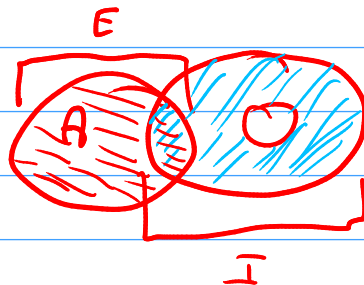


A - All atoms are red

E: No

I Some are

O: Some not



Finding 1: "some" is a subset of "all".

If something is true for some, it can be true  
for all

→ What are truth values?  
→

# Truth values, negations, quantifiers

Relationship between falsehood, negation and quantifiers (all and some).

What are Truth values?

Propositions are statements about the world.  
Describe how the world is.

Truth value is an indication whether the proposition was in accordance to the world or not.  
Truth value indicates whether there is a correspondence between what the proposition states with the help of language and how the world is.  
Propositions are truth-bearers.

Criteria of Truth  $\rightarrow$  test the truth values.

Our course

Truth value = logical value = Correspondence/relationship of the proposition to the world/reality.

Truth value  $\neq$  Truth  $\neq$  True  
 $\downarrow$  relationship between reality & proposition  $\downarrow$  reality  
One of the values of Truth value

In classical logic, only two truth values  
(and this course)

There are also multi-valued logic.

Binary truth value in classical logic allows for law of excluded middle (Either a statement or its negation is true).

Problem with Binary Truth value = Truth value of the events you have no means to test the truth value of (future events, past events which you never observed, feelings of others, cat in the schrodinger's box).

(you can't say if something is true if everybody else doesn't?)

For our course:

— Is the statement stating the reality  
Correct or not?

A proposition is either true or false, never both

> 1 truth  
intermediate

If you can't check the statement's truth value, do you consider it to be true unless proven false, or false unless proven true?

What about the truth values of statements about feelings, emotions, god, etc.?

'True' - tag given to  $\&$  propositions

└ True statement is an indication of correct/true status of world.

False is opposite of True

What is negation? How is it connected with falsehood

→ Operator that operates on a proposition

operators have an arity associated (e.g. John subtracts 2 from what?)  
(functions)

Negation has arity 1

There are 5 ways to express negation

- $P_3 = \text{John is happy}$
- (i) It is not the case that John is happy (It is not the case that)
  - (ii) It is false that John is happy (It is false that)
  - (iii) John is not happy
  - (iv) John is unhappy
  - (v) Symbolic logic expresses the negation of  $P$  as  $\sim P$
- (v)  $\sim P_3 \rightarrow$

False  $\neq$  negation

Truth value	operator on proposition
↓	(proposition $\rightarrow$ proposition $\Rightarrow$ ) generates new prop.
Status	i/p      o/p
	action

$\neg P$

not

$\supset P$

we will use  $\sim$ , chill

Thus, if a proposition is negated, then it IMPLIES that it is false.

If it is a  
Simple proposition

$P$  has a truth value,  $\sim P$  also has a truth value

$\sim P$  is not always false

$P = \text{Pigs can fly}$   
 $\sim P = \text{Pigs cannot fly}$   
In this case  $\sim P$  is true

No need to know the truth value of  $P$  in order to negate it. Any examples?

$P = \text{There is life on Alpha Centauri}$

$\sim P = \text{It is not the case that there is life on Alpha Centauri.}$

You don't need to explore Alpha Centauri to negate  $P$ . But in order to know which of the two propositions is true, and which one is false, you need to explore the star.

negation  $\neq$  negative quality

negative quality

$P_5 - \text{John is a boy}$   
 $\sim P_5 - \text{John is not a boy}$

Negation is not the same thing as the negative quality of a proposition.

Negative Quality = A proposition has negative quality when it declares a negative relationship between its Subject and predicate.

Some S is not P

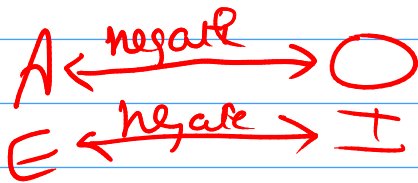
No S is P

Negation complicates the things when quantifiers are involved.

$P_6 = \text{All bitizens are boys}$   
 $\sim P_6 \rightarrow \text{Not All bitizens are boys}$

(But not "All bitizens are not boys")

There is at least 1 bitizen <sup>not</sup> boy  
Some bitizens are not boys



What is the negative of, P8 = Some BITSIANS are not boys.

$\sim$ P8 = It is not the case that (Some BITSIANS are not boys)

Paraphrase = It is not the case that (There is at least one BITSIAN who is girl)

Paraphrase = If you look at the entire population of BITSIAN, you will not find a girl.

Paraphrase = There are only boys in BITSIAN population

Paraphrase = All BITSIANS are boys.

So for P8 = Some BITSIAN is not boy.

$\sim$ P8 = All BITSIANS are boys.

Let's put the findings together:

Finding 1: "Some" is a subset of "All".

If something is true for "all" members of a set, it will be true for "some" members too.

Whenever A-type is true, I-type is true too.

Finding 2: "Some-not" is a subset of "No".

If something is true for "No" members, there will "not be some" (aka, any) member for whom it be true.

Whenever E-type is true, O-type is true too.

Finding 3: So the negation of "All Subj is Pred" is "Some Subj is not Pred".

This means that whenever "All" is false, "Some-not" is true.

Whenever A-type is false, O-type is true.

Finding4: So the negation of "Some Subj is not Pred" is "All Subj is Pred".

This means that whenever "Some-not" is false, "All" is true.

Whenever O-type is false, A-type is true.

Relationships among propositions:

Square of opposition