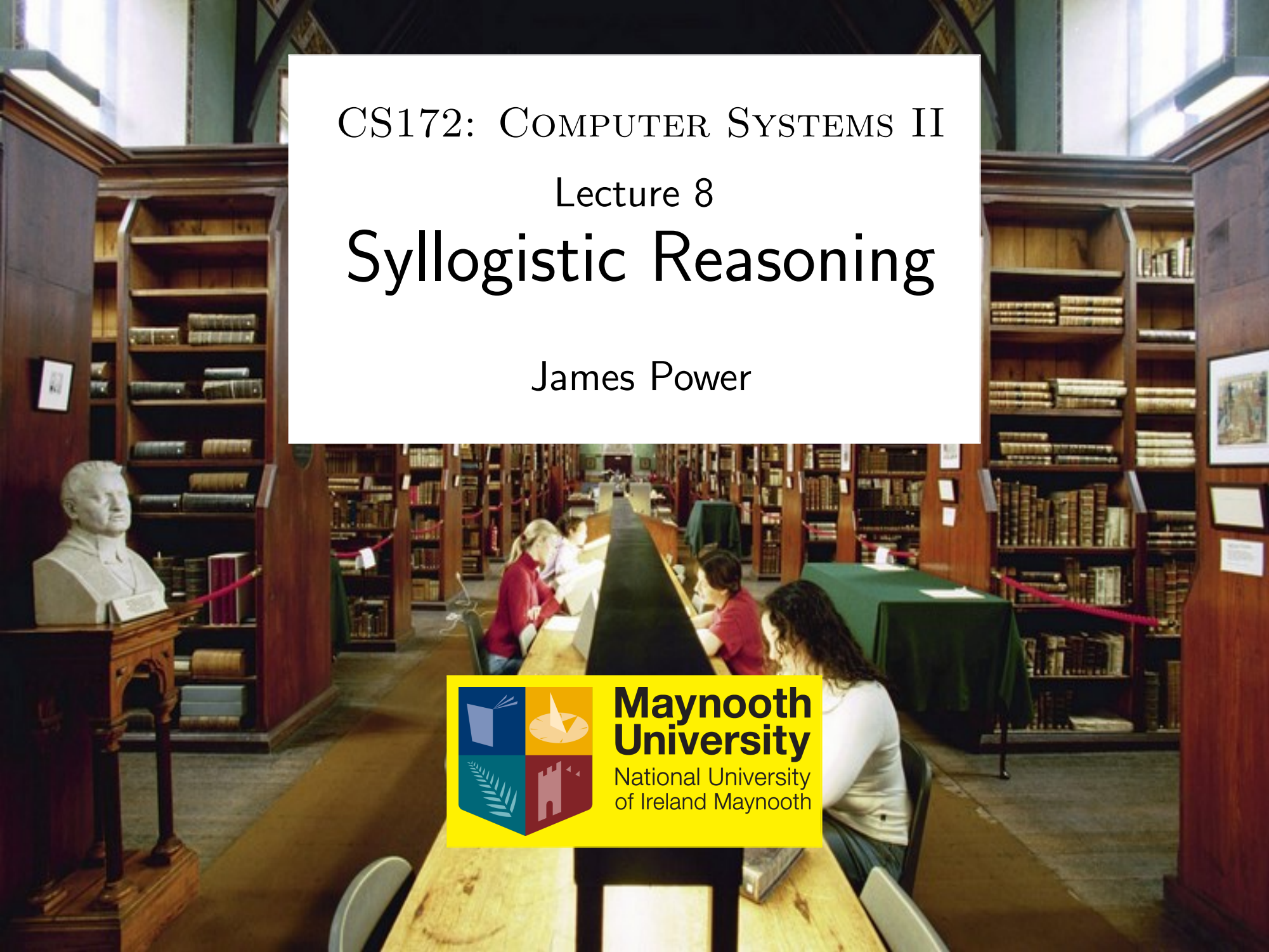


CS172: Computer Systems II

Lecture 8

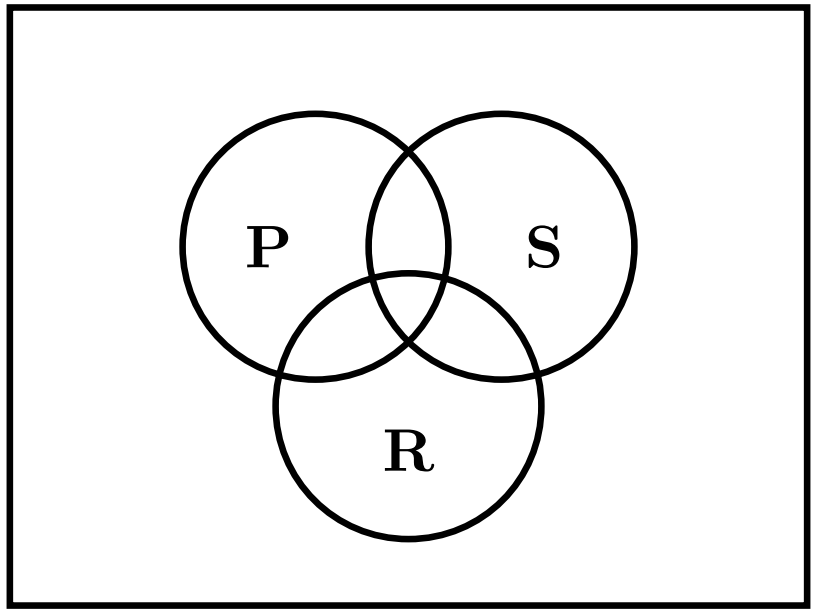
Syllogistic Reasoning

James Power

Maynooth University
National University of Ireland Maynooth

The syllogistic method: example (2)

	All students are politician.	**To draw**
	All politician are rich.	**To draw**
?	---	
	All students are rich.	**To verify**



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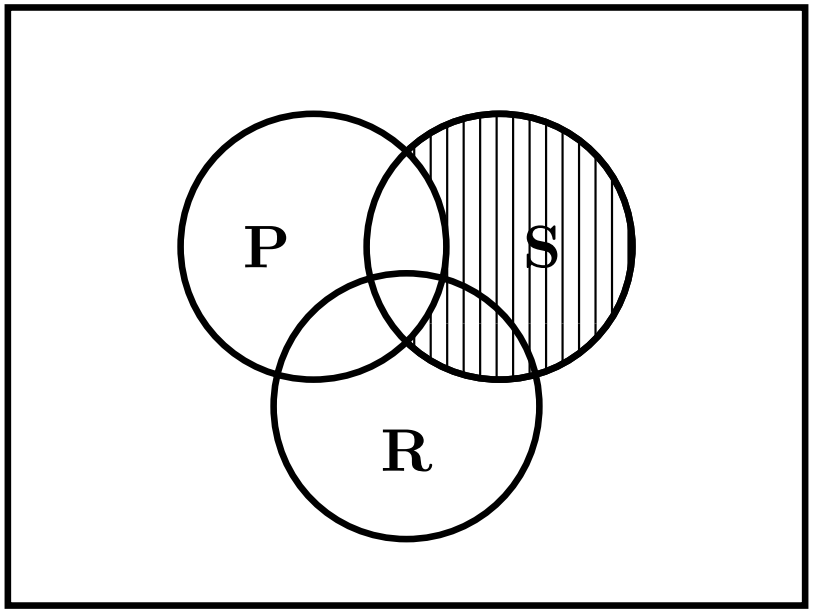

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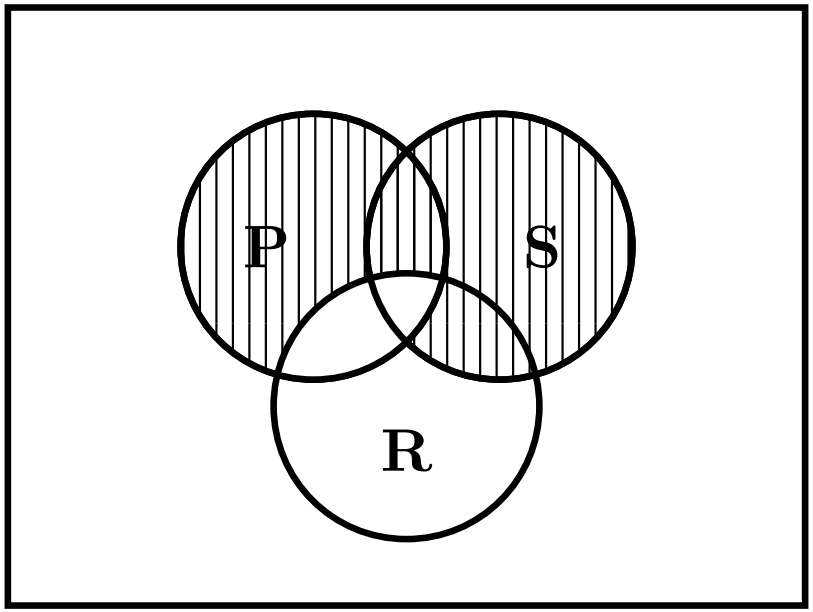
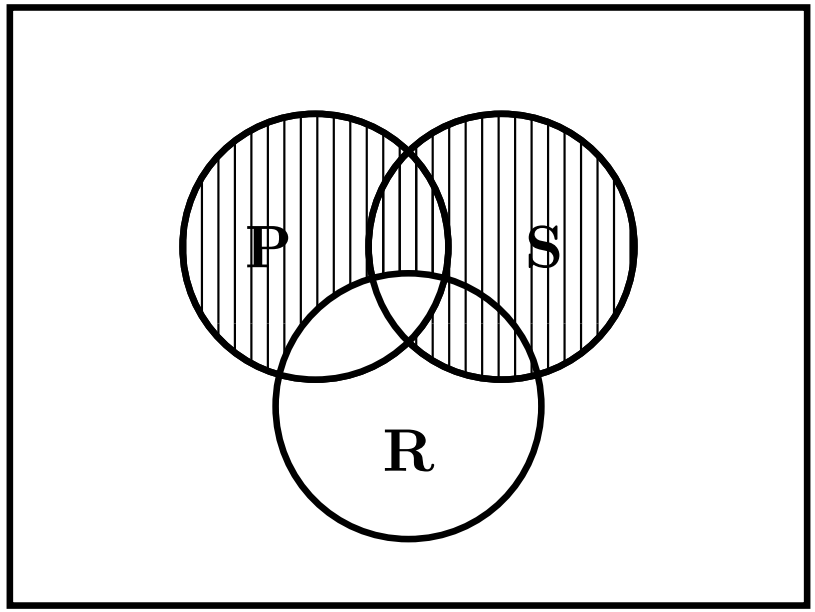


The syllogistic method: example (2)

	All students are politician.	**Drawn**
?	All politician are rich.	**Drawn**
	All students are rich.	**Success**



The unique conclusion's representation **is** in the unique diagram.

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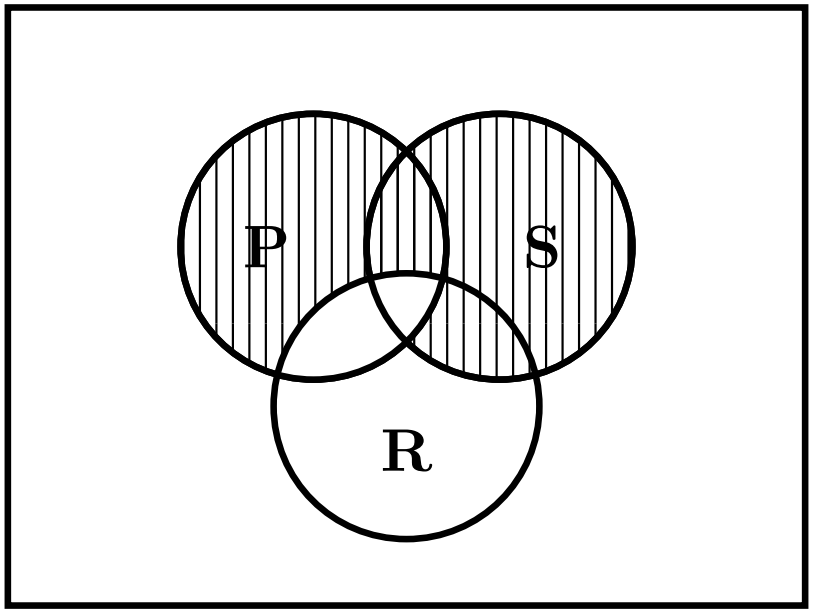

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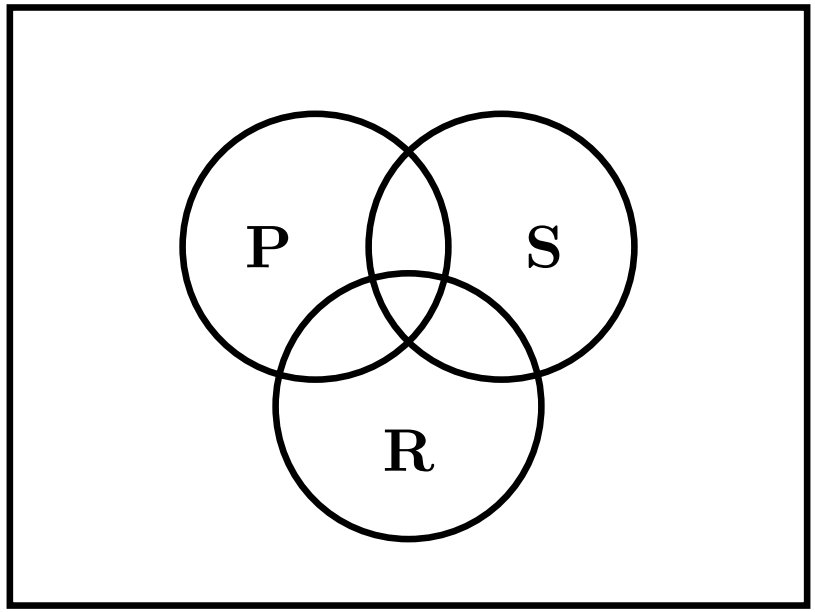
The syllogistic method: example (3)

All students are rich. **To draw**

Some students are politicians. **To draw**

? ——————————

Some students are rich. **To verify**



The syllogistic method: example (3)

	All students are rich.	**Drawn**
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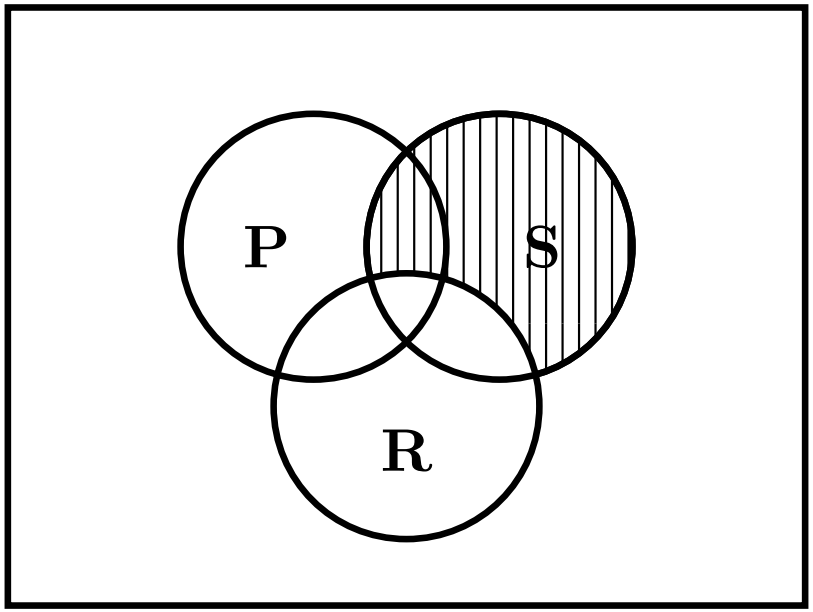
	Some students are rich.	**To verify**



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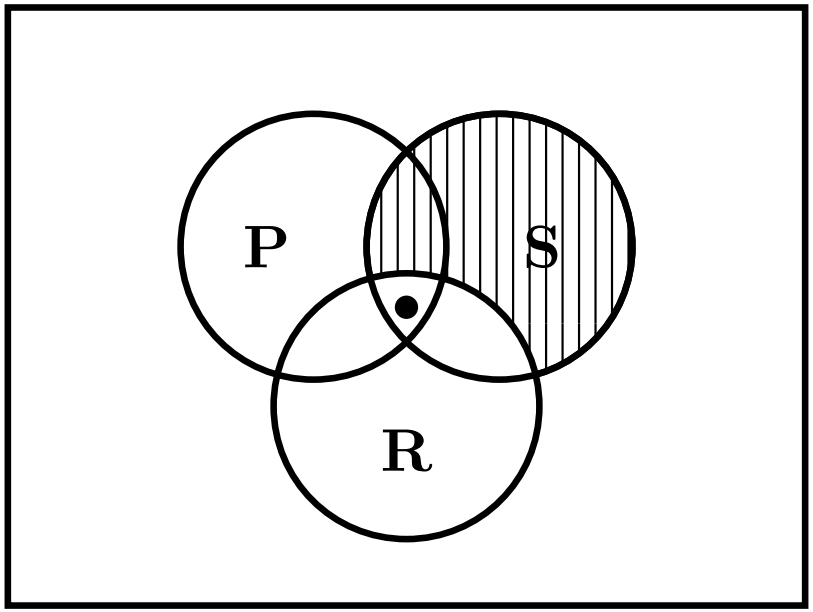

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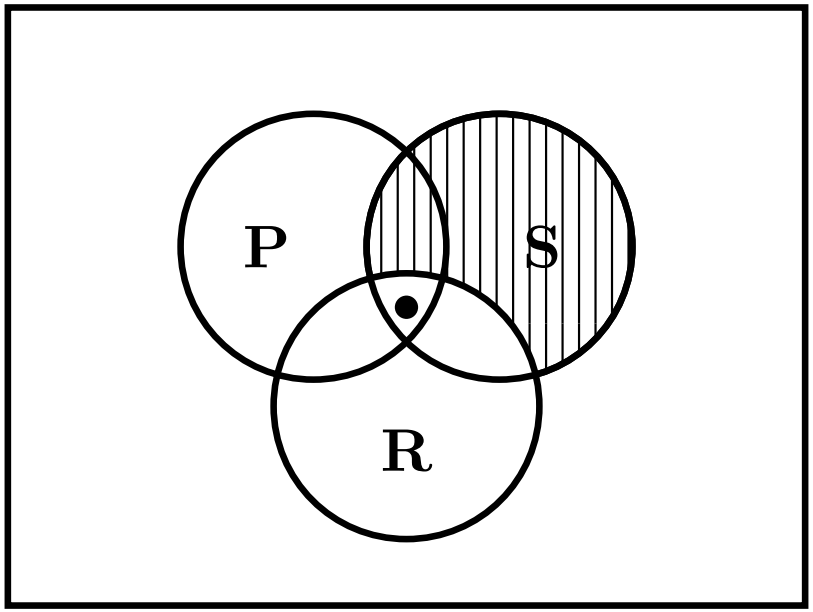

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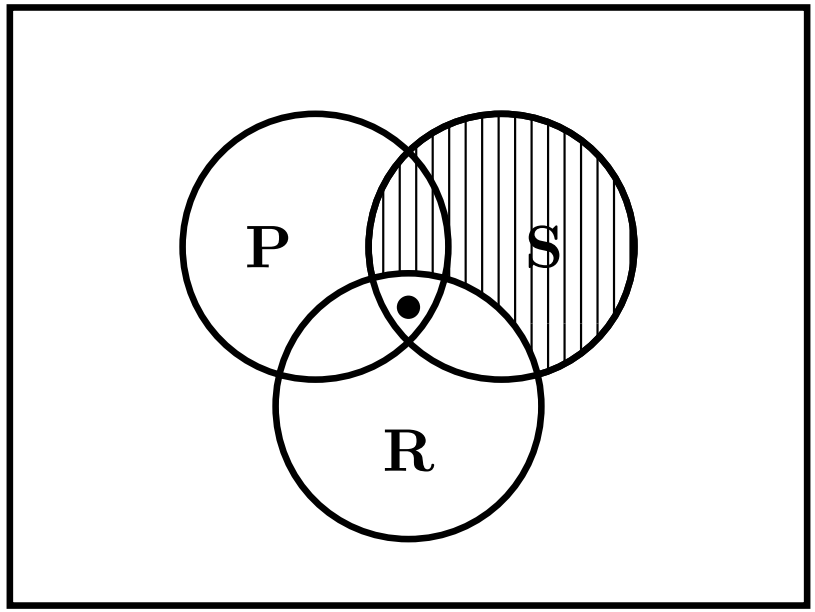

One of the conclusion's representation **is** in the unique diagram.

Syllogistic Reasoning: More examples

LiA §3.5

Some philosophers are Greek
No Greeks are barbarians

No philosophers are barbarians.

All Greeks are not barbarians
Some barbarians are philosophers

Not all philosophers are Greek.

All Athenians are Greek
Some Greeks are not philosophers

Some Athenians are not philosophers.

Counting Syllogistic Forms

How many kinds of syllogistic inferences are there?

Counting Syllogistic Forms: Moods

How many kinds of syllogistic inferences are there?

The mood of a syllogistic inference is a label based on the *forms* of the two premises and conclusion.

A	All A are B	universal affirmative
I	Some A are B	particular affirmative
E	All A are not B	universal negative
O	Some A are not B	particular negative

Latin: **A**ff**i**rmo and N**e**g**o**

Example of *the mood of an inference*: A-A-A

Counting Syllogistic Forms

Suppose we choose a particular mood, e.g. A-A-A.

Counting Syllogistic Forms: Figure

Suppose we choose a particular mood, e.g. A-A-A.

The figure of a syllogistic inference defines the order of the predicates in the premises.

For each *mood* there are four *figures*:

Figure 1	Figure 2	Figure 3	Figure 4
All A are B All B are C --- All A are C	All A are B All C are B --- All A are C	All B are A All B are C --- All A are C	All B are A All C are B --- All A are C

Syllogistic Moods

How many kinds of syllogistic inferences are there?

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  Thus $4 \times 4 \times 4 = 64$ different *moods*
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  Thus there are $64 \times 4 = 256$ possible forms of syllogistic inferences
- Note: only 15 of these are (universally) considered valid
  ... plus maybe 9 more if you assume *existential import*

(Textbook, pg. 3-3)

Extending Syllogistic Reasoning: more premises

Normally a syllogism only has two premises, but our system of syllogistic reasoning will work just as well with more...

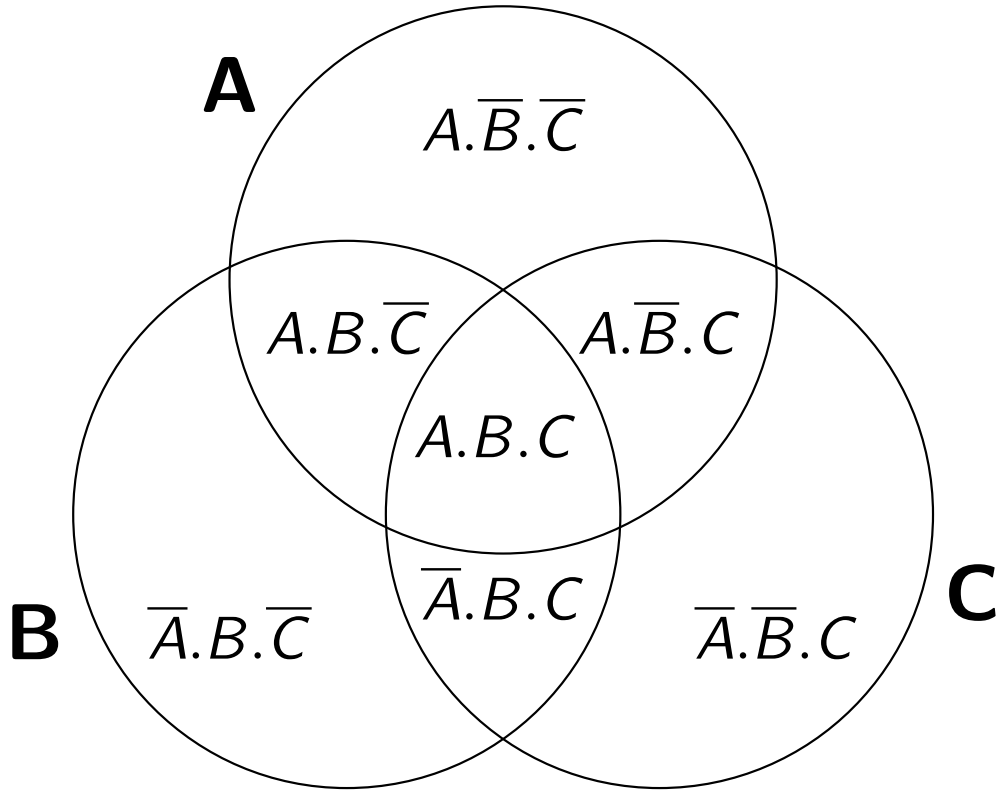
All Spartans are Greek
Some philosophers are Greek
No Spartans are philosophers

Some Greeks are not Spartans.

Note that there are still only three *predicates*.

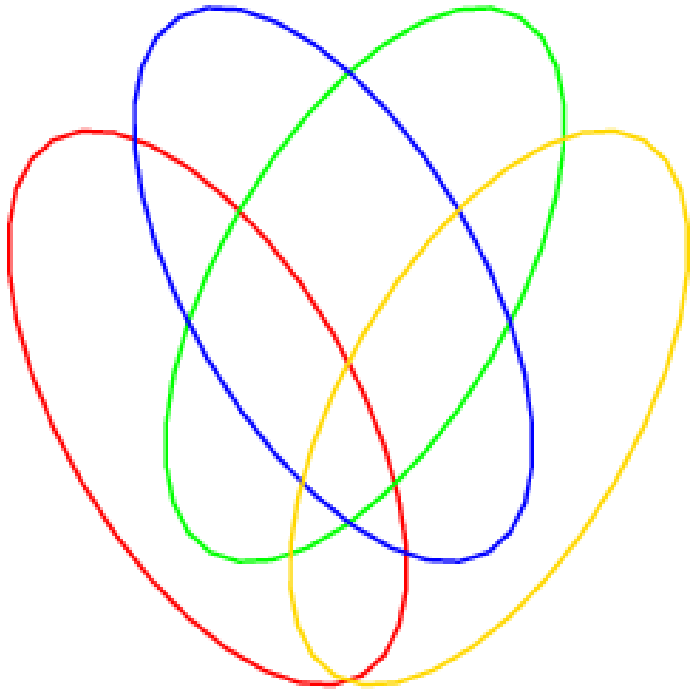
Standard Syllogistic Reasoning: 3 predicates

Working with *three* predicates always gives us the following kind of picture



Can we have pictures for more than 3 predicates?

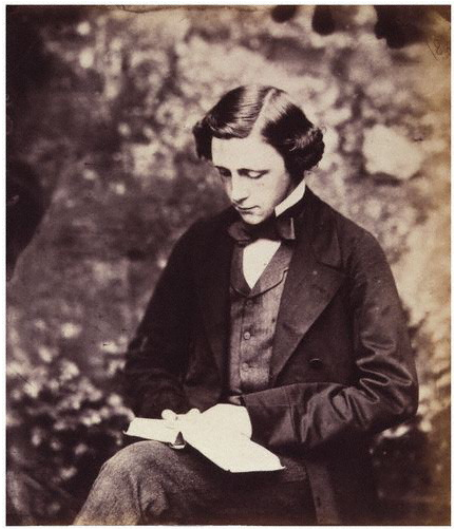
Extending Syllogistic Reasoning: 4 predicates



John Venn's diagram for 4 sets/predicates

Source: Frank Ruskey and Mark Weston
combinatorics.org

Lewis Carroll's diagrams



Lewis Carroll
(Charles Dodgson)
1832-1898

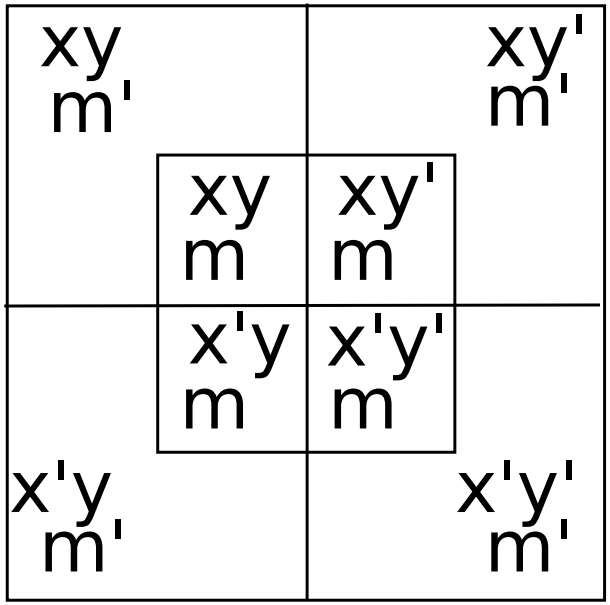
"The time has come," the Walrus said,
"To talk of many things:
Of shoes - and ships - and sealing-wax -
Of cabbages - and kings -
And why the sea is boiling hot -
And whether pigs have wings."

- *Through the Looking-Glass, and What Alice Found There*, 1871
- *The Game of Logic*, 1887
- *Symbolic Logic*, 1896

Lewis Carroll's diagrams

With each copy of this Book is given an Envelope, containing a Diagram (similar to the frontispiece) on card, and nine Counters, four red and five grey.

The Envelope, &c. an be had separately, at 3*d*. each.



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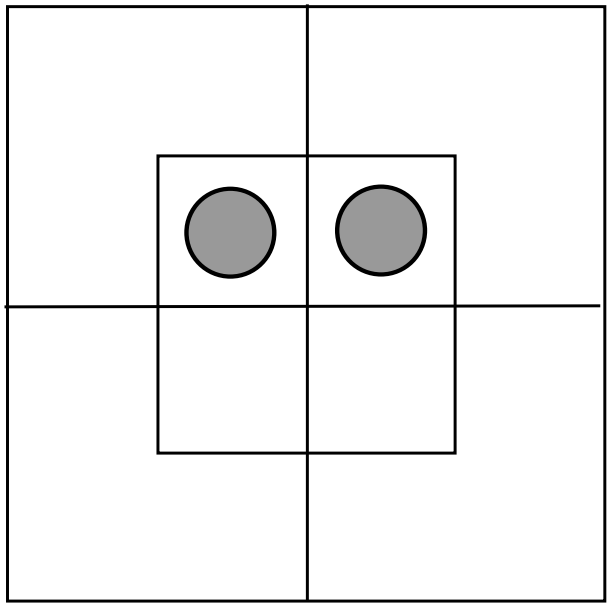
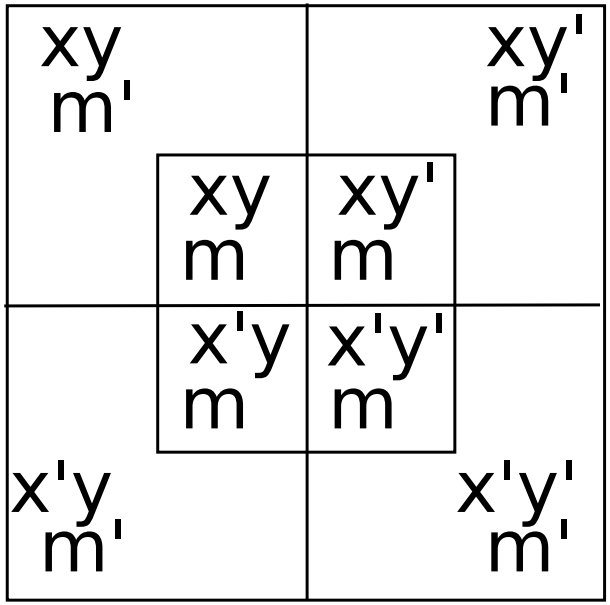


No x are m



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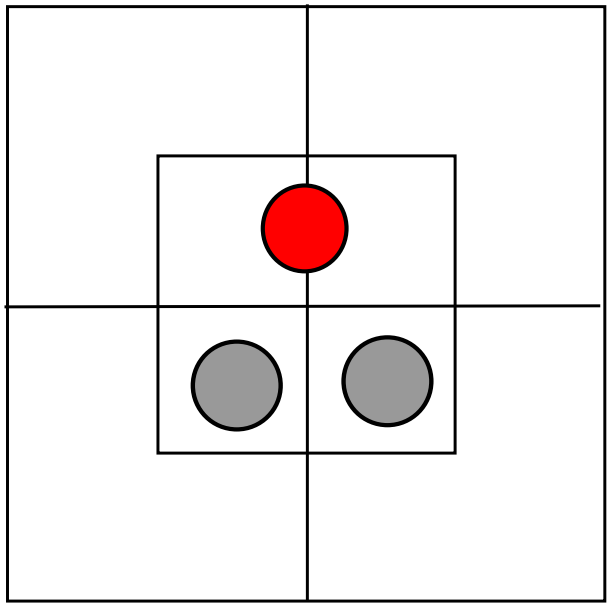
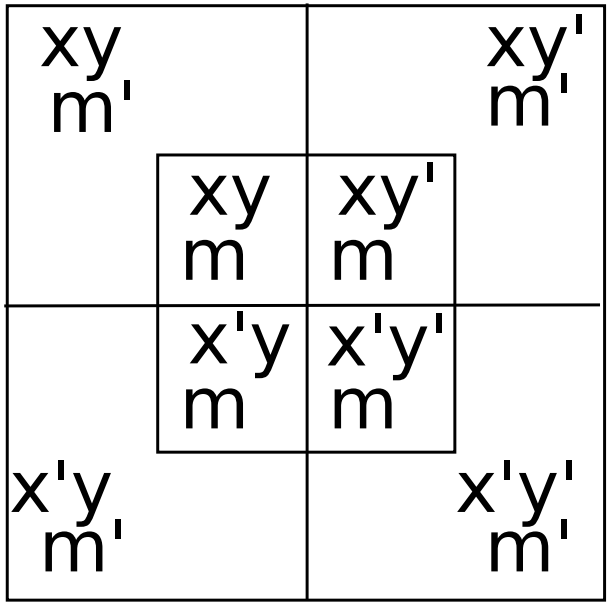


All m are x



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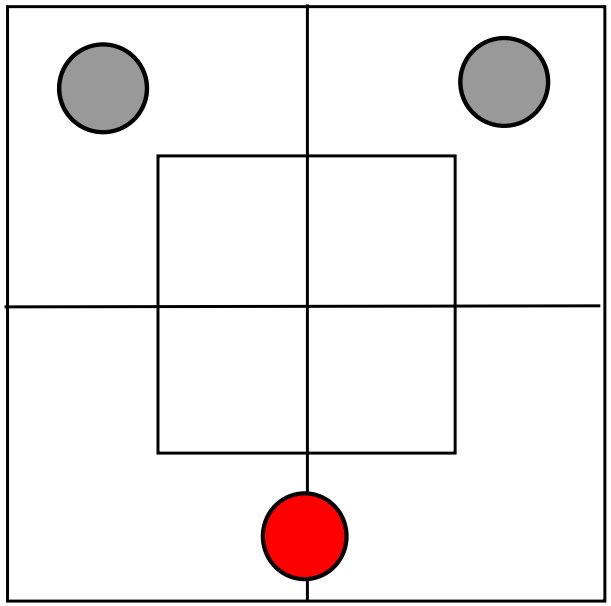
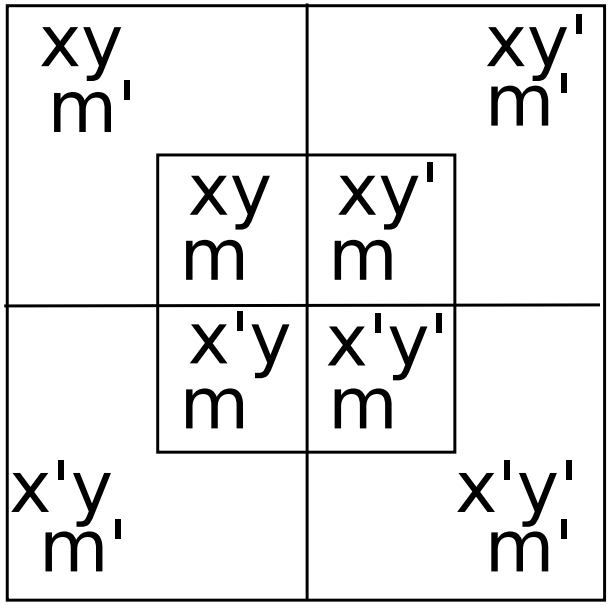
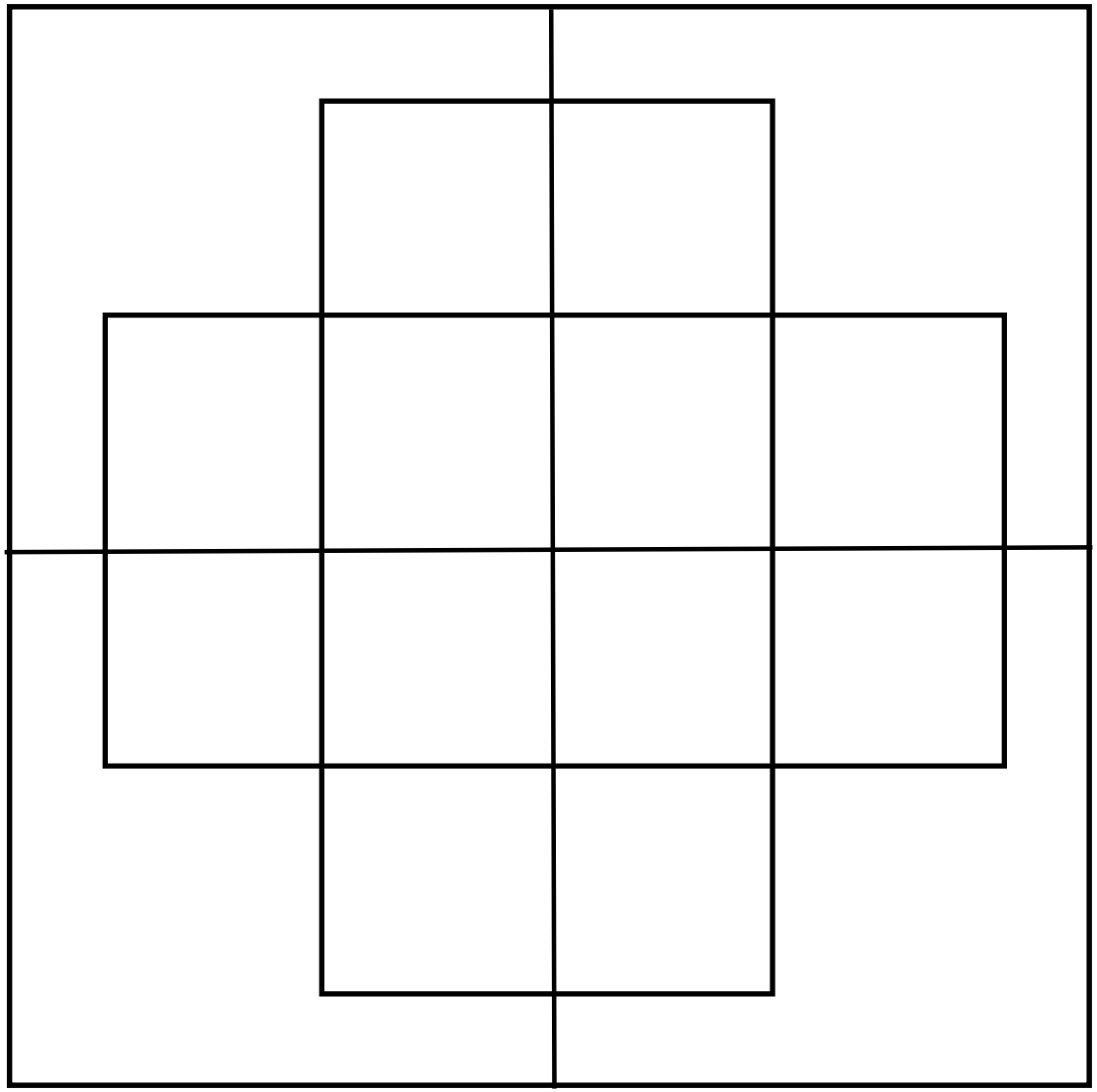


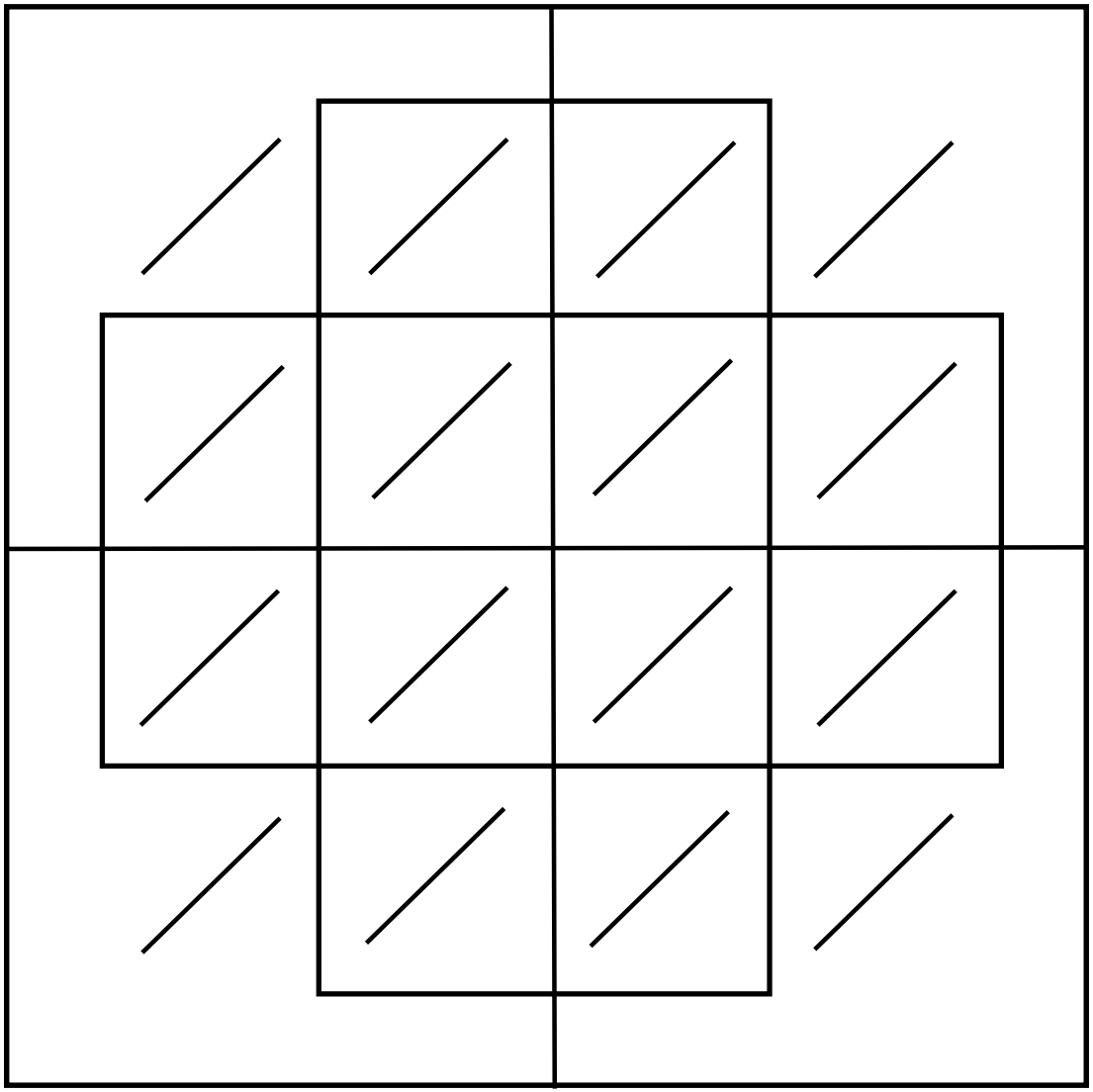
All m' are x'



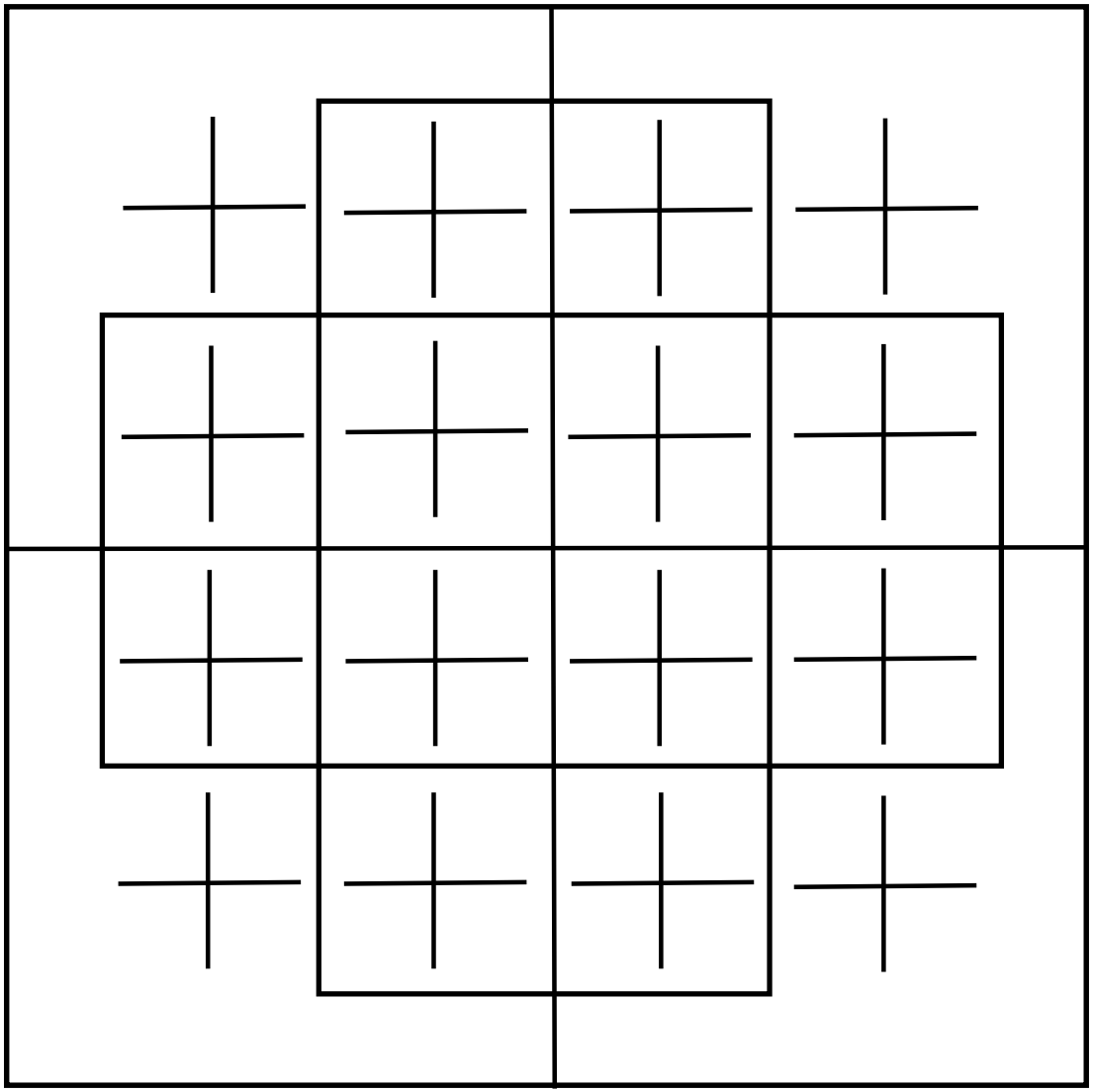
Lewis Carroll's diagrams: 4 predicates



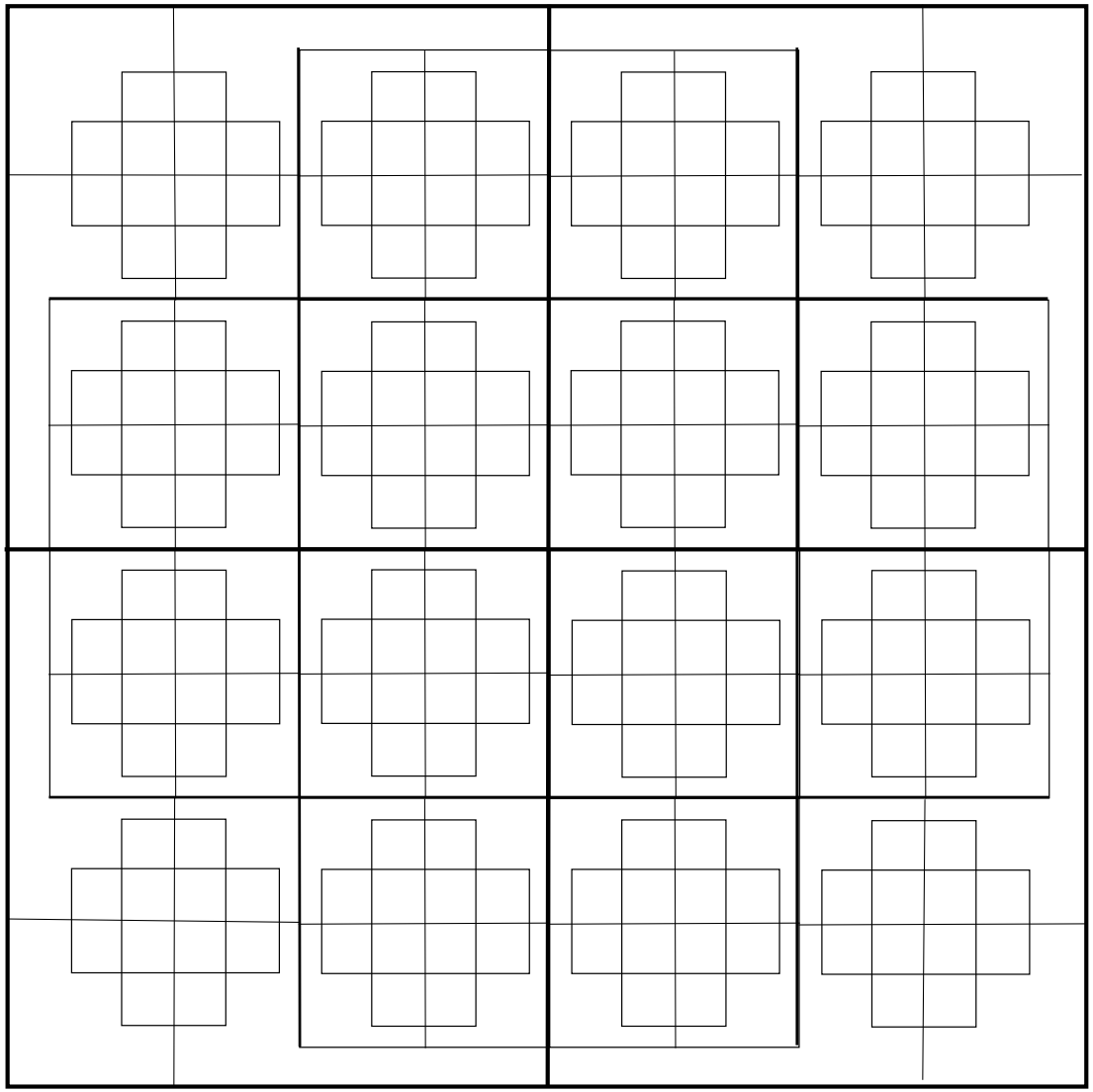
Lewis Carroll's diagrams: 5 predicates



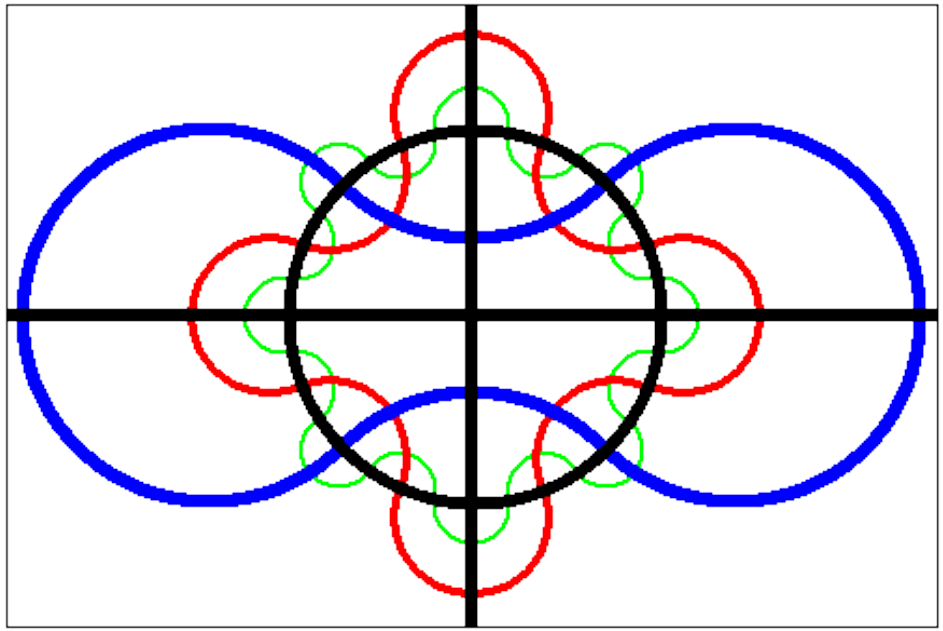
Lewis Carroll's diagrams: 6 predicates



Lewis Carroll's diagrams: 10 predicates



Extending Syllogistic Reasoning: 6 predicates



Anthony Edwards' diagram for 6 sets/predicates

Source: Frank Ruskey and Mark Weston
combinatorics.org