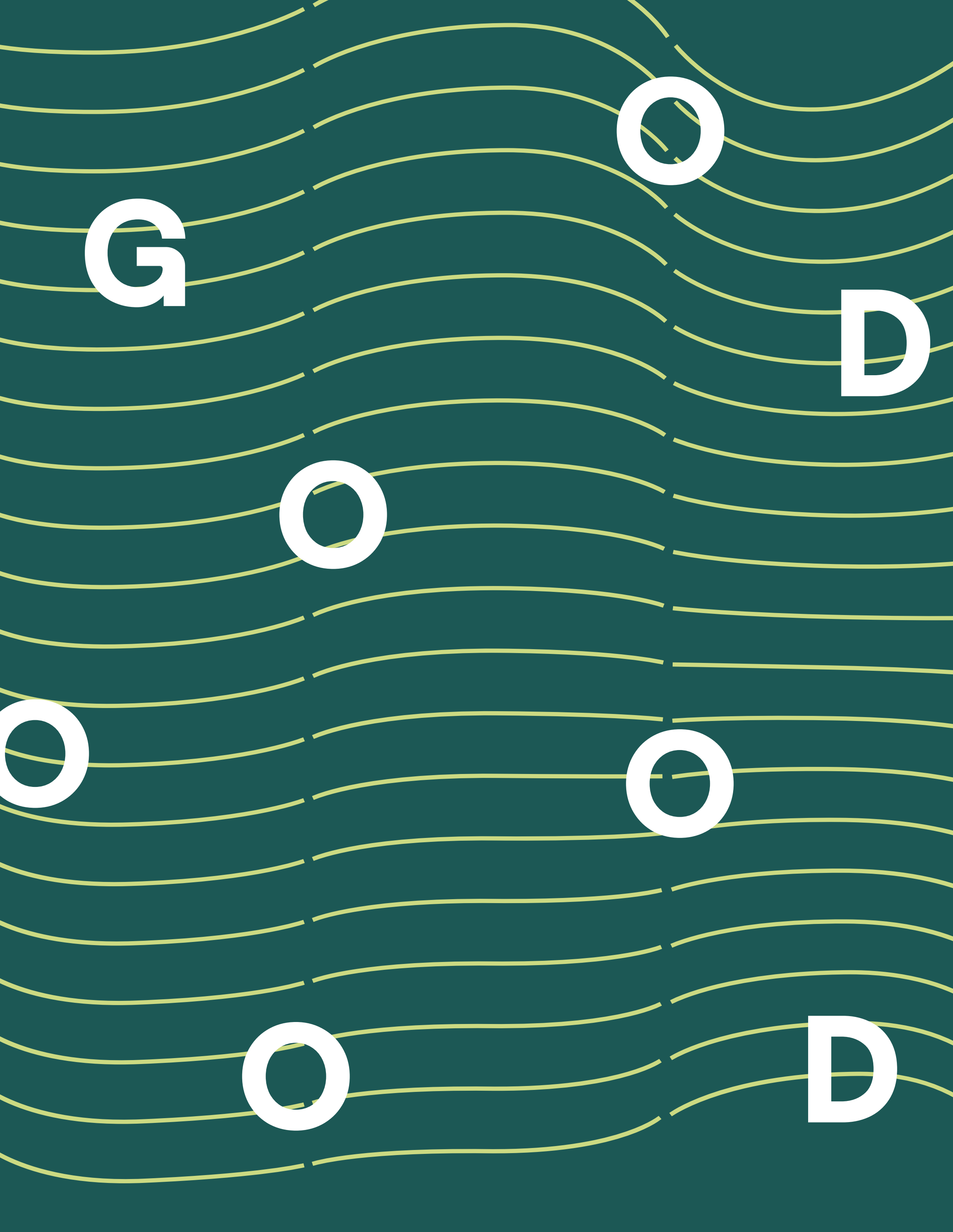

G
O
D
O
O
O
O
D

3) Sets -

* write orders alphabetically, ascending order, increasing order

3.1 Set preliminaries {, }

Set Definition: A set is an unordered collections of objects or members of the set.

A set is said to contain its elements

* usually capital letters of the alphabet

a list

* Roster Method

A = {1, 2, 3, 4}   C = {1, 3, 5}   E = {a, b, c, d ... z}

B = {1, 2, 3}   D = {1, 2, 3, 4, ... 10}   F = {1, 2, 3, 4, 5 ...}

* Rule Method - uses set builder notation
- specify one or more property

G = {x | x is a positive integer less than or equal to 10}

G = {y | y is a counting number less than 11}

starts at 1, used to count

* Rules should be specific

$\in$ $\notin$

Canvas /in /not in

Kunkunyari: insert $\in$ or $\notin$ to complete each statement

1. 3 A $\in$
2. 4 B $\notin$
3. 4 C $\notin$
4. 9 D $\in$
5. u E $\in$

Definition: Equal sets $=$ $\neq$ \ne

Let A and B be sets. A is equal to B, written $A=B$, iff $\forall x\,(x\in A \leftrightarrow x\in B)$

* $p \leftrightarrow q = (p\to q)\wedge(q\to p)$

* $x\in A \leftrightarrow x\in B = (x\in A \to x\in B)\wedge(x\in B \to x\in A)$

Kunkunyari: Insert $=$ or $\neq$ to complete each statement

1. $A \neq B$
2. $D \neq F$
3. $F \neq G$
4. $D = G$
5. $B = \{2,1,3\}$
6. $C = \{1,1,3,3,3,3,5,5,5\}$

* even if you repeat an element, still considered an element
* omit dupes in answers.

Definition: Subset $\subseteq$ \subseteq

Let A and B be sets. A is a subset of B, written $A\subseteq B$ iff

all $\forall x\,(x\in A \to x\in B)$

Kunkunyari: Insert $\subseteq$ or $\not\subseteq$ to complete each statement

1. $B \subseteq A$
2. $A \not\subseteq B$
3. $C \subseteq D$
4. $D \not\subseteq F$
5. $H \subseteq E$
6. $G \subseteq D$
7. $G \not\subseteq \{\}$ no element in G is an empty set
8. $\{\} \subseteq G$
9. $H \subseteq H$

Definition: The empty set \emptyset

The empty set or null set, denoted by $\emptyset$ or $\{\}$, is the set with no elements.

$I = \{x \mid x^2+7=-5\}$ does not satisfy property /set

Definition: Singleton Set

A singleton set is a set containing one element

Theorem:

If S is any set, then (i) $\emptyset \subseteq S$ and (ii) $S \subseteq S$

Definition: Proper subset $\subset$ \subset \not subset

Let A and B be sets. A is a proper subset of B, written $A \subset B$, iff

$\forall x (x \in A \rightarrow x \in B) \cap \exists x (x \in B \wedge x \notin A)$

Kunkunyari: $\subset$ or $\not\subset$ to complete each statement.

1. $B \subset A$
2. $C \subset D$
3. $F \not\subset D$
4. $G \not\subset G$
5. $H \not\subset \{\}$
6. $\{\} \subset H$

$U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$A = \{0, 1, 2, 3, 4, 5\}$

$B = \{6, 7, 8, 9, 10\}$

$C = \{0, 2, 4, 6, 8, 10\}$

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

$E = \{0, 1, 4, 5, 8, 9\}$

$F = \{3, 4, 5, 6, 7\}$

Union

Given two sets A and B, the union of A and B, denoted by $A \cup B$, is defined as

$$A \cup B = \{x \mid (x \in A) \vee (x \in B)\}$$

x such that x is an element of set A or set B

Ex. 1. $A \cup B$

$A = \{0, 1, 2, 3, 4, 5\}$

$B = \{6, 7, 8, 9, 10\}$

$A \cup B = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} = U$

3. $B \cup C$

$B = \{6, 7, 8, 9, 10\}$

$C = \{0, 2, 4, 6, 8, 10\}$

$B \cup C = \{0, 2, 4, 6, 7, 8, 9, 10\}$

Observations

$A \cup B = B \cup A$, $A \cap D = D \cap A$ } Commutativity

$A \cap (A \cup B) = A$, $A \cup (A \cap B) = A$ } Absorption

$A \cup \emptyset = A$, $A \cap U = A$ } Identity

$\overline{(\overline{B})} = B$ → Complimentation

$\overline{E \cap F} = \overline{E} \cup \overline{F}$ → De Morgan's Laws intersection

Given two sets A and B, the intersection of A and B, denoted by $A \cap B$, is defined as

$$A \cap B = \{x \mid (x \in A) \wedge (x \in B)\}$$

x such that x is an element of set A and set B

Ex.

1. $A \cap D$

$A = \{0, 1, 2, 3, 4, 5\}$

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

$A \cap D = \{1, 3, 5\}$

2. $D \cap A$

$A = \{0, 1, 2, 3, 4, 5\}$

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

$D \cap A = \{1, 3, 5\}$

3. $A \cap B$

$A = \{0, 1, 2, 3, 4, 5\}$

$B = \{6, 7, 8, 9, 10\}$

$A \cap B = \{\ \}$ or $\varnothing$

* $\{\ \} / \varnothing$ = disjoint sets

3. $A \cap (A \cup B)$

$A = \{0, 1, 2, 3, 4, 5\}$

$B = \{6, 7, 8, 9, 10\}$

$A \cap (A \cup B) = \{0, 1, 2, 3, 4, 5\} = A$

5. $A \cup (A \cap B)$

$A = \{0, 1, 2, 3, 4, 5\}$

$B = \{6, 7, 8, 9, 10\}$

$A \cup (A \cap B) = \{0, 1, 2, 3, 4, 5\} = A$

6. $A \cap U$

$U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$A = \{0, 1, 2, 3, 4, 5\}$

$A \cap U = \{0, 1, 2, 3, 4, 5\} = A$

Difference (Relative Complement)

Given two sets A and B, the difference of A and B, denoted by $A - B$, is defined as

$$A - B = \{x \mid (x \in A) \land (x \notin B)\}$$

x such that x is an element of A but not an element of b

The difference of A and B is also called the (relative) complement of B with respect to A.

1. $A - C$

$A = \{0,1,2,3,4,5\}$

$C = \{0,2,4,6,8,10\}$

$A - C = \{1,3,5\}$

2. $C - A$

$A = \{0,1,2,3,4,5\}$

$C = \{0,2,4,6,8,10\}$

$C - A = \{6,8,10\}$

3. $D - F$

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

$F = \{3,4,5,6,7\}$

$D - F = \{1,9\}$

4. $(D \cap F) - B$

$B = \{6,7,8,9,10\}$

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

$F = \{3,4,5,6,7\}$

$D \cap F = \{3,5,7\}$

$(D \cap F) - B = \{3,5\}$

5. $(A - D) \cap E$

$A = \{0,1,2,3,4,5\}$

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

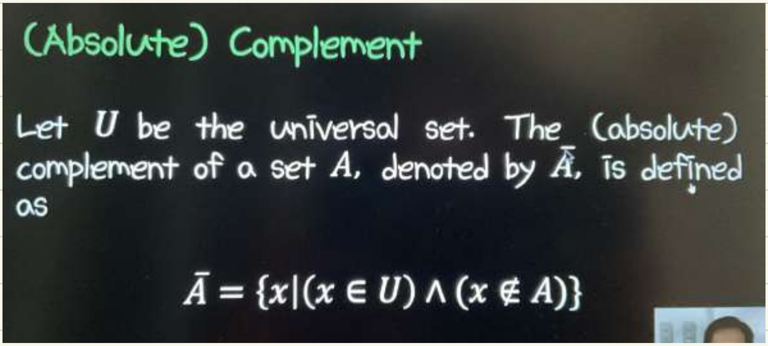
$E = \{0,1,4,5,8,9\}$

dapat ganito palagi pag nagsosolve

$(A-D) \cap E = (\{0,1,2,3,4,5\} - \{1,3,5,7,9\}) \cap \{0,1,4,5,8,9\}$

$= \{0,2,4\} \cap \{0,1,4,5,8,9\}$

$= \{0,4\}$



set of all x such that x is an element of U and x is not in A

Ex.

1. $\bar{A}$

$U = \{0,1,2,3,4,5,6,7,8,9,10\}$

$A = \{0,1,2,3,4,5\}$

$\bar{A} = \{6,7,8,9,10\}$

2. $\overline{(\bar{B})}$

$U = \{0,1,2,3,4,5,6,7,8,9,10\}$

$B = \{6,7,8,9,10\}$

$\overline{(\bar{B})} = \overline{\overline{\{6,7,8,9,10\}}}$

$= \overline{\{0,1,2,3,4,5\}}$

$\overline{(\bar{B})} = \{6,7,8,9,10\} = B$

3. $\bar{E} \cup \bar{F}$

$U = \{0,1,2,3,4,5,6,7,8,9,10\}$

$E = \{0,1,4,5,8,9\}$

$F = \{3,4,5,6,7\}$

$\bar{E} \cup \bar{F} = \overline{\{0,1,4,5,8,9\}} \cup \overline{\{3,4,5,6,7\}}$

$= \{2,3,6,7,10\} \cup \{0,1,2,8,9,10\}$

$= \{0,1,2,3,6,7,8,9,10\}$

4. $\overline{E \cap F}$

$U = \{0,1,2,3,4,5,6,7,8,9,10\}$

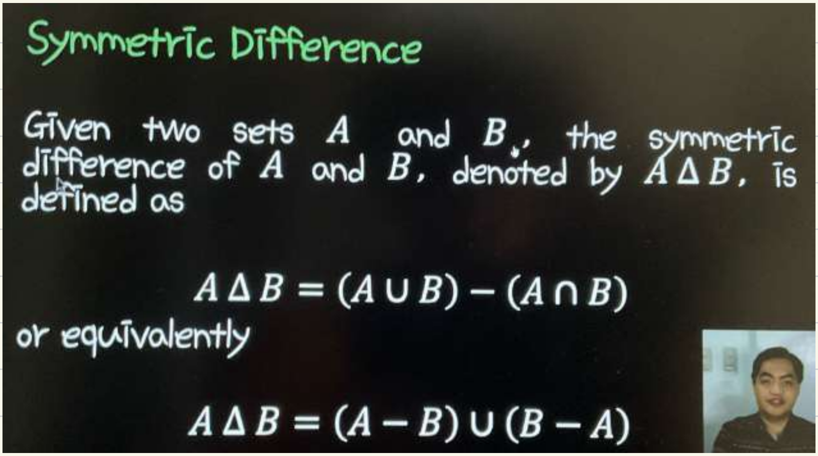
$E = \{0,1,4,5,8,9\}$

$F = \{3,4,5,6,7\}$

$\overline{E \cap F} = \overline{\{0,1,4,5,8,9\} \cap \{3,4,5,6,7\}}$

$= \overline{\{4,5\}}$

$= \{0,1,2,3,6,7,8,9,10\} = \bar{E} \cup \bar{F}$



Ex.

1. $D \Delta F$

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

$F = \{3,4,5,6,7\}$

$D \Delta F = (D \cup F) - (D \cap F)$

$= (\{1,3,5,7,9\} \cup \{3,4,5,6,7\}) - (\{1,3,5,7,9\} \cap \{3,4,5,6,7\})$

$= \{1,3,4,5,6,7,9\} - \{3,5,7\}$

$= \{1,4,6,9\}$

2. $A \Delta C$

$A = \{0,1,2,3,4,5\}$

$C = \{0,2,4,6,8,10\}$

$A \Delta C = (\{0,1,2,3,4,5\} - \{0,2,4,6,8,10\}) \cup (\{0,2,4,6,8,10\} - \{0,1,2,3,4,5\})$

$= \{1,3,5\} \cup \{6,8,10\}$

$= \{1,3,5,6,8,10\}$

3.

0, 1, 2, 8, 9, 10

0, 1, 8, 9

3, 5, 7 ∪ 0, 8

$4 (A \cup \bar{C}) \cap (\overline{E \Delta D})$

1, 3, 5, 7, 9

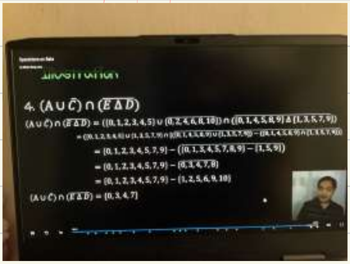
0, 1, 2, 3, 4, 5, 7, 9

1, 2, 3, 9

0, 4, 8 $\cup$, 3, 7

0, 4, 8, 3, 7

1, 2, 5, 6, 9, 10



3.3 - Venn Diagram

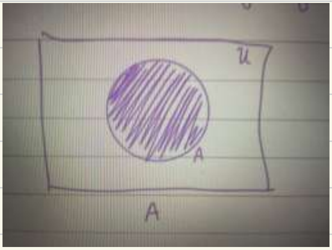
↳ John venn

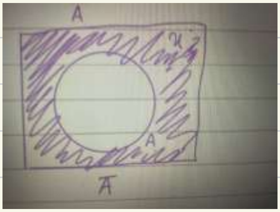
↳ graphical tool that helps us understand set

Illustration

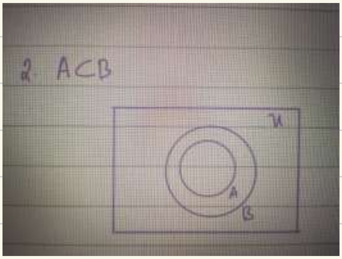
1. A

$\bar{A}$



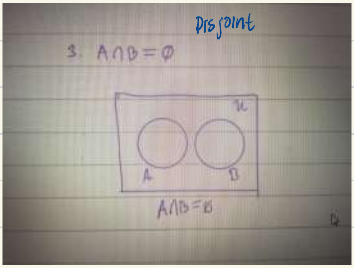


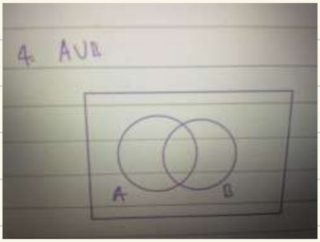
A subset B

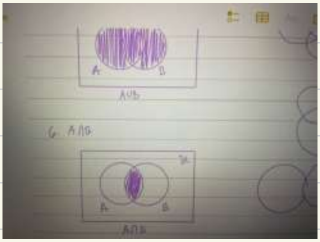


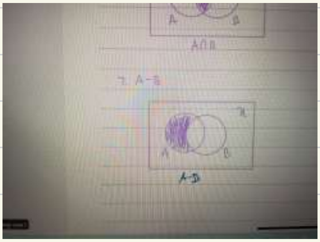
* intersection

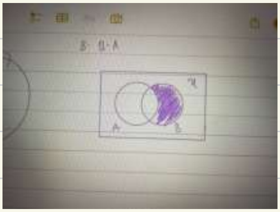
Disjoint









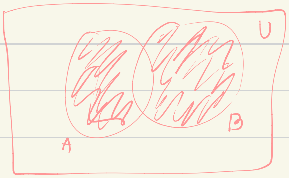


Delta

9. $A \Delta B$

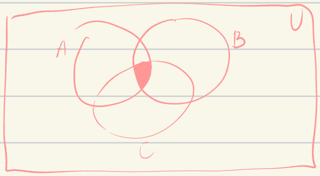
$A \Delta B = (A - B) \cup (B - A)$

$A \Delta B = (A \cup B) - (A \cap B)$

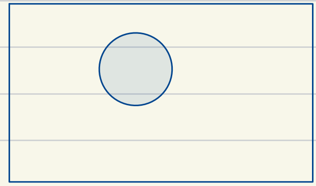


$A \Delta B$

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



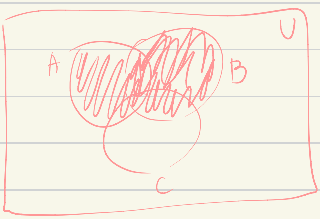
$A \cap (B \cup C)$



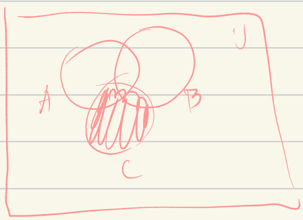
Carbonel, Radaç Daryll A.

CC9-1C

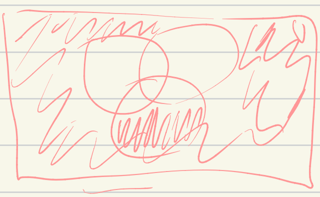
11. $\overline{A \cup B} \cap C$



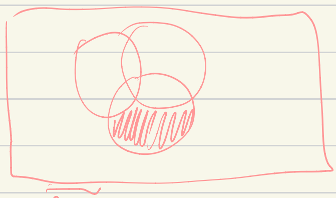
$A \cup B$



C



$\overline{A \cup B}$

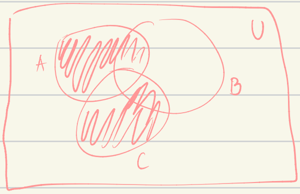


$\overline{A \cup B} \cap C$

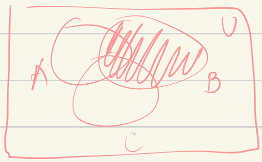
Carbonel, Radge Daryll A.

CC9-1C

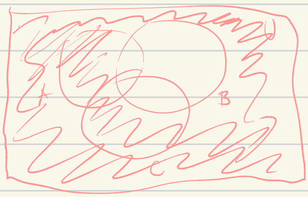
12. $(A \Delta C) - \overline{B}$



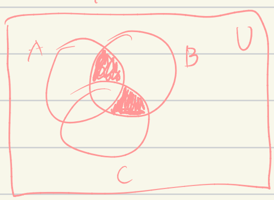
$A \Delta C$



B

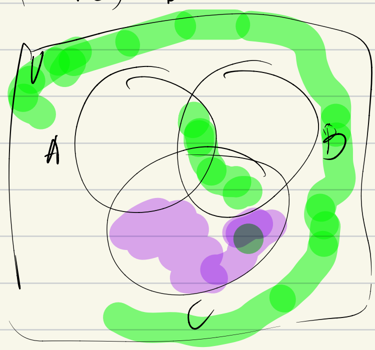


$\overline{B}$

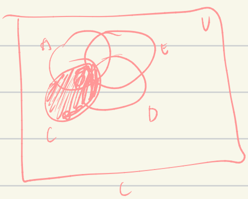


$(A \Delta C) - \overline{B}$

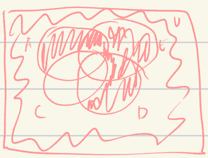
$(A \Delta C) - \overline{B}$



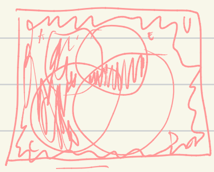
$(A \cup \overline{C}) - (\overline{E \Delta D})$



C

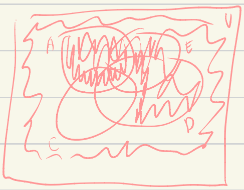


$\overline{C}$

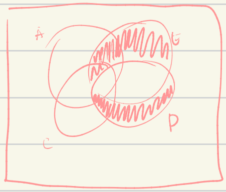


$\overline{E \Delta D}$

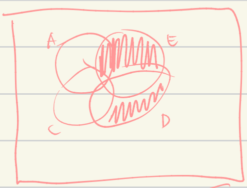
& sorry sorry ehe



$A \cup \overline{C}$

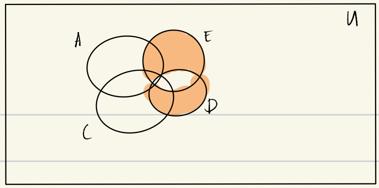


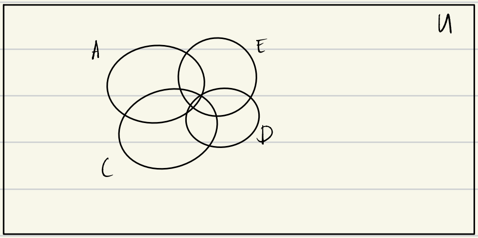
$E \Delta D$

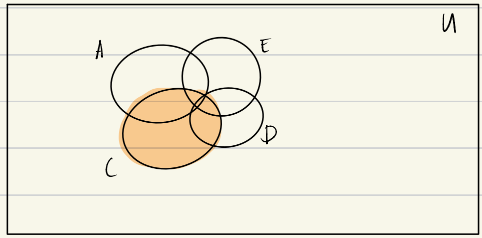


$(A \cup \overline{C}) - (\overline{E \Delta D})$

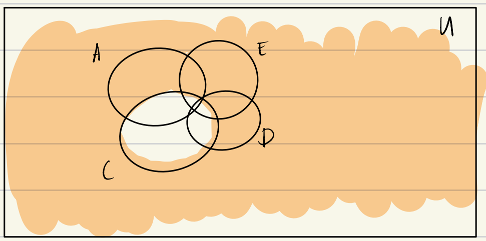
$(A \cup \bar{C}) - (\overline{E \triangle D})$



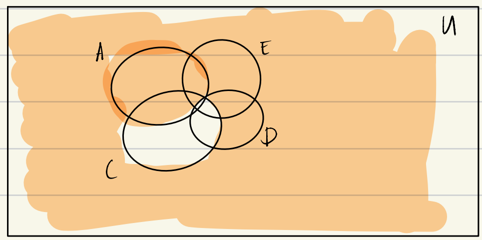




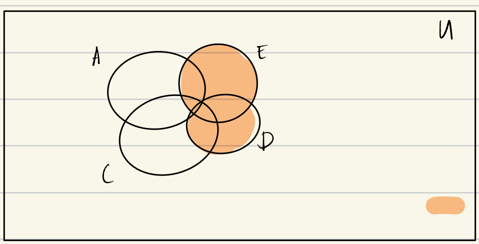
C



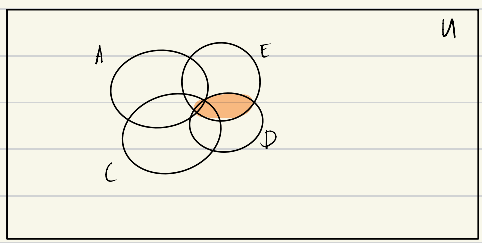
$\bar{C}$



$A \cup \bar{C}$

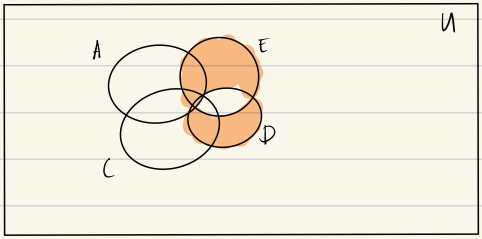


$E \triangle D$ $(E \cup D)$

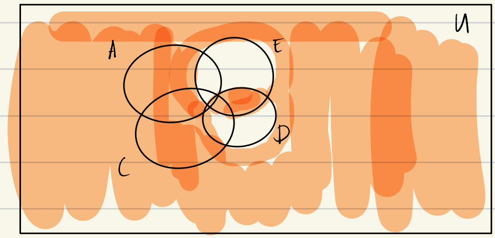


$E \triangle D$ $(E \cap D)$

$\underline{(A \cup B) - (A \cap B)}$



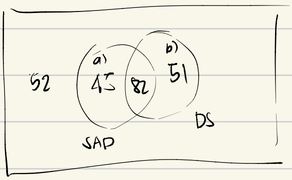
$(E \cup D) - (E \cap D)$

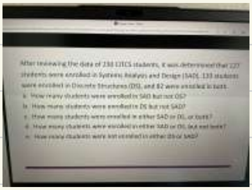


$(\overline{E \triangle D})$

3.4 Cardinality of Sets

↳ term for the number of unique items in a set




After reviewing the data of 230 CITCS students, it was determined that 127 students were enrolled in Systems Analysis and Design (SAD), 133 students were enrolled in Discrete Structures (DS), and 82 were enrolled in both.

a. How many students were enrolled in SAD but not DS?
b. How many students were enrolled in DS but not SAD?
c. How many students were enrolled in either SAD or DS, or both?
d. How many students were enrolled in either SAD or DS, but not both?
e. How many students were not enrolled in either DS or SAD?

c) total: 178

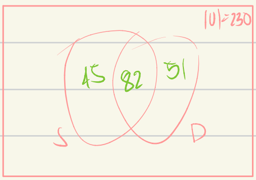
d) total (no both): 96

e) 52

230 overall

1. Let S = { x | x is a CITCS students enrolled in SAD }

D = { x | x is a CITCS student enrolled in DS }



a. 45 students

b. 51 students

c. 178 students

d. 96 students

e. 52 students

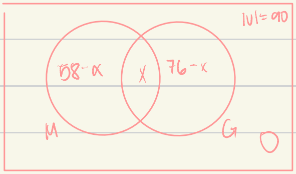
2.


A survey conducted in a group of students revealed that 90 of them have at least one hobby, listening to music or playing games. If 58 of them liked listening to music and 76 of them liked playing games.

(a) How many students liked both hobbies?
(b) How many students liked listening to music but did not like playing games?
(c) How many students liked exactly one hobby?

Let M = { y | y likes listening to music }

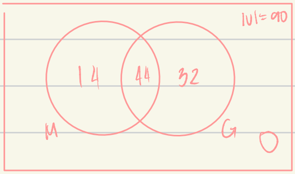
G = { z | z likes playing games }



$90 = (58-x) + x + (76-x)$

$-x = -44$

$x = 44$



a. 44 people

b. 14 students

c. 46 students

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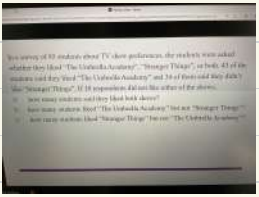
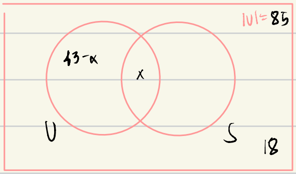
3. Let $U = \{x \mid x$ students who like The Umbrella Academy$\}$

$S = \{y \mid y$ students who like Stranger Things$\}$



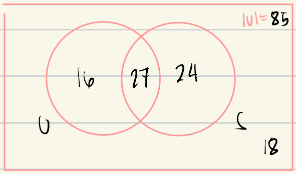


$34 = (43 - x) + 18$

$34 = 61 - x$

$x + 85 = 95$

$x = 27$



a. 27 students

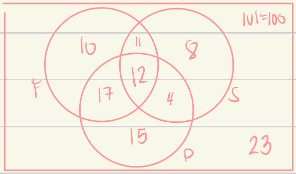
b. 16 students

c. 24 students

4. Let $F = \{x \mid x$ like "The fault in our stars"$\}$

$S = \{x \mid x$ like "The spectacular Now"$\}$

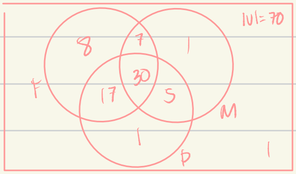
$P = \{x \mid x$ like "the Perks of being a Wallflower".



5. Let $F = \{x \mid x$ like "The Father"$\}$

$M = \{x \mid x$ like "Minari"$\}$

$P = \{x \mid x$ like "Promising Young Woman"$\}$



a: 8 students

b: 5 students

c: 24 students

d: 1 student

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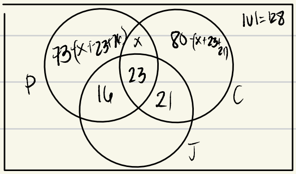
5. Let $P = \{x \mid x \text{ know Python}\}$

$C = \{x \mid x \text{ know C++}\}$

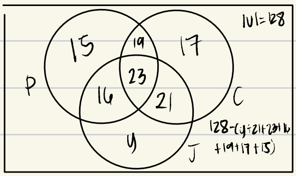
$J = \{x \mid x \text{ know Java}\}$



$31 = 73 - x - 23 - 16 + 16$

$31 = 50 - x$

$x = 19$



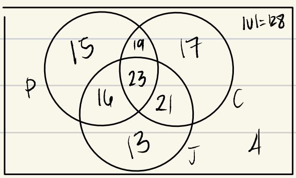
$55 = 15 + 19 + 17 + (128 - (y + 21 + 23 + 16 + 19 + 17 + 15))$

$= 51 + 128 - y - 111$

$55 = 68 - y$

$y + 55 = 68$

$y = 13$



a. 4 students

b. 13 students

c. 19 students

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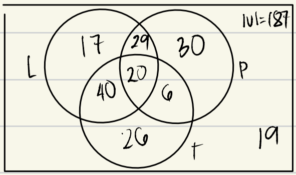
Let $L = \{x \mid x \text{ about love}\}$
$P = \{x \mid x \text{ about prison}\}$
$T = \{x \mid x \text{ about trucks}\}$



a) 92 songs
b) 85 songs
c) 102 songs
d) 81 songs
e) 187 songs

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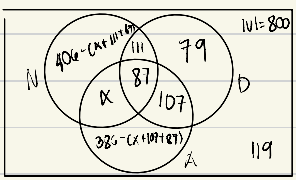
Let $N = \{x \mid x \text{ subscribes to Netflix}\}$
$D = \{x \mid x \text{ subscribes to Disney+}\}$
$A = \{x \mid x \text{ subscribes to Amazon Prime}\}$



$800 = 119 + 79 + 107 + 111 + 87 + (406 - (x + 111 + 87)) + x + (386 - (x + 107 + 87))$

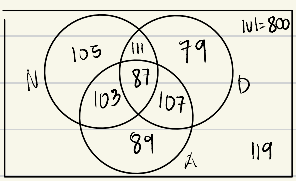
$800 = 503 + (406 - x - 198) + x + (386 - x - 194)$

$800 = 503 + 208 - x + x + 192 - x$

$800 = 903 - x$

$x + 800 = 903$

$x = 103$



a. 103 households
b. 105 households
c. 89 households
d. 194 households
e. 321 households