

# Discrete Structures (2IT50)

## Feedback on Homework

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Here are some of the things that I encountered.

### Readability of handwriting

- Major difficulties in reading text and or formulae
- Some words or symbols are not readable  
E.g.:  $R^+$  looks like  $R^\top$

### Level of Rigor

- Does not look like a proof [0 points]
- Handwaving and storytelling [usually 0 points]
- Use of ‘...’ [usually leads to a deduction in points]
- Natural deduction with flags and/or calculations [no deduction, but in the longer run, textual proofs are more efficient]

Preferred: Textual proof with formulae and/or calculations

### Notation

- Abusing  $\Rightarrow$  for ‘the next formula follows from the preceding’

### Accompanying Natural Language Text

- Missing
- Misleading

Clearly distinguish

- Predicate whose validity follows immediately from a definition, theorem, or lemma (‘According to Theorem Xyz, we have  $P$ .’)
- Predicate whose validity is given in the problem statement (‘Given is  $P$ .’)
- Predicate whose validity is assumed (to prove an implication) (‘We now assume  $P$ .’)

- Predicate whose validity is to be proven (proof goal) ('To prove:  $P$ ')
- Formula that is part of a calculation

Each free variable must be introduced ('Let  $n \in V$ '), usually together with its type and relevant constraint on its values.

**Calculation Format** Use the vertical format, where lines alternate between

- a single formula (first and last), and
- a relationship ( $\stackrel{\text{val}}{=}$ ,  $\stackrel{\text{val}}{=}$ ,  $=$ ,  $\subseteq$ , ...) and a motivation between braces ( $\{\dots\}$ )

Do not condense it. Every step needs a motivation.

**Motivation for Deductive or Computational Step**

- Missing
- Incomplete
- Irrelevant

**Inductive Proof** Missing one or more of

1. Statement that proof is by induction, and on what one inducts: 'We prove by induction on  $n$ '; it should also be clear what one intends to prove.
2. Base and Step
3. (in Step) Introduction of induction variable and how it is constrained
4. (in Step) Statement of the Induction Hypothesis (involving the induction variable)
5. (in Step) Application of the Induction Hypothesis

All 5 items are required.

**Miscellaneous**

- In calculations, some parts of a formula do not change over many steps (consider splitting the formula; focus on what is essential; abstract from what is irrelevant).
- Reasoning in terms of 'low-level' definitions (rather, use relevant properties, lemmata, theorems).

Special case: Reasoning in terms of specific elements of a set. (rather, reason about the set as a whole; known as 'pointfree' reasoning). Note that relations and functions are also sets.