(for this homework and for life in general)



(for this homework and for life in general)



Include your name in papers you hand in. Anonymous documents never look good.





(for this homework and for life in general)

Include your name in papers you hand in. Anonymous documents never look good.

Read assignments thoroughly. Make sure you understand what you are asked to do.





(for this homework and for life in general)

Include your name in papers you hand in. Anonymous documents never look good.

Read assignments thoroughly. Make sure you understand what you are asked to do.

ppp Answer the questions you are asked.





(for this homework and for life in general)

Include your name in papers you hand in. Anonymous documents never look good.

Read assignments thoroughly. Make sure you understand what you are asked to do.

ppp Answer the questions you are asked.

In our case: *"determine which invariant preservation proofs (if any) would have failed"*. A (hard to follow) proof that does not mention what is being attempted and whether the proof is or not successful is difficult to understand and, therefore, evaluate. Formally it could be an F (or zero, in numeric terms), as the question asked has not been answered!



(for this homework and for life in general)

If you write by hand, please be **extra clear** and careful. Strike-through, bent, slanted, uneven lines: simply more difficult to understand. Do not squeeze words, symbols, in a small space. Send documents easily readable on a screen (e.g., avoid dark backgrounds, photographs of wrinkled papers, ...).





 All the proofs we have been doing have the form of sequents.
 Hypotheses ⊢ *Goal* is the standard form for a sequent. That is what we have been using so far.
 Other forms of proofs not admissible. The assignment was explicit about this, I sent a reminder, and clarified it in the classroom.





All the proofs we have been doing have the form of sequents. *Hypotheses* \vdash *Goal* is the standard form for a sequent. That is what we have been using so far. Other forms of proofs not admissible. The assignment was explicit about this. I sent a reminder, and clarified it in the classroom. Sequents make the scenario (*Hypotheses*) and the objective (*Goal*) clear and non-ambiguous. Some of you sent proofs not adhering to this standard. Most of them are very unclear as what you are starting with, what you are trying to

prove, and what are the steps are very confusing!

At this stage we do **not** work with the code / model. All relevant information is in the sequent.





Is $H \vdash b < b$ a valid deduction?



Is $H \vdash b < b$ a valid deduction? Depends: if H inconsistent, the deduction is valid. $x > b, x < 0, b > 0 \vdash b < b$ valid It is an instance of the inference rule $\perp \vdash Q$





Is $H \vdash b < b$ a valid deduction? Depends: if H inconsistent, the deduction is valid. $x > b, x < 0, b > 0 \vdash b < b$ valid It is an instance of the inference rule $\perp \vdash Q$ $b > 0 \vdash b < 0$ $b > 0 \vdash b < 0$ MON



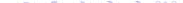


Is $H \vdash b < b$ a valid deduction? Depends: if H inconsistent, the deduction is valid. $x > b, x < 0, b > 0 \vdash b < b$ valid It is an instance of the inference rule $\perp \vdash Q$ $\frac{b > 0 \vdash b < 0}{b = 0, b > 0 \vdash b < 0}$ MON





$\Gamma \vdash \Delta$ valid if every valuation that makes Γ true makes Δ true as well.





 $\Gamma \vdash \Delta$ valid if every valuation that makes Γ true makes Δ true as well. Enumerating all possible scenarios where Γ holds and, for every one, check if Δ is infeasible. That is why we make proofs.





 Γ ⊢ △ valid if every valuation that makes Γ true makes △ true as well.

 Enumerating all possible scenarios where Γ holds and, for every one, check if △ is infeasible. That is why we make proofs.

 $\Gamma \vdash \Delta$: if Γ true (for a valuation) and Δ false (for the same), sequent not valid. This is a counterexample. If you have a counterexample, the sequent cannot be proven.





 $\Gamma \vdash \Delta$ valid if every valuation that makes Γ true makes Δ true as well. Enumerating all possible scenarios where Γ holds and, for every one, check if Δ is infeasible. That is why we make proofs.

 $\Gamma \vdash \Delta$: if Γ true (for a valuation) and Δ false (for the same), sequent not valid. This is a counterexample. If you have a counterexample, the sequent cannot be proven.

From the homework: "You can either find out a counterexample (a scenario / variable valuation that is consistent with the hypotheses but makes the goal false)..."



 $\Gamma \vdash \Delta$ valid if every valuation that makes Γ true makes Δ true as well. Enumerating all possible scenarios where Γ holds and, for every one, check if Δ is infeasible. That is why we make proofs.

 $\Gamma \vdash \Delta$: if Γ true (for a valuation) and Δ false (for the same), sequent not valid. This is a counterexample. If you have a counterexample, the sequent cannot be proven.

From the homework: "You can either find out a counterexample (a scenario / variable valuation that is consistent with the hypotheses but makes the goal false)..."

We are not looking for an execution that violates the invariant, but which proofs of the invariant fail.

You can have an invariant that passes invariant preservation, but which would be false after an "execution" step.



We are stressing the process, not a particular result.





We are stressing the process, not a particular result. Sound processes make it possible to always obtain correct results.

