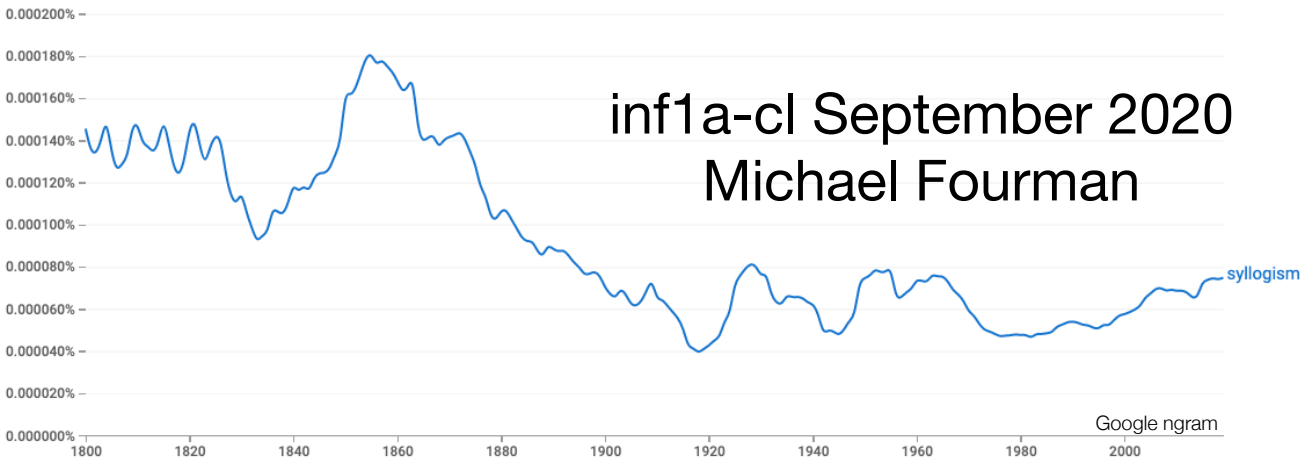
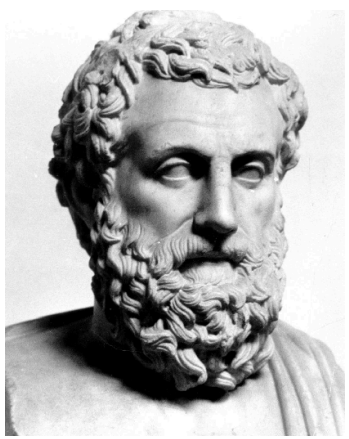


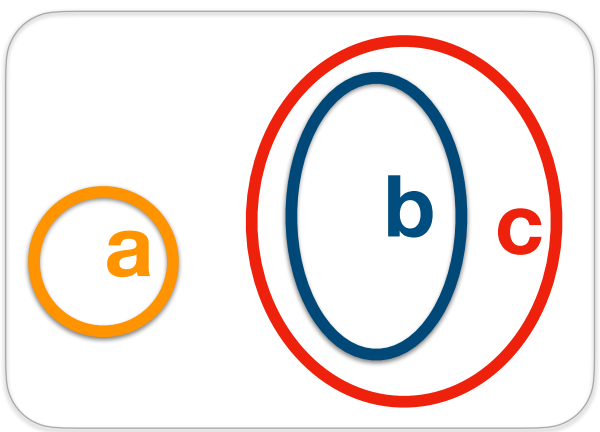
inf1a-cl September 2020
Michael Fourman

INF1A
from
Aristotle to
Euler

Aristotelian Syllogisms
Euler diagrams



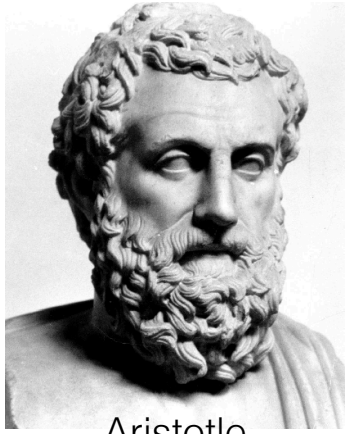
Aristotle
384-322 BC



Euler
1707-1783

INF1A

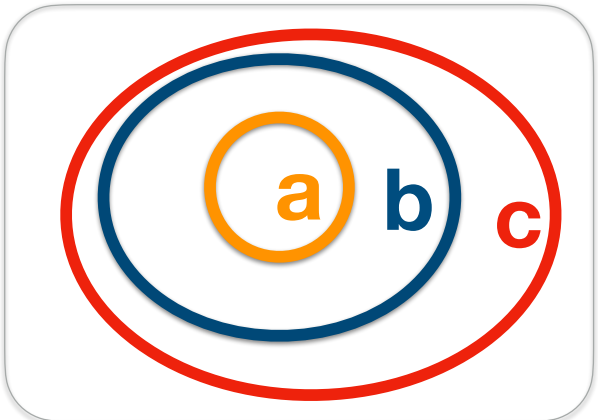
deduction

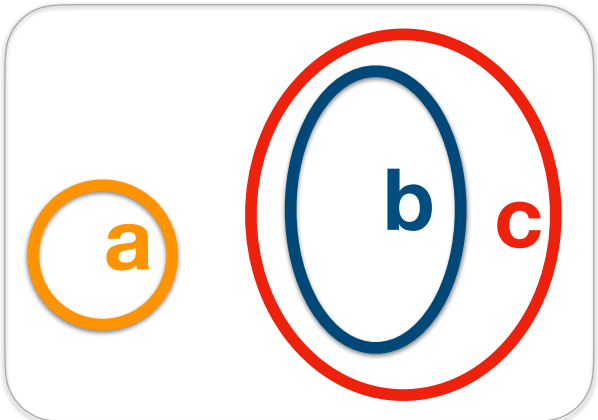


Aristotle
384-322 BC

A **deduction** is speech (*logos*) in which, certain things having been supposed, something, different from those supposed, results, of necessity, because of their being so.

Aristotle





Socrates is a man
All men are mortal
∴ Socrates is mortal

$$\{x \mid x = \text{Socrates}\} \subseteq \{x \mid \text{isaMan } x\}$$
$$\{x \mid \text{isaMan } x\} \subseteq \{x \mid \text{isaMortal } x\}$$
$$\therefore \{x \mid x = \text{Socrates}\} \subseteq \{x \mid \text{isaMortal } x\}$$

$$\text{isSocrates } x \quad =_{\text{def}} \quad x = \text{Socrates}$$

INF1A

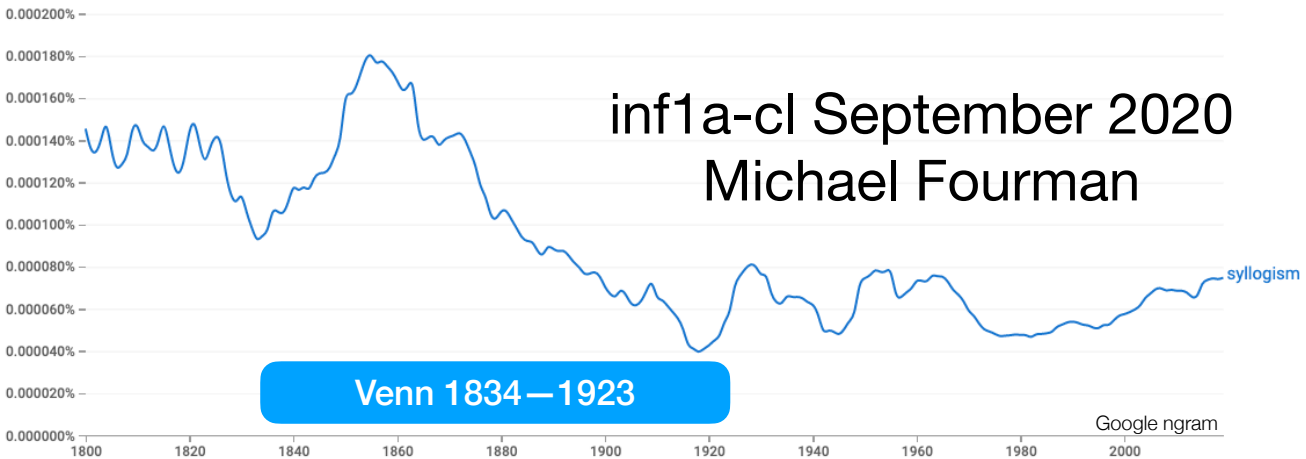
syllogism

$$\frac{\text{isSocrates} \models \text{isaMan} \quad \text{isaMan} \models \text{isaMortal}}{\text{isSocrates} \models \text{isaMortal}}$$

Euler diagram

$$\frac{a \models b \quad b \models c}{a \models c}$$

Socrates is a man
All men are mortal
∴ Socrates is mortal



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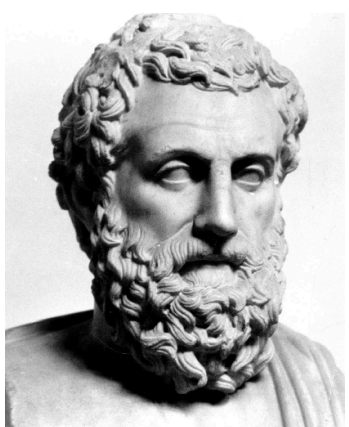
INF1A

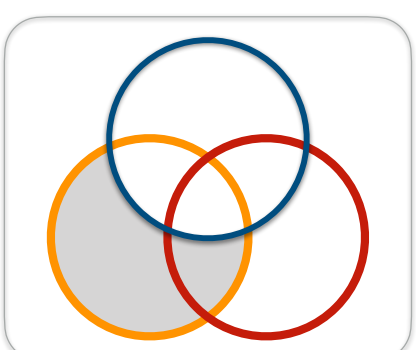
Aristotle
via Venn

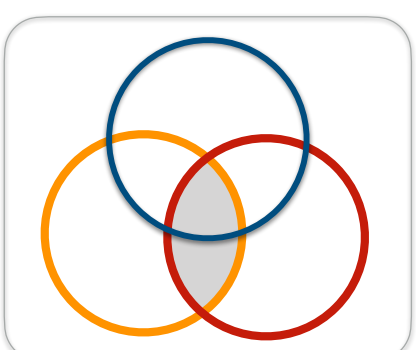
Aristotelian Syllogisms

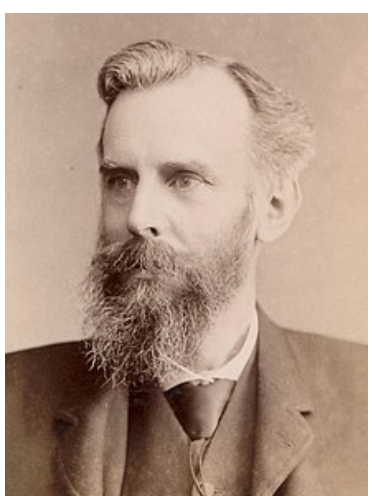
Venn diagrams



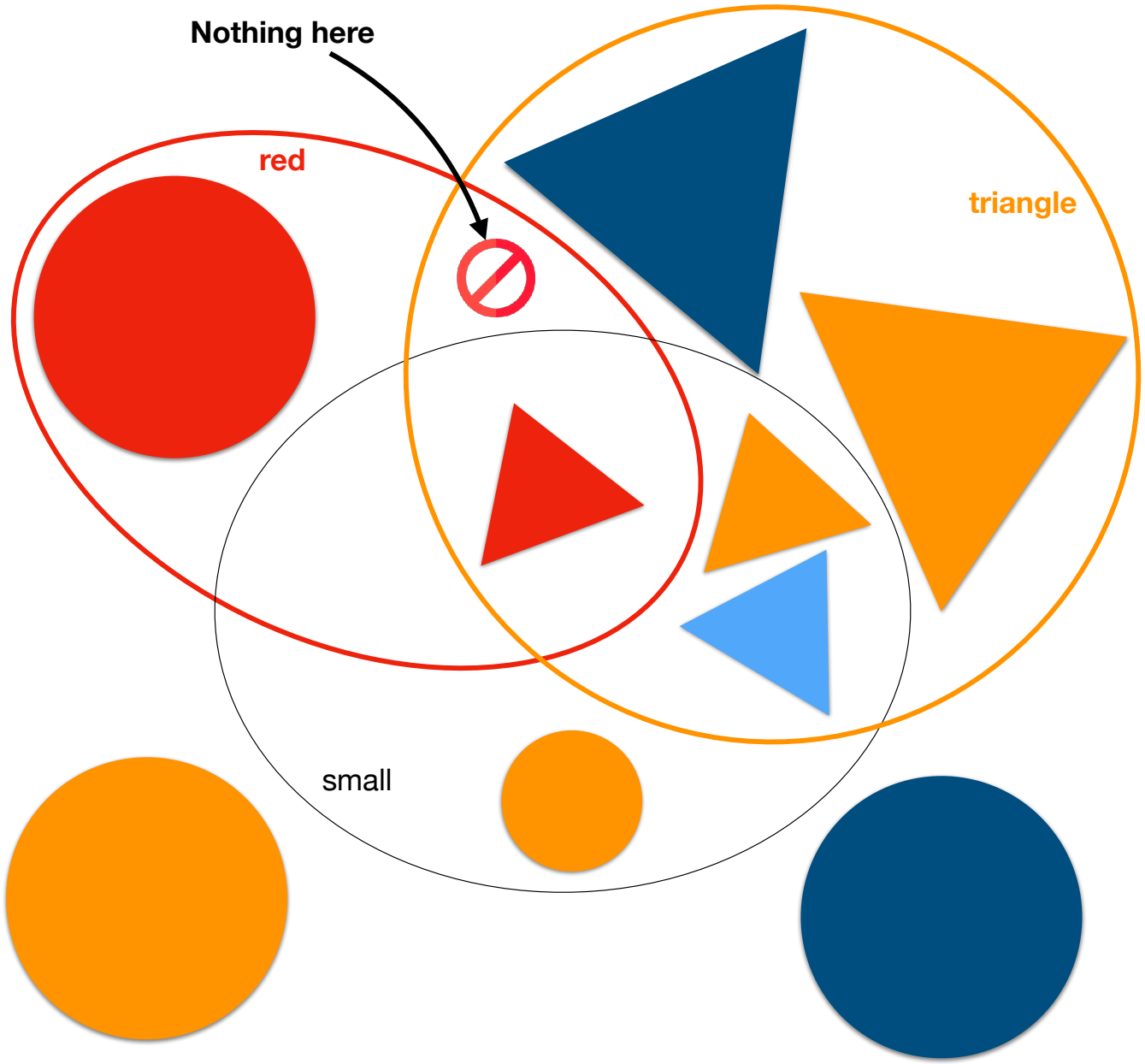
Aristotle
384-322 BC







John Venn
1834–1923



INF1A-CL

universal
affirmative

every red triangle is small ✔

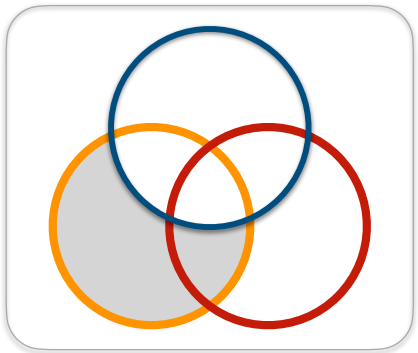
every small triangle is red ✘

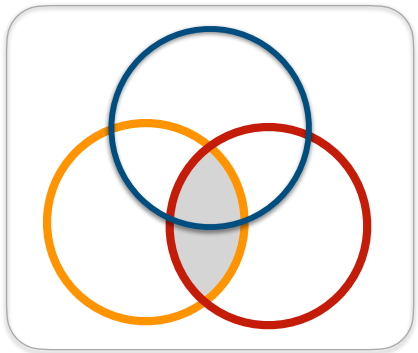
some big triangle is amber ?

some small disc is red ?

no red thing is blue ?

John Venn
1834–1923





INF1A

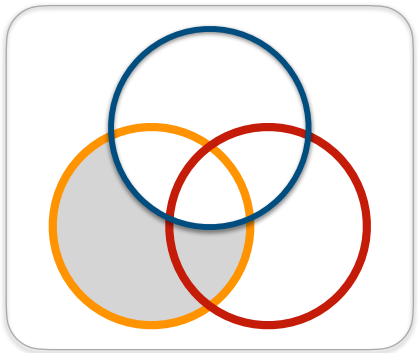
from Venn to Euler

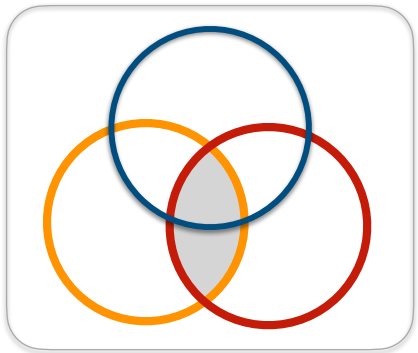
¿?

¿?

Euler
1707-1783

John Venn
1834–1923



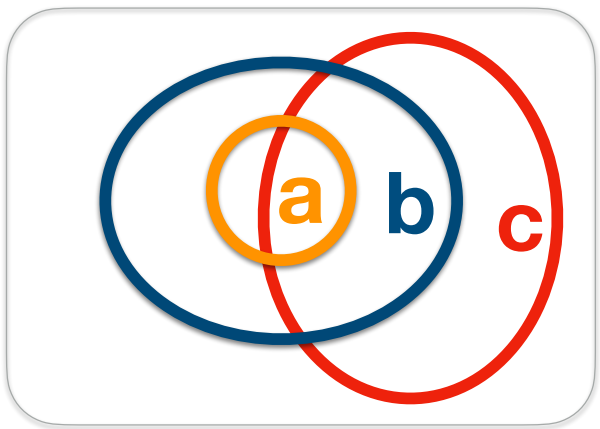


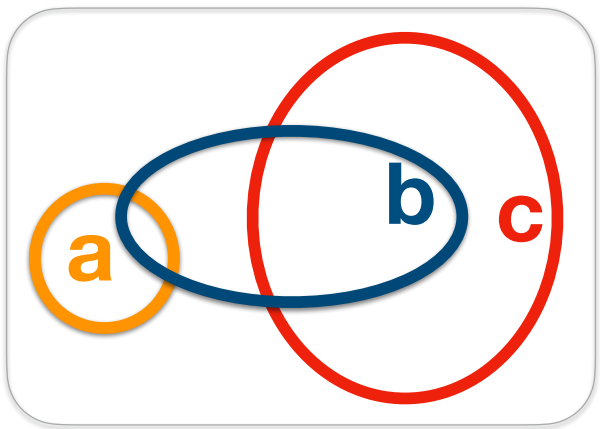
INF1A

from Venn to Euler

every **a** is **b**

no **a** is **c**

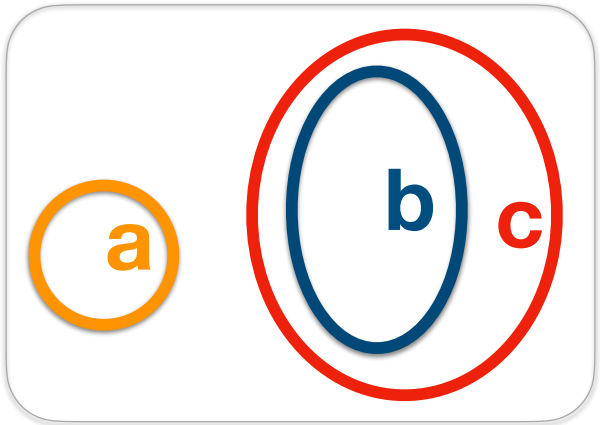




$a \models b$

$a \models \neg c$

Euler
1707-1783



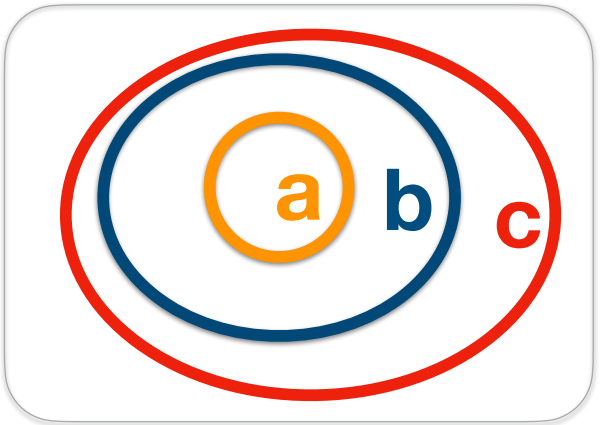
INF1A

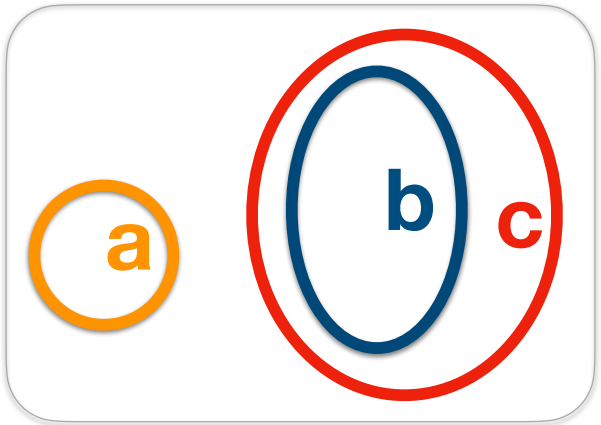
from Euler
to Venn

¿?

¿?

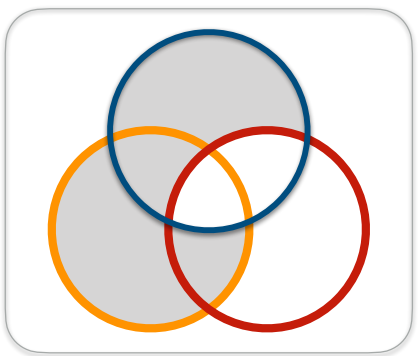
John Venn
1834–1923

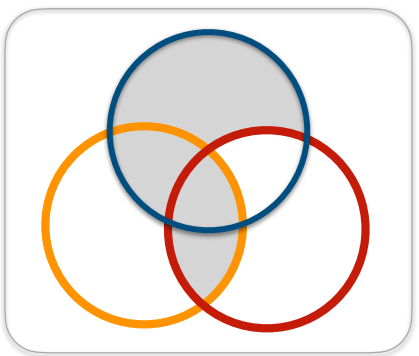




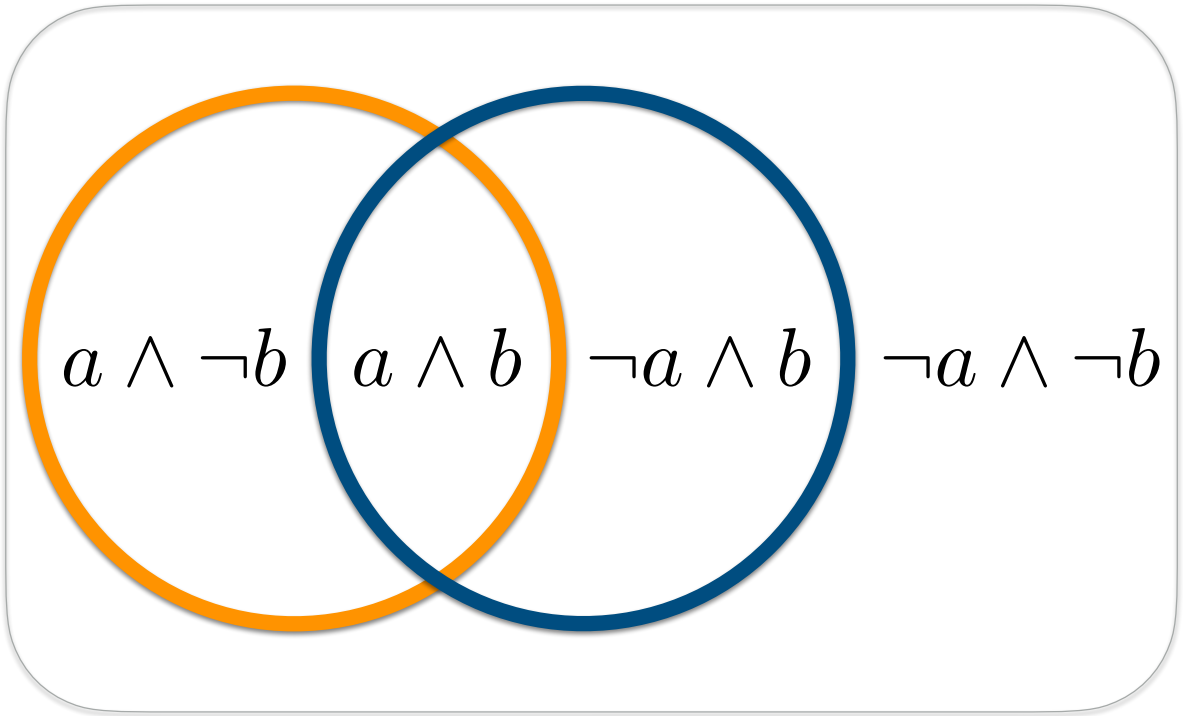
INF1A

from Euler
to Venn





John Venn
1834–1923



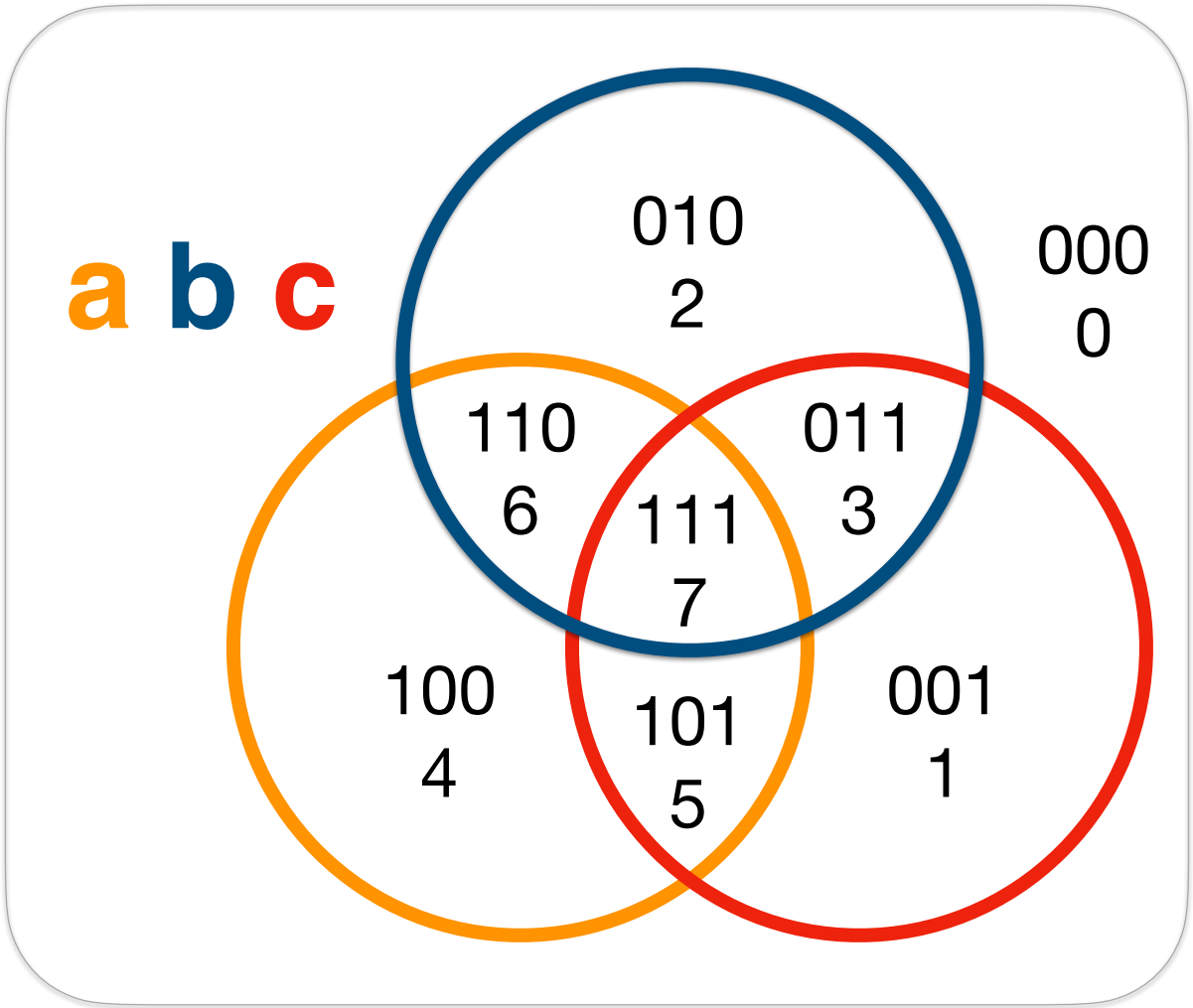
INF1A

combinations

a Venn diagram represents
all imaginable combinations

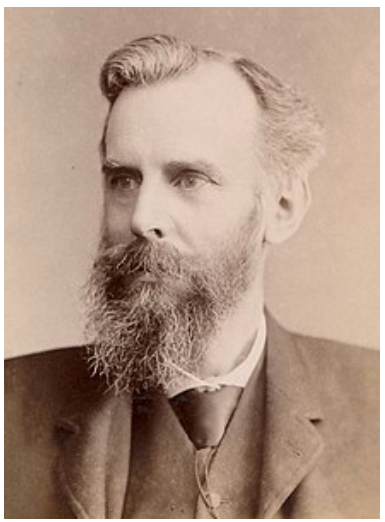
for two predicates
there are four combinations

$$\text{not } \neg, \quad \text{and } \wedge, \quad \text{or } \vee$$

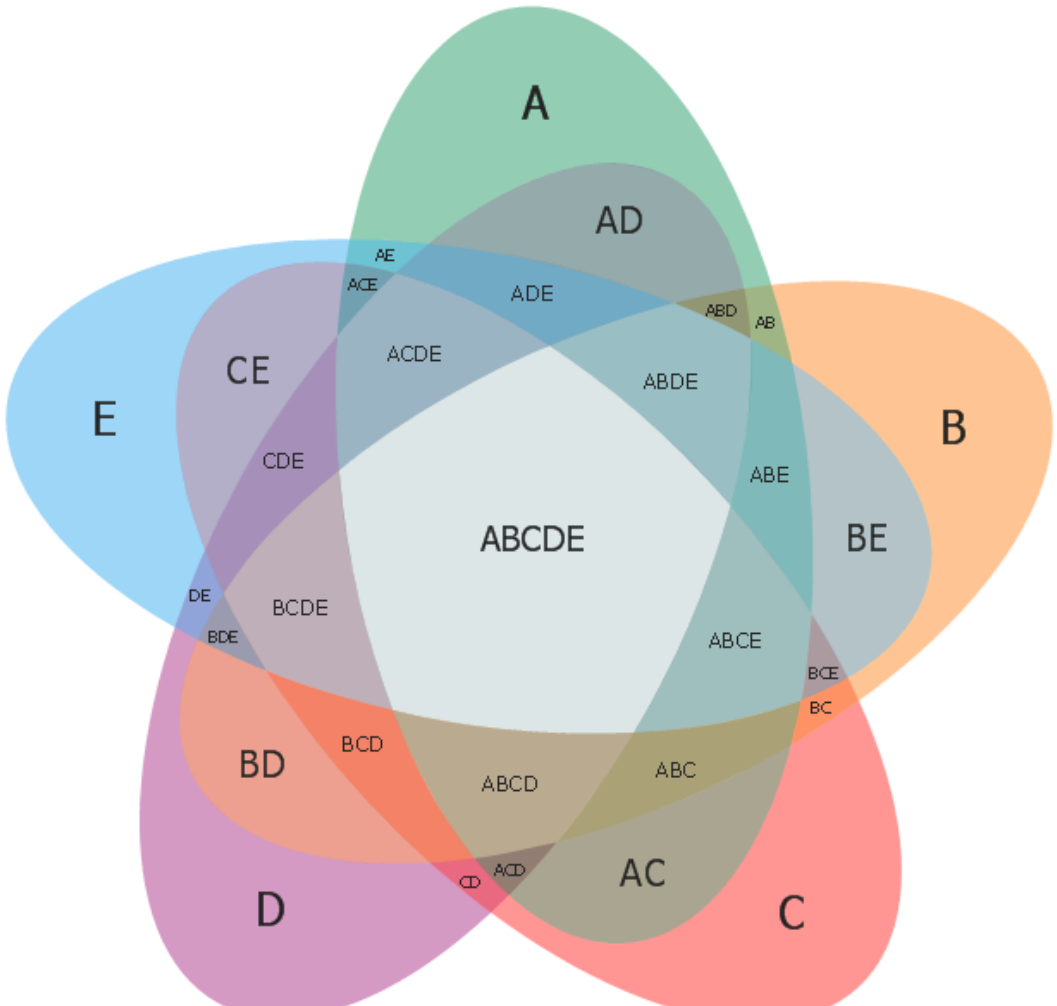


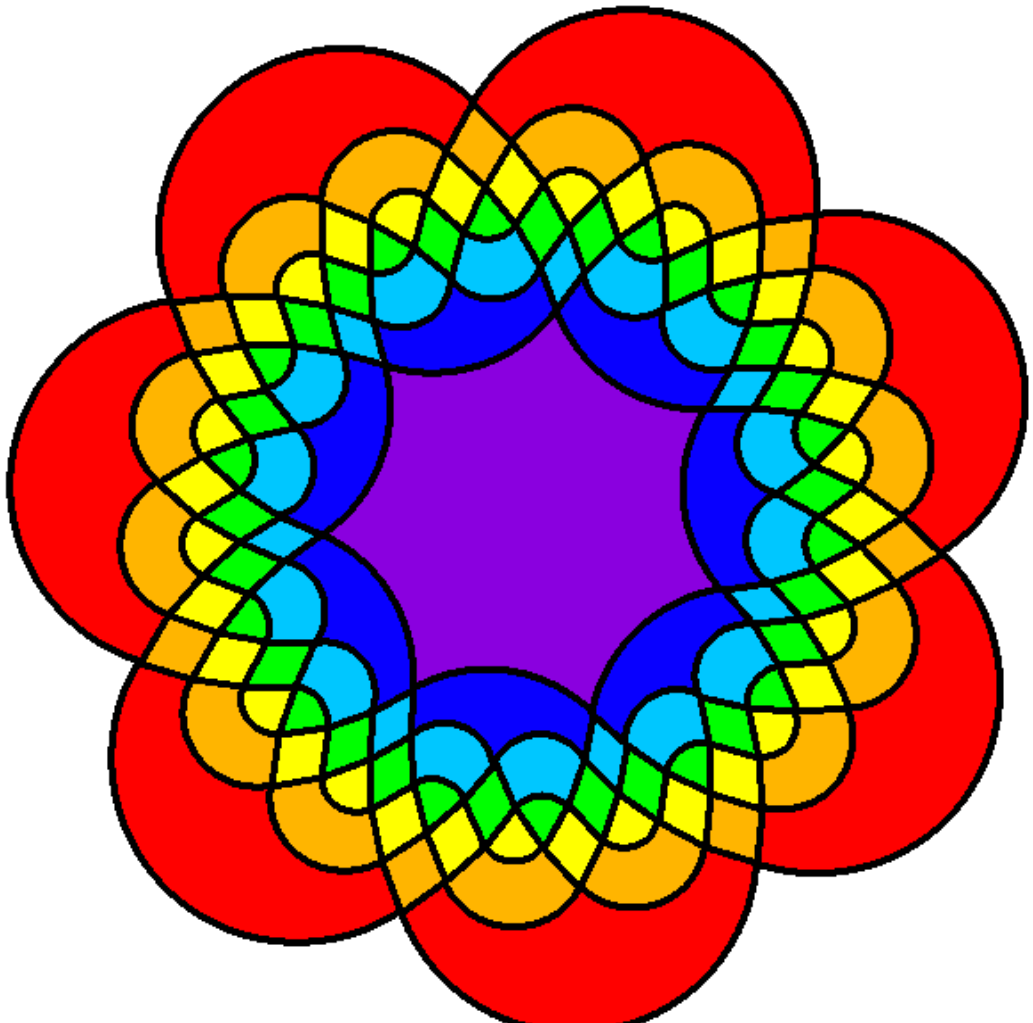
INF1A

combinations



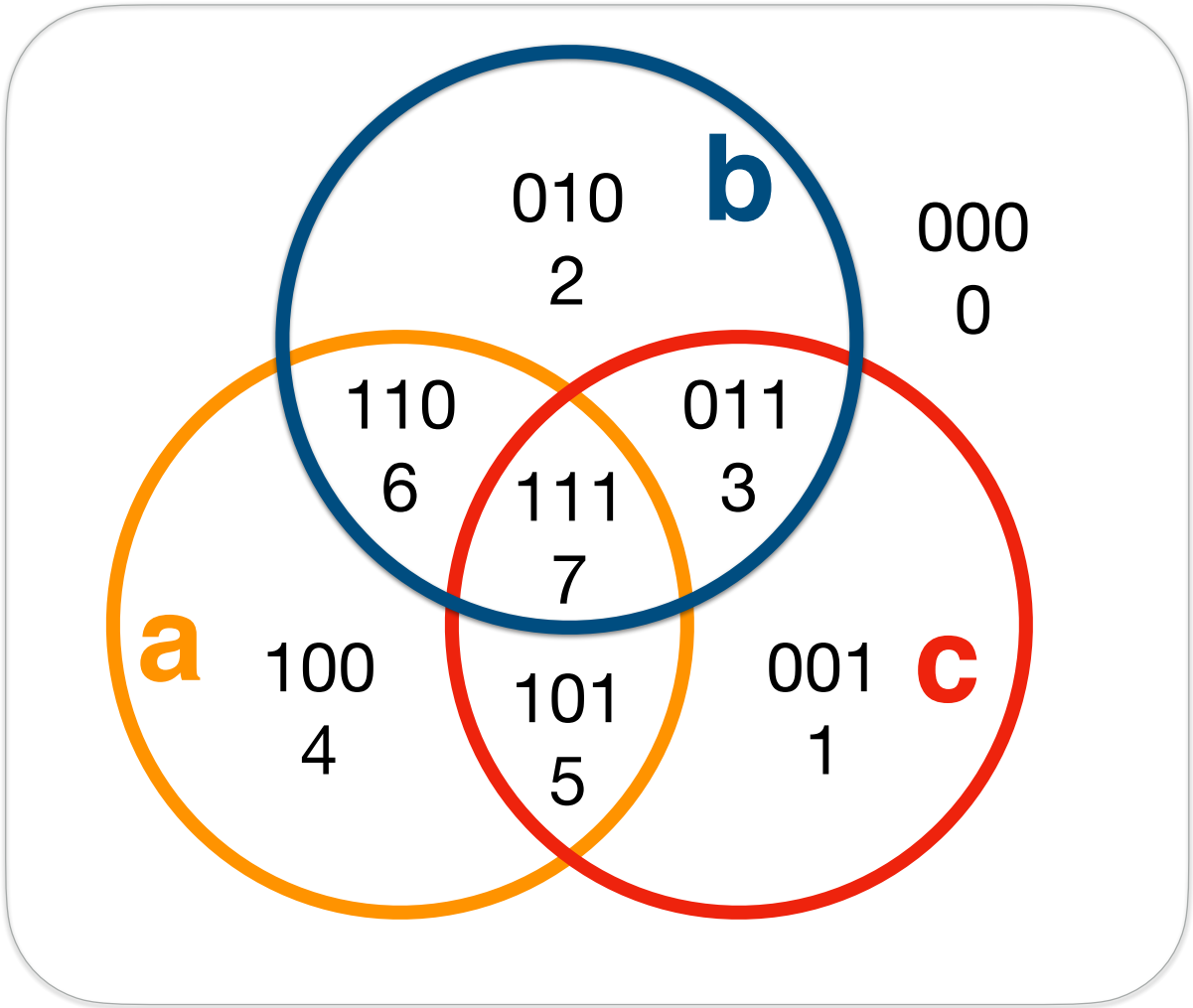
John Venn
1834–1923





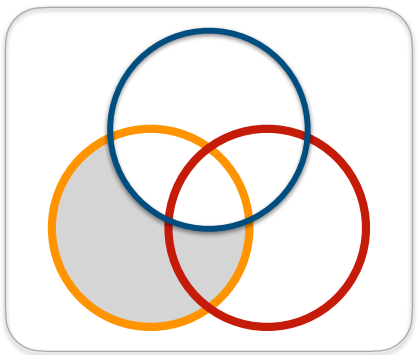
rotationally symmetric Venn diagrams for n predicates exist if and only if *n* is a prime number.

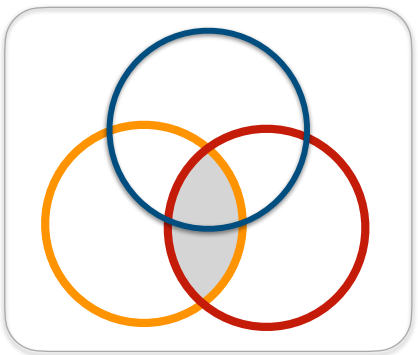
a b c



INF1A

Venn diagram





every **a** is **b**

$a \models b$

no **a** is **c**

$a \models \neg c$