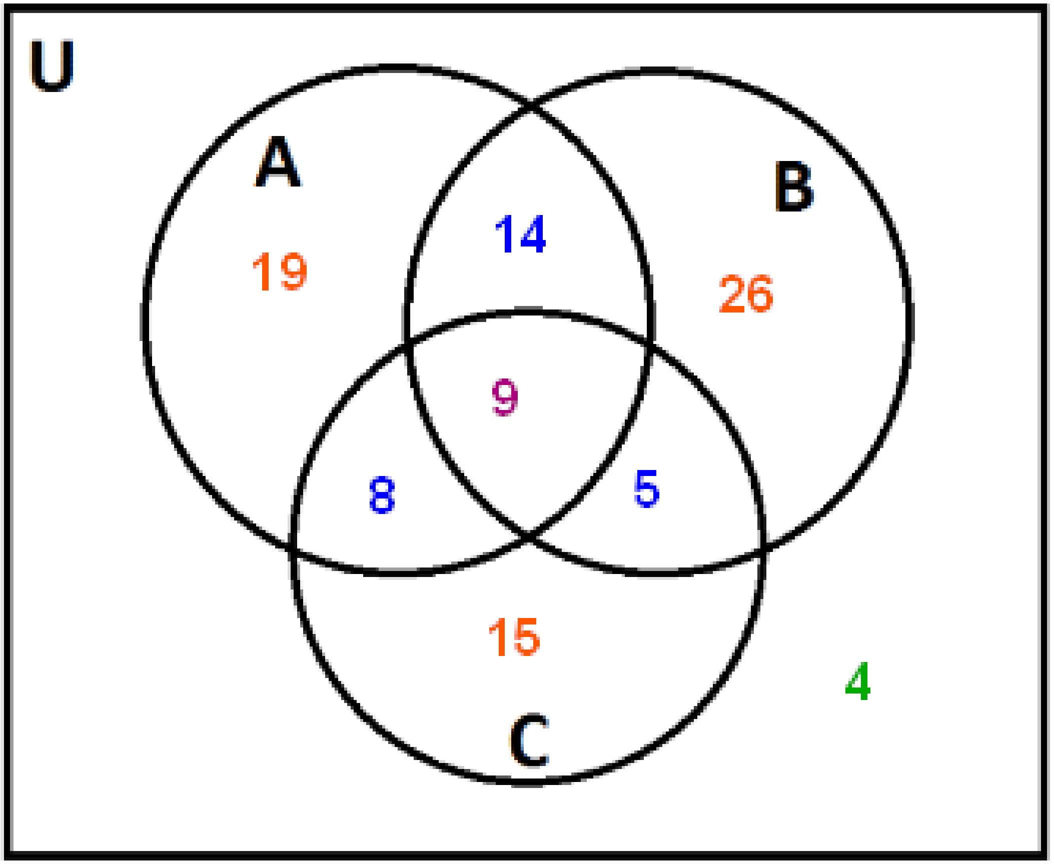
n[(A∩B) \ C] = 14

n(A ∪ B ∪ C)' = 4

n(A∪ B ∪ C) =

n[(B∪ C) \ A] =

Example #2:



$n(U) = 100$

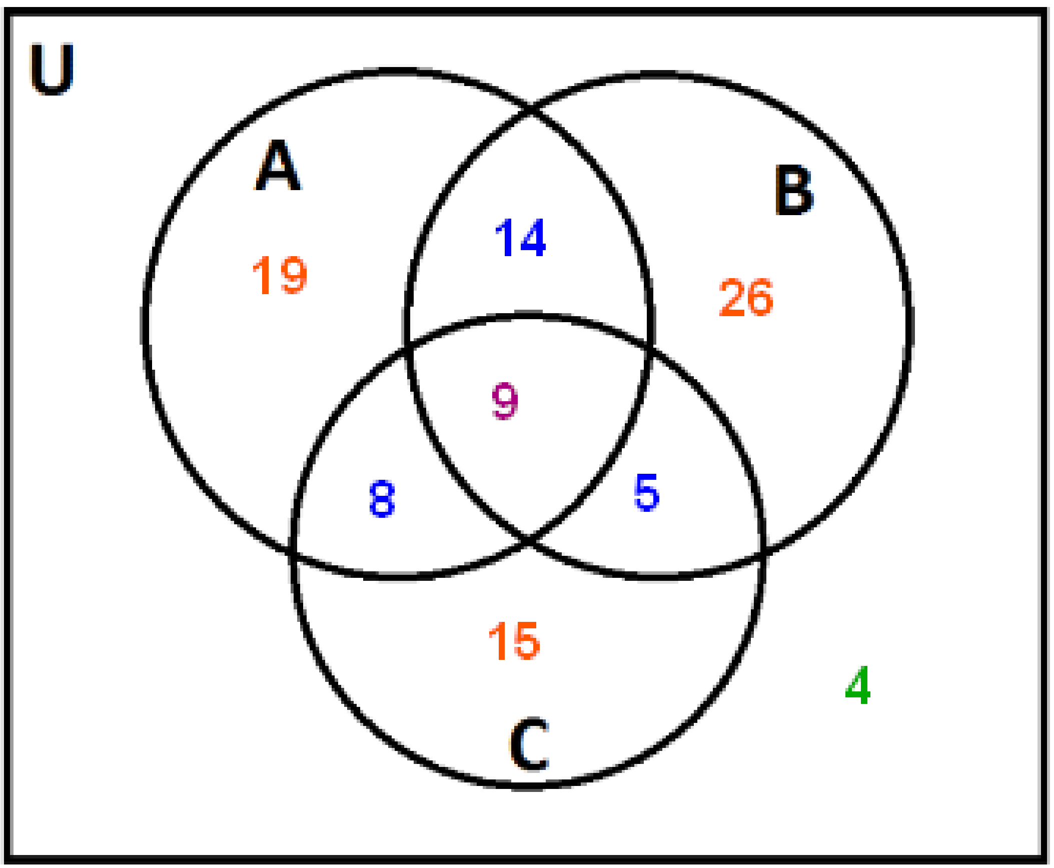
$n[(A \cap B) \setminus C] = 14$

$n(A \cup B \cup C)' = 4$

$n(A \cup B \cup C) =$

$n[(B \cup C) \setminus A] =$

Example #2:



$n(U) = 100$

$n[(A \cap B) \setminus C] = 14$

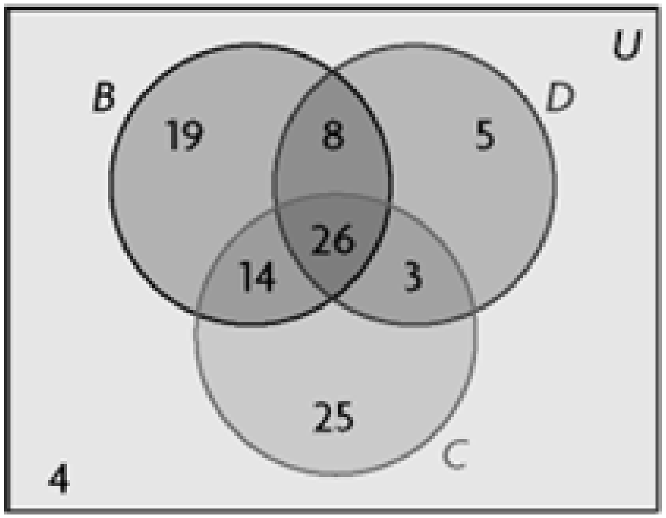
$n(A \cup B \cup C)' = 4$

$n(A \cup B \cup C) = 96$

$n[(B \cup C) \setminus A] =$ 46

Example #3:

Some table games use boards (B), some use cards (C), some use dice (D), and some use a combination of these, while others use none of them.
This Venn diagram illustrates the number of games using these tools.



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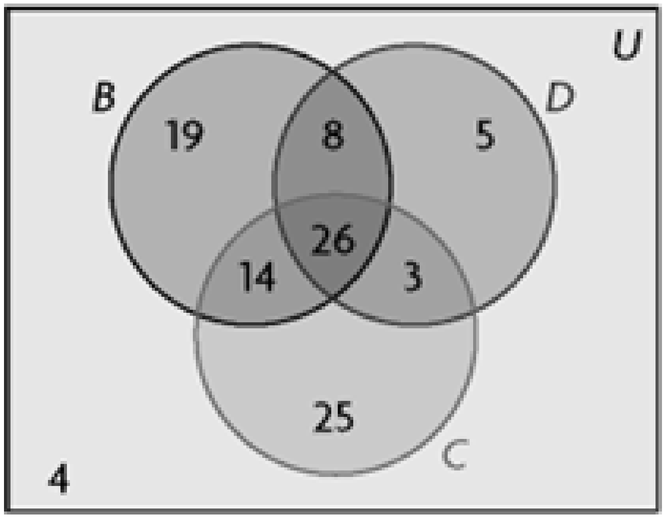

How many of these games use all three of the tools?

$n(B \cap D \cap C) = 26$

Example #3:

Some table games use boards (B), some use cards (C), some use dice (D), and some use a combination of these, while others use none of them.
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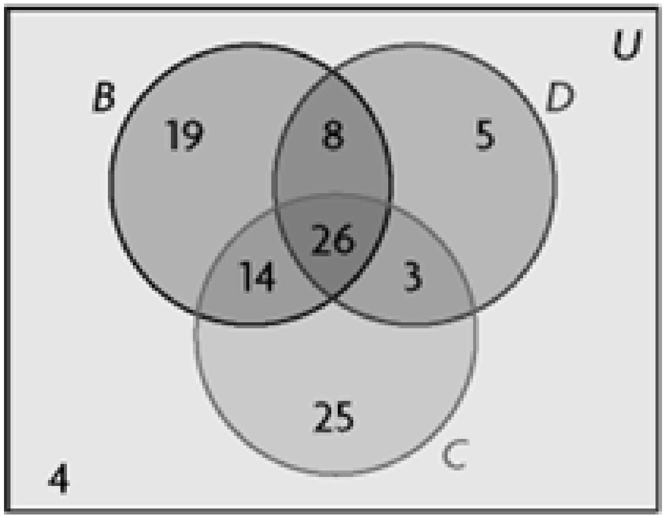

How many of these games use none of the tools?

$n(B \cup D \cup C)' = 4$

Example #3:

Some table games use boards (B), some use cards (C), some use dice (D), and some use a combination of these, while others use none of them.
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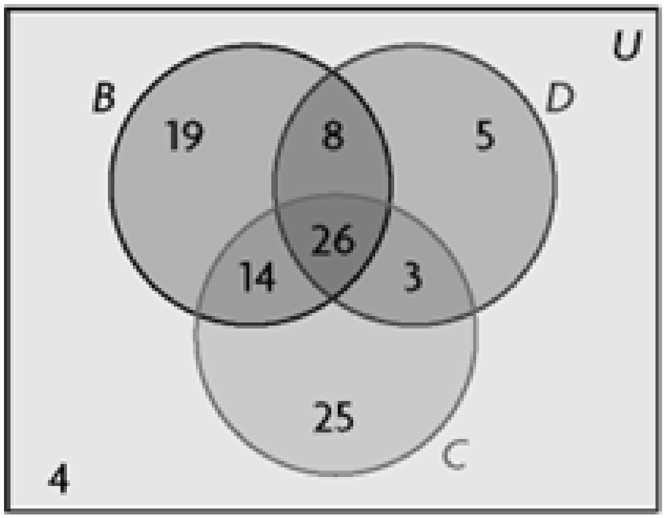

How many of these games use only cards?

$n(C \setminus D \setminus B) = 25$

Example #3:

Some table games use boards (B), some use cards (C), some use dice (D), and some use a combination of these, while others use none of them.
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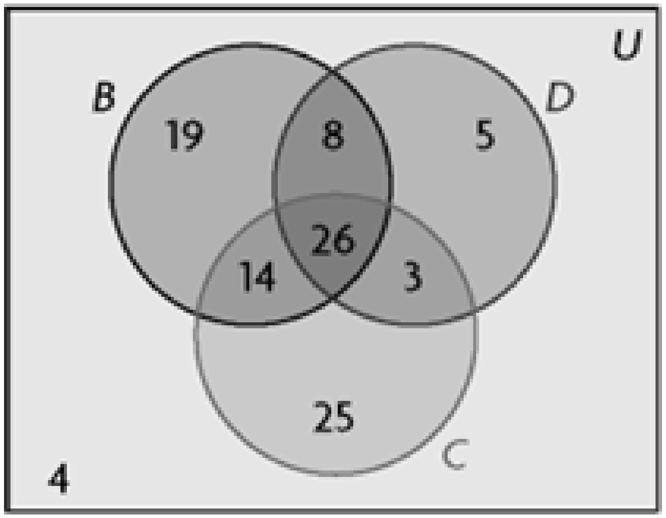
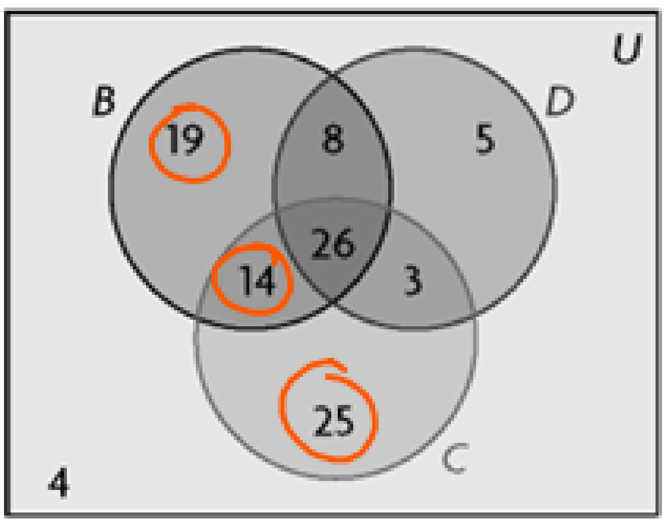


How many of these games use dice and boards but not cards?

$n[(D \cap B) \setminus C] = 8$

Example #3:

Some table games use boards (B), some use cards (C), some use dice (D), and some use a combination of these, while others use none of them.
This Venn diagram illustrates the number of games using these tools.

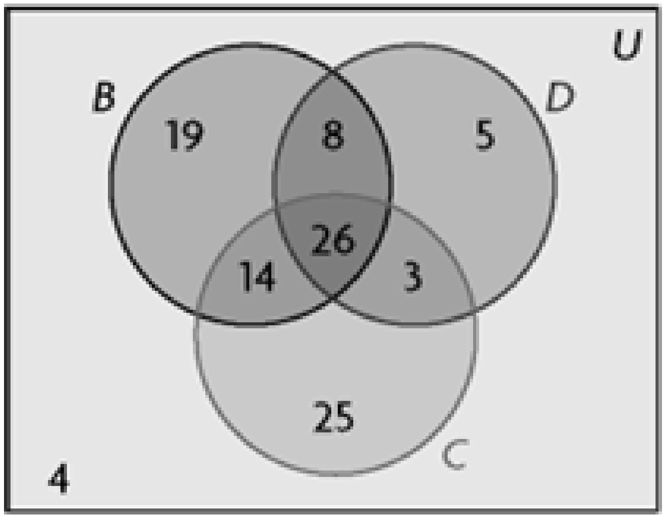


How many of these games use boards or cards but not dice?

$n[(B \cup C) \setminus D] = 58$

Example #3:

Some table games use boards (B), some use cards (C), some use dice (D), and some use a combination of these, while others use none of them.
This Venn diagram illustrates the number of games using these tools.

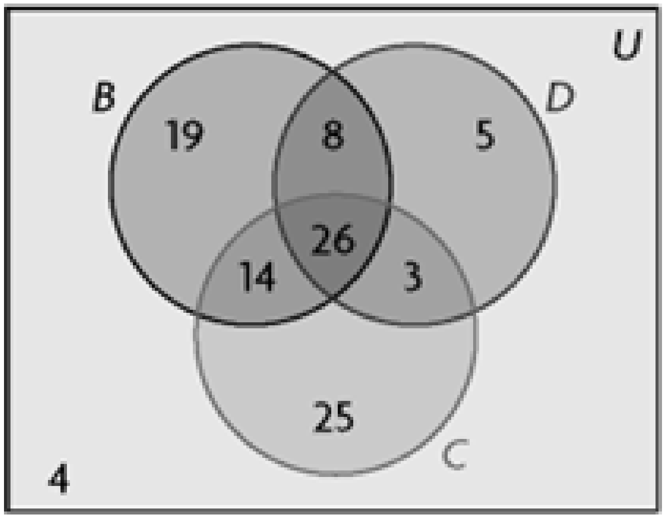


How many of these games do not use boards?

$n(B') = 37$

Example #3:

Some table games use boards (B), some use cards (C), some use dice (D), and some use a combination of these, while others use none of them.
This Venn diagram illustrates the number of games using these tools.

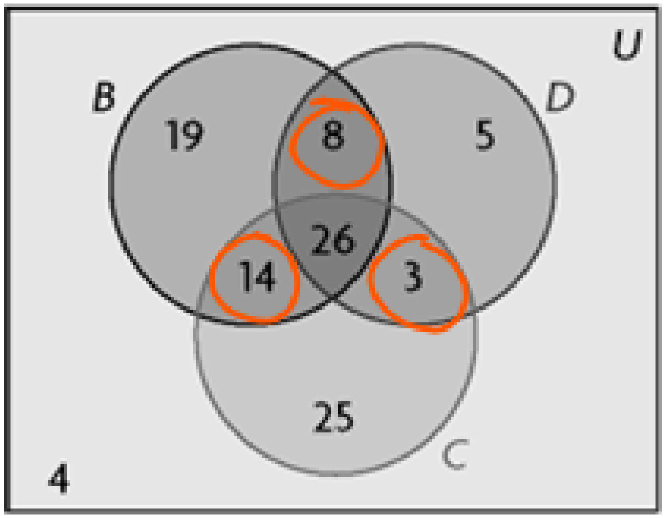


How many of these games do not use dice or cards?

$n(D \cup C)' = 23$

Example #3:

Some table games use boards (B), some use cards (C), some use dice (D), and some use a combination of these, while others use none of them.
This Venn diagram illustrates the number of games using these tools.



How many of these games use any two of the three tools?

25

Check your understanding:

Handout:
#1, 2, 3