

LOAL - Assignment: Introduction To Propositional Logic

Objective

Get familiar with the general concepts of propositional logic.

Things To Learn

- Creating truth tables
- *Translating* natural sentences into propositional logic

Materials

- Pen and paper

Submission Guidelines

Solve the following tasks on a sheet of paper in a **neat and readable form** (including headlines!). Submit either scans or high-quality-photographs of your work assembled in a *.zip*-file or a *.pdf*-document.

Tasks

1. Prove Equivalence Using Truth Tables

Let P and Q be two propositional formulas as defined below. Show that $P \equiv Q$ holds.

a.

$$P \equiv \neg(A \vee B)$$

$$Q \equiv \neg A \wedge \neg B$$

b.

$$P \equiv A \implies \neg B$$

$$Q \equiv \neg(A \wedge B)$$

2. De Morgan's laws

Take a close look at *De Morgan's laws*. Give a *sound* example for one of the cases to show how it applies to the real world.

a.

$$\neg A \vee \neg B \equiv \neg(A \wedge B)$$

Example: *I don't have a cat or I don't have a dog* is equivalent to *I don't have **both** cat and dog.*

b.

$$\neg A \wedge \neg B \equiv \neg(A \vee B)$$

Example: *I drink coffee without milk and without sugar* is equivalent to *My coffee contains **neither** milk **nor** sugar.*

3. Recreate Sentences Using Propositions

You have the following propositions:

A ... It's cold.

B ... It's breezy.

Use these propositions to recreate the following sentences as propositional formulas and create a *truth table* for each one!

1. *It's cold and breezy.*
2. *It's cold but not breezy.*
3. *It's not cold and not breezy.*
4. *It's either cold or breezy (or both).*
5. *It's cold or breezy, but it's not breezy when it's cold.*
6. *When it's breezy, it's cold.*

5. Translate Complex Sentences

Translate the following German sentences as adequately as possible into the language of propositional logic. Define the propositions you used as shown in class (e.g. $S = \text{It's sunday.}$).

1. *Im Donauparkstadion trinke ich gerne einen Radler oder esse eine Bosna - aber nur wenn sie vegane Würstchen haben! Manchmal konsumiere ich auch beides.*
2. *Mittwochs gehen wir zur Schule und lernen DSAI oder C#, aber nur, wenn es kein Feiertag ist. Wenn es aber Feiertag ist, sind wir unglücklich.*