Programming Theory

— Comments on Bonus assignment 2 —

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Here are some common mistakes made in the second bonus assignment:

• Notation, look at a proof in the compendium and compare it with yours, layout should look the same, i.e.,

\[
\begin{align*}
F_0 &= \{R_1\} \\
F_1 &= \{R_2\} \\
& \vdots \\
F_n &= \{R_n\}
\end{align*}
\]

• State all arithmetic rules you use.

• If you use definition of assignment and derive textual substitution, then you must use the textual substitution rule to perform the actual substitution!

• Proofs should like in the compendium, which means that no textual arguments are allowed when performing proof steps. By textual argument I mean a sentence or a paragraph arguing why a step can be made.

• There are three proof methods shown in the begining of the course, stick to those. This means that you can make assumptions when starting a proof and not in a random spot in the proof. Also, always clearly state what you’re proving and using which method. When you do this, it is less likely to make a mistake in your proof.

• Meta reasoning about assumptions is not allowed. If you want to derive something from assumptions directly, write a lemma and then use it in your proof.

• Lemmas should be stated clearly and outside of the body of main proof. State the lemma, then prove it. Assumptions made in the main proof cannot be used in the lemma proof. If you want to do that, those assumptions need to be part of the lemma you’re proving. Once proved, lemma can be used in the main proof using, e.g., conditional substitution or modus ponens, depending on its form.
• Assumptions of the form $A \lor B$ cannot be used directly to show that $A$ is true!!! You need to weaken $A$ to $A \lor B$ and then you can derive that it’s true by assumption.

• Think carefully when using arithmetic rules! Several people used

$$\{\text{Arithmetic} : "(x < y \lor x > y) = T"\}$$

which is false, since it doesn’t hold when $x$ and $y$ have the same value. Consider all the cases carefully, instead of blindly applying arithmetic rules which would conveniently (and incorrectly) solve your problem in one step. Also, if an arithmetic rule is not obvious and it is not in the compendium, you need to prove it!

• Substitution cannot be used for integer equalities! Instead, you should use definition of equality $(x = y) = (x \leq y \land x \geq y)$ and proceed with the proof.

• You need to state what you need to prove in order for the program to be correct according to Alternative Command Theorem.

Another advice, read your solution carefully before handing it in. There are many errors which could be avoided just by proof reading and that cost you points, because I can’t tell whether it’s a typo or something else.

Any of the above, that was already discussed after the first bonus assignment, cost you roughly half of earned total points on this assignment (i.e., notation, arithmetic, lemmas, etc.). You can send me an email if you want to take a look at your assignment, and we can schedule a meeting sometime during next week.