

PHL245 Lecture Notes

MAX XU

'25 Winter Semester

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§1 Day 1: Course Details, Arguments, and Validity (Jan. 6, 2025)

§1.1 About this Course

1. Course email
2. Quercus
3. Lectures on Mondays and Wednesdays
4. Office hours on Thursdays!

First half of the course will be sentential logic, while the second half will be about predicate logic. This course is actually hybrid! For this reason, **sometimes the lecture on Wednesday won't happen**. When sending emails to the course email, include LEC 5101 and your Student Number. Assignments are due at 11:59PM on Sundays. Refer to the [syllabus](#) for the latest details.

§1.2 Arguments and Validity

Arguments are sequences of statements, which are either true (T) or false (F). Such statements consists of 2 parts:

1. Premise
2. Conclusion

If the premise makes it more likely that the conclusion is true, it is an *inductive* argument. If the premise is best explained by the conclusion, it is an *abductive* argument. If the premise necessitates the conclusion, it is a *deductive* argument, which logically guarantees the conclusion. Such an argument is 'good' if and only if it is **valid** and **sound**.

Definition 1.1 (Validity). It's not possible for all of the premises P to be true and for the conclusion Q to be false.

$$\neg(P \wedge \neg Q) \iff (\neg P \vee Q) \iff (P \implies Q)$$

Definition 1.2 (Soundness). An argument is sound if and only if the argument is valid and all of its premises are "actually" true

For the sake of argument, we suppose (or assume by hypothesis) that the premises are true to analyze the statement's validity.

Definition 1.3 (Logical OR (Disjunction)). An infix binary logical connective¹ denoted by \vee . The inputs are called **disjuncts**.

| P | Q | $P \vee Q$ |
|-----|-----|------------|
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | F |

¹joins things together (in this case binary indicates 2, unary indicates 1...)

Definition 1.4 (Logical AND (Conjunction)). An infix binary logical connective denoted by \wedge . The inputs are called **conjuncts**.

| P | Q | $P \wedge Q$ |
|-----|-----|--------------|
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | F |

Definition 1.5 (Negation (NOT)). An infix unary logical connective denoted by \sim or \neg . The input is called the **negand**.

| P | $\neg P$ |
|-----|----------|
| T | F |
| F | T |

Problem 1.6

Are the following arguments **valid** and **sound**? When isn't the argument sound?

1. If the ground is raining, then the ground is wet.
2. If all humans are mortal, then I (a human) am immortal.
3. If $P \wedge \neg P$, then Q .
4. If $(P \vee Q) \wedge (Q \vee R)$, then $P \vee R$,

Bonus: Recall the definition of a 'good' argument. What do you notice about the premise(s) and the conclusion(s) of a 'good' argument?