Propositional Logic

1.1

Proposition

A **proposition** is a declarative sentence that is either true or false, but not both

 Remember that a declarative sentence is a sentence that declares a fact!

Determine which sentences are propositions:

1. Odin is on our side.





1. What is a Viking's favorite food?

No cauestions are

7. Obey the Viking Code!



Never froposition)

1. Every Saxon is under attack.



Propositional Variables

Propositional Variables are variables used to denote propositions.

- conventional letters for propositional variables are p, q, r, s
- sometimes other letters are used but capital letters should never be used as they will be reserved for propositional functions.

Example: "Thor's hammer is named Mjölnir" could be denoted as **p.**

• At this point, anytime you see **p**, you know it means "Thor's hammer is named Mjölnir"

Negation of p

Consider a proposition, p. The negation of p is denoted by $\neg p$.

• In English, it is read as "It is not the case that *p.*"

Let's Negate!

1. Ronnie likes Taco Bell.

T: Rennie Likes faco bell

Tr: it is not the case that rounse (ikes taro bell

Coka: Ronnie doesn't like taco bell)

1. "Thor's hammer is not named Mjölnir" Let this be Tim

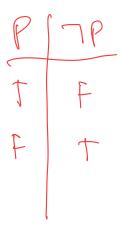
m: Thors hammer is named Mjonir

The 3 lines here means logically carrivant to

Truth Values and Truth Tables

A proposition can be either True (T) or False(F).

1. Suppose we have a proposition p. Create a truth table for p and $\neg p$



Conjunctions and Disjunctions

Let p and q be propositions:

- A **conjunction** of *p* and *q* is the statement "*p* and *q*"
 - o it is denoted as $p \land q$
 - **Both** p and q must be true for $p \land q$ to be true.

- A **disjunction** of p and q is the statement "p or q"
 - \circ it is denoted as $p \lor q$
 - p V q is true whenever p is true, q is true, or both p, q are true
 - inclusive or in apcs, regular or

Examples

Let *p* be the statement "Ronnie has 3 cats"

Let *q* be the statement "Ronnie does crossfit"

- 1. Find p V q Ronnie has 3 cuts or rounte does crossely
- 2. Find ¬p ∧ q Romune shown there I can't and does chocses

Translate into propositional logic A lucys define propositional Statement!

1. My first cat is Hazelnut and my second cat is Pistachio.

1. Thor is a deceiver or Loki is a deceiver.

Exclusive Or (XOR)

Let p and q be propositions:

- The exclusive or of p and q is the statement p XOR q
 - sometimes abbreviated as p ⊕ q
 - \circ Note that p \oplus q is true only when exactly one of p,q is true. It is false otherwise.
 - Also note that $p \oplus q$ can be written as $(p \lor q) \land \neg(p \land q)$
- 1. Let p and q be the propositions that state "A student can have a salad with dinner" and "A student can have soup with dinner," respectively. What is p ⊕ q, the exclusive or of p and q?

Student con have salad y dinner or student Can have soup of donner, but not both

1. Why is the statement "I will use all my savings to travel to Europe or to buy an electric car" an example of **exclusive or?**

Inter xor 6/c you can only use "all my savings" on 1 thing.