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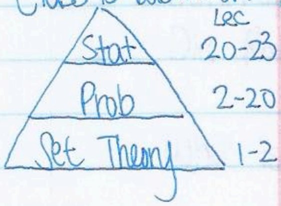
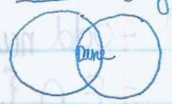
Class is based on



• Set Theory: 1870's by 20^{th} century (all math based on it).

Let: → F := {Jane, Mary, Susan, Dane} (defines as sign as; elements) → ☆ order does not matter!

Venn Diagram



M := {Bob, Joe, Max, Dane}

N := {1, 2, 3, ...} → infinite number

Z := {..., -1, 0, 1, ...} → set of integers.

"element of"
• ∈ = "set inclusion" "in"

• ∉ = not in

Operation sets:
- Jane ∈ F
- Joe ∉ F
- {Jane, Mary, Susan, Dane} = F
≠ F

☆ Sigleton (need a set)
- {Jane} ⊂ F True
- Jane ⊂ F False
- {Jane} ∉ F True
- Jane ∈ F True

all element in set
• ⊆ = subset

Subsets:
- {Jane, Mary} ⊆ F

• ⊂ = same def as ⊆ but not equal

Proper Subset:
- {Jane, Mary} ⊂ F

f(A, B) ← ∈, ∉, =, ≠, ⊆, ⊂ → Predicates
range {T, F}

• Union combines both set elements
F ∪ M
{ {Jane, Mary, Susan, Dane}, {Bob, Joe, Max, Dane} }
{Jane, Mary, Susan, Dane, Bob, Joe, Max}

Ex: {Jane} ∪ {Jane} = {Jane}

∪ - union - non exclusive or

☆ • If you want to include 0 in $\mathbb{N}$ → $\mathbb{N}_0 := \mathbb{N} \cup \{0\}$

- **Intersection**: And "only elements in both"

$F \cap M = \{Dana\}$

$\cdot \emptyset, \{\ \} =$ empty sets

- Odd numbers $\cap$ Even numbers $= \{\ \}$ — $\emptyset$ empty sets
- $F \cap \{Bob\} = \emptyset$

- Def: sets A, B are "mutally exclusive" if $A \cap B = \emptyset$
  - once you are A, you can't be B

- $\emptyset \subseteq F$ True
- $\emptyset \in F$ False $\{\ \} \in F$ is False b/c there are element in F

- **Difference/Subtraction:**

- $F \setminus M =$ F minus elements in M (all elements in F not in M)

$F \setminus M = \{Jane, Mary, Susan\}$

- $A = B \Rightarrow A \cap B = A$ or B (U)
- $A \cap B = \emptyset$, $A \cap B = \{\ \}$? Since there is nothing common between A & B, there is nothin to subtract

$\Rightarrow A \setminus B = A$ — $A \subseteq B \Rightarrow A \setminus B = \emptyset$ B (A)

$\Rightarrow B \setminus A = B$

- $\{2n : n \in \mathbb{Z}\}$ = all elements $2 \cdot n$ such that n is $\mathbb{Z}$.

$\cdot \mathbb{Z} = \{-4, -2, 0, 2, 4.\}$

$A = \{1, 2, 3\}$ $2^A = \{B : B \subseteq A\} = \{\emptyset, \{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}, \underset{\{1,2,3\}}{A}\}$ 8 sets

2^A ↓ powered set

$\cdot \{B : B \subseteq A\}$ = B such that B is an subset of A

- $|2^A| = 8$
- $\{3, 2\} \in 2^A$

- **"Size AKA Cardanality"**

$|A| = 3$ $|\ | : \text{set} \to \mathbb{N}_0$

pipe operation.

- **Special set Ω** = "Universe," "Scope"
  "Sample Space"
  "Space of disclosure"

- $|F \cup M| = 7$ $\neq |F| + |M|$
- $|F \cap M| = 1$
- $|F / M| = 3$
- $|2^F| = 16$

[set everything in right now]

- $\Omega := F \cup M = \{Jane, Mary, Susan\}$
- $F \subseteq \Omega$ True
- $2^F \subseteq \Omega$ False ($\{Jane, Mary\} \notin \Omega$) power set

★ "counting in a nutshell"

For $|S| < \infty \rightarrow \boxed{|2^S| = 2^{|S|}}$

- Coin Flip $\Omega = \{H, T\}$ order doesn't matter
- Die Roll $\Omega = \{1, 2, 3, 4, 5, 6\}$

- What is the probability that a random name is female?

Assume $\Omega = F \cup M$

$|\Omega| := |F \cup M| = 7$ random = which are all equal likely.

$P(F) = \frac{|F|}{|\Omega|} =$

- Working Def:

$P(A) = \frac{|A|}{|\Omega|}$ for all A.