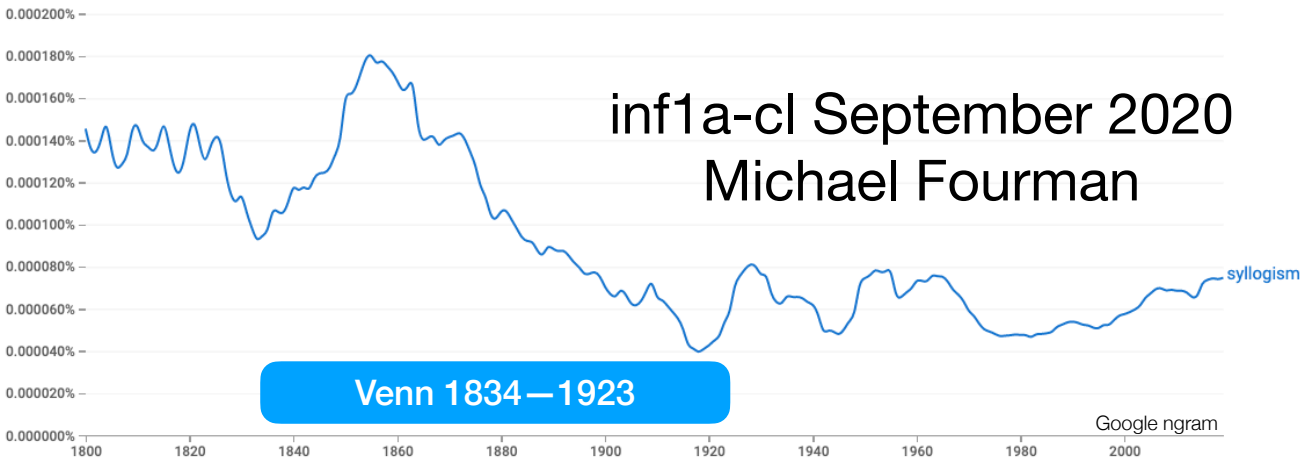


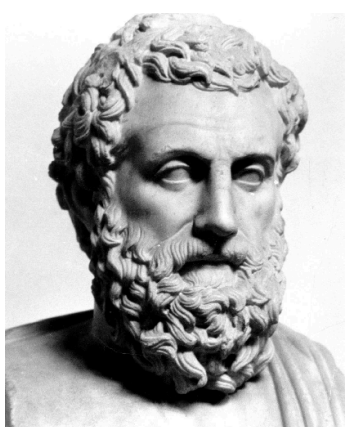
inf1a-cl September 2020
Michael Fourman

INF1A

Aristotle
to Venn

Aristotelian Syllogisms

another example



Aristotle
384-322 BC

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

All snakes are reptiles.
No reptile has fur.
∴ No snake has fur.

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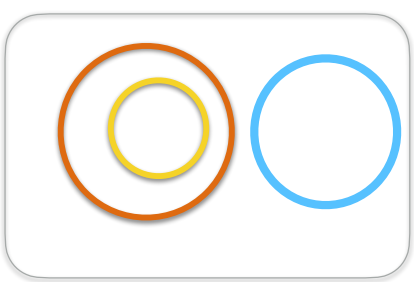
substitution

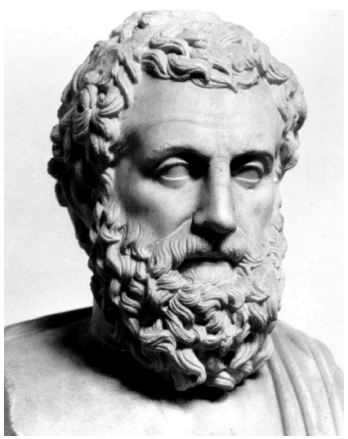
$$\frac{a \models b \quad b \models c}{a \models c}$$

since this works for *any* predicates,
a,b,c, it works for a, b, ¬c
the following rule must also be sound

Euler diagram?

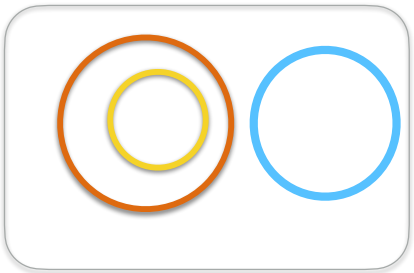


$$\frac{a \models b \quad b \models \neg c}{a \models \neg c}$$



Aristotle
384-322 BC

Euler diagram?



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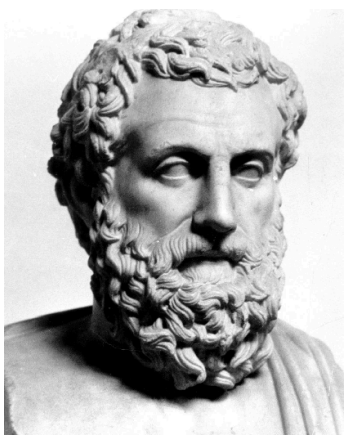
syllogism

every **a** is **b** every **b** is not **c**

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

every **a** is not **c**



Aristotle
384-322 BC

INF1A

syllogism

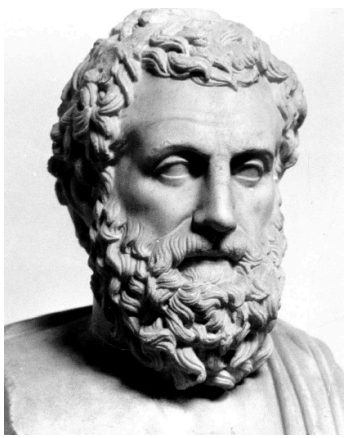
no **b** is **c**

every **a** is **b** every **b** is not **c**

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

every **a** is not **c**

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



Aristotle
384-322 BC

INF1A

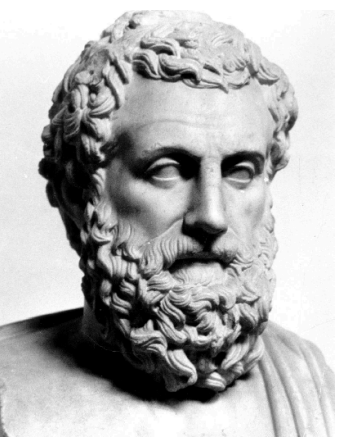
syllogism

all **a** is **b** no **b** is **c**

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

celarent

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



Aristotle
384-322 BC

All snakes are reptiles
No reptiles have fur
∴ No snakes have fur

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

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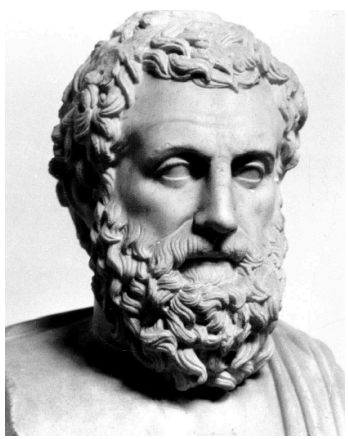
Venn interpretation



Aristotle
384-322 BC

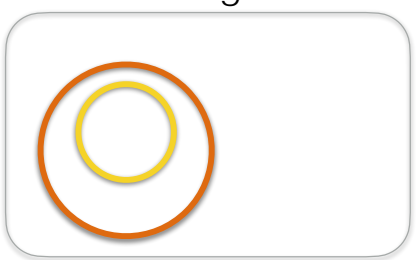
all **a** is **b**

$$a \models b$$

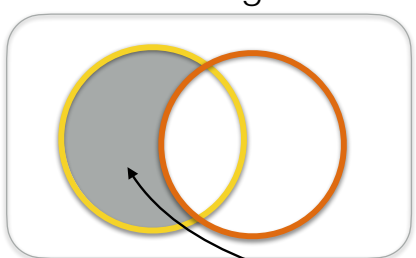
no **a** is **b**

$$a \models \neg b$$

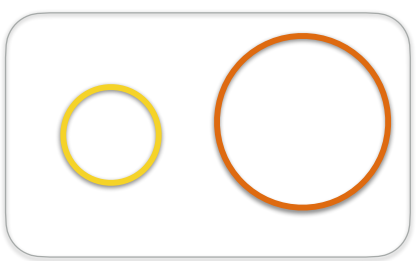
Euler diagrams?

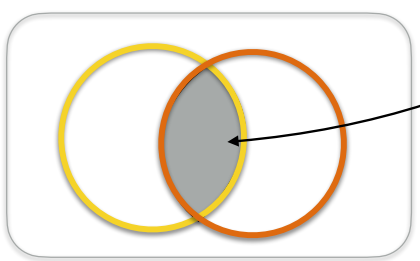


Venn diagrams

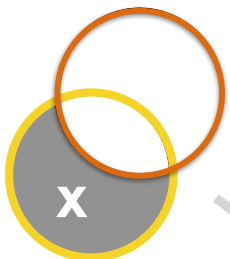


These regions are empty

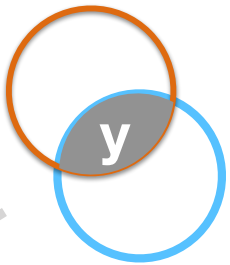


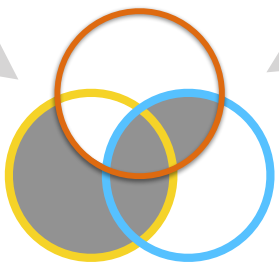


all **a** is **b**

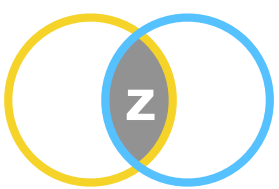


no **b** is **c**





z ⊆ x ∪ y



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

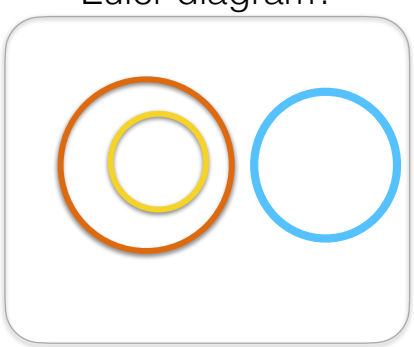
INF1A

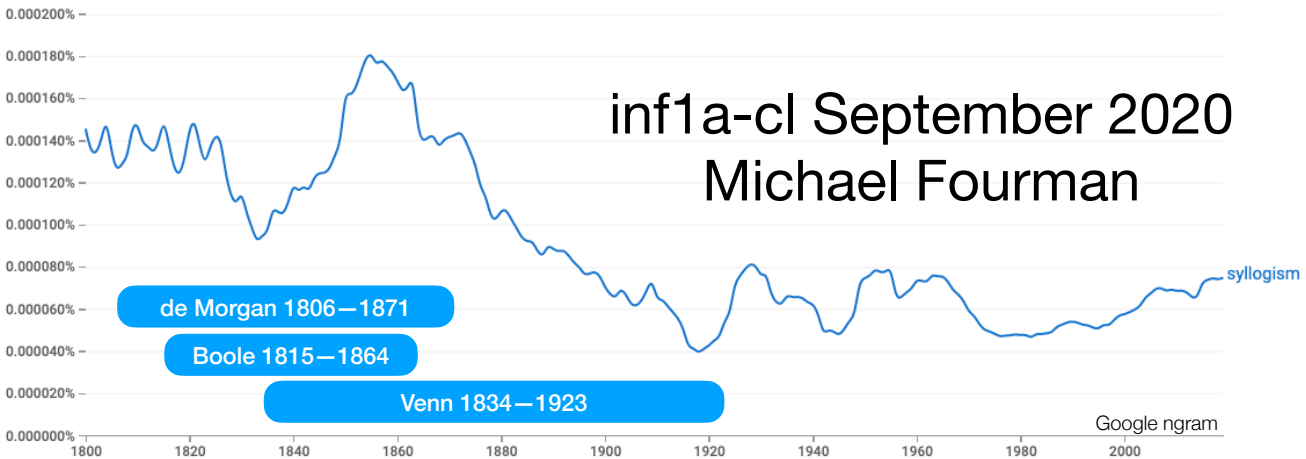
soundness

$$\frac{a \models b \quad b \models \neg c}{a \models \neg c}\ \text{celarent}$$

All snakes are reptiles
No reptiles have fur
∴ No snakes have fur

Euler diagram?





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Michael Fourman

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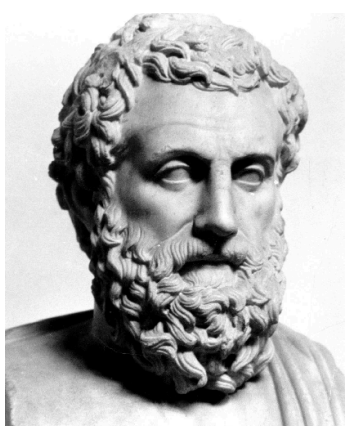
Aristotle
to Venn

Syllogisms for free!



Aristotle
384-322 BC

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

All snakes are reptiles.
No reptile has fur.
∴ No snake has fur.

INF1A

syllogism

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

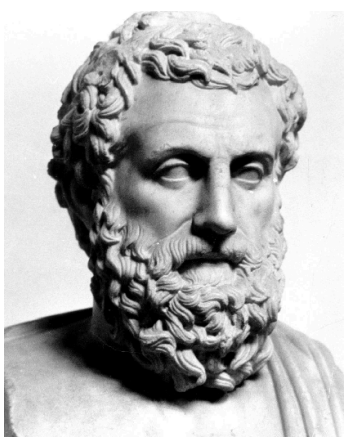
$$\frac{a \models b \quad b \models \neg c}{a \models \neg c}$$ celarent

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

take contrapositive

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

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



Aristotle
384-322 BC

INF1A

syllogism

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

$$\frac{a \models b \quad b \models \neg c}{a \models \neg c}\ \text{celarent}$$

$$\frac{a \models b \quad c \models \neg b}{a \models \neg c}\ \text{cesare}$$

logic is just

common sense

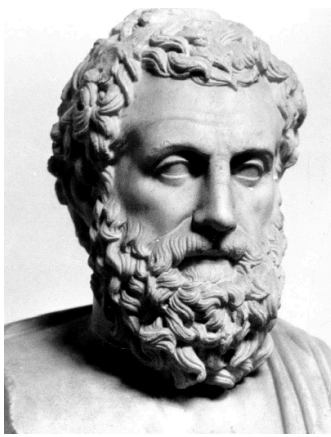
in

symbolic form

$$\frac{a \models b \quad c \models \neg b}{c \models \neg a}\ \text{camestres}$$

$$\frac{a \models b \quad b \models \neg c}{c \models \neg a}\ \text{calemes}$$

More sound rules



Aristotle
384-322 BC

all greeks are men
all men are mortal
∴ all greeks are mortal

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

$$\frac{a \models b \quad b \models \neg c}{a \models \neg c}\ \text{celarent}$$

all humans are mammals
no mammals are reptiles
∴ no humans are reptiles

INF1A

example

our first five syllogisms

$$\frac{a \models b \quad c \models \neg b}{c \models \neg a}\ \text{camestres}$$

all humans are mammals
no reptiles are mammals
∴ no reptiles are humans

$$\frac{a \models b \quad b \models \neg c}{c \models \neg a}\ \text{calemes}$$

all humans are mammals
no mammals are reptiles
∴ no reptiles are humans

$$\frac{a \models b \quad c \models \neg b}{a \models \neg c}\ \text{cesare}$$

all humans are mammals
no reptiles are mammals
∴ no humans are reptiles