Deduction versus induction

Direct Proof

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Autumn 2013 – Part 2/Session 4/Video 5
Recorded: 18th September 2015

An example

If you do every exercise in the module, then you pass the exam.

$$s := \text{you do every exercise in the module,} \tag{1}$$
$$t := \text{you pass the exam} \tag{2}$$

$$s \Rightarrow t \tag{3}$$

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Induction

If you do every exercise in the module, then you pass the exam.

1. Now, suppose you pass the exam
2. Therefore, you have done all the exercise.

Is this argument valid?

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Induction

False arguments

- We know $s \Rightarrow t$ and t
- We try to conclude s
- This is called induction

This is the opposite of modus ponens, which would assume s and prove t.

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False generalisation

Students who do all exercises are students who pass the exam.

- S is set of students who do all exercises
- T is set of students who pass the exam
- The premise is that $S \subset T$

Modus ponens observe $x \in S$ and conclude that $s \in T$
special case

Induction observe $x \in T$ and conclude that $s \in S$
Generalising from the subset S to the rest of T

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Summary

From $p \Rightarrow q$ and q, we can conclude nothing.