Proof-Writing Criteria & Guidelines

15-312 Principles of Programming Languages

Spring 2017

To help you learn to write more rigorous proofs as well as to reason about inference rule-based systems more effectively, we'll be using the following criteria to evaluate proofs you write in this class.

Rubric

These points will all directly affect scores assigned to proofs.

The phrase "abundantly clear" is used to mean "the proof cannot be made significantly more clear by being explicit or verbose." That is, the proof is already as clear or nearly as clear as it can be.

1. When using rule induction, the proof explicitly states which judgement(s) the rule induction is being carried out over.
2. Whenever referencing a property $\mathcal{P}(e)$ in a proof, $\mathcal{P}(e)$ is explicitly stated, or it is abundantly clear what $\mathcal{P}(e)$ refers to.
3. Before using a lemma as a justification in a proof (for example, "Canonical Forms for X" or "Inversion for Y"), the lemma is explicitly restated.
4. It is abundantly clear what the IH is for relevant cases of a rule induction proof.
5. Applications of the IH assumption are abundantly clear.
6. Justifications for intermediate assertions or final conclusions are abundantly clear.

Ultimately, proof clarity is at the discretion of the grader, though you may request that a grader reconsider your proof with a regrade request.

Guidelines

In the interest of suggesting a way of structuring your proof for clarity, you are strongly encouraged (but are not required) to follow these guidelines when

writing your proofs.

1. Restate what you are going to prove as it was stated in the handout.
2. When your proof proceeds by rule induction, state this.
3. In each case of a rule induction proof, instantiate the claim you are trying to prove to this specific case, and state it. Note that rule induction proofs generally rely on constructing larger objects, rather than de-structuring or "pattern matching" objects into smaller ones.
4. Show all intermediate steps. When proving a multi-faceted property, iteratively modify and restate what you are currently trying to show.
5. Put each intermediate conclusion on its own line, and number it. This makes it easier to be clear about which results justify others by referencing the justifications to the left of the result.

Examples

It's best to see what a good proof looks like by studying good examples. The first recitation handout is a good case study.

- http://www.cs.cmu.edu/~rwh/courses/ppl/recitations/recitation01-simulinduction.pdf

Also, be sure to read the assignment solutions when they come out for examples of what's expected in your proofs.