

FPV Week 1: Implications, Assertions and Conditions



Exercises

- There will be tutorial exercises every week
- In non-programming weeks, there will be quizzes to be solved during tutorials
- In programming weeks, there will be homework
- All exercises will be managed on Artemis
artemis.ase.in.tum.de
- Programming exercises will be graded automatically, with secret tests
- This means you see your results already before the deadline ("What you see is what you get")

- Successful participation ($\geq 70\%$) in quizzes and programming tasks will lead to a bonus of 0.3 in the final exam, provided that you passed the exam.
- Programming homework and quizzes are to be submitted individually.
- Discussing solutions before the end of the week is considered plagiarism.
- Plagiarism will not be tolerated and will (at the very least) lead to exclusion from the bonus system

Material

The screenshot shows a GitHub repository page for 'Funky-Punky / FPV_SoSe23_Mo-15-17'. The repository is public and has a 'main' branch with 1 branch and 0 tags. The file list shows three files: 'Funky-Punky' (Create README.md, 40 minutes ago, 2 commits), '.gitignore' (Initial commit, 41 minutes ago), and 'README.md' (Create README.md, 40 minutes ago). The 'README.md' file is open, showing the text: 'Materialien für das FPV Tutorium von Jonas im SoSe23 Montag von 15 bis 17 Uhr' and 'Hier ist der Zulip Stream: https://zulip.in.tum.de/#narrow/stream/1613-FPV_Mo-15-17.2C-1'. The right sidebar contains the 'About' section with the description 'Materialien für das FPV Tutorium von Jonas im SoSe23 Montag von 15 bis 17 Uhr', '0 stars', '1 watching', and '0 forks'. Below this are sections for 'Releases' (No releases published) and 'Packages' (No packages published).

Funky-Punky / **FPV_SoSe23_Mo-15-17** Public

[Code](#) [Issues](#) [Pull requests](#) [Actions](#) [Projects](#) [Wiki](#) [Security](#) [Insights](#) [Settings](#)

main 1 branch 0 tags

Go to file Add file <> Code

File	Commit	Time
Funky-Punky	Create README.md	fb80986 40 minutes ago 2 commits
.gitignore	Initial commit	41 minutes ago
README.md	Create README.md	40 minutes ago

README.md

Materialien für das FPV Tutorium von Jonas im SoSe23 Montag von 15 bis 17 Uhr

Hier ist der Zulip Stream: https://zulip.in.tum.de/#narrow/stream/1613-FPV_Mo-15-17.2C-1

About

Materialien für das FPV Tutorium von Jonas im SoSe23 Montag von 15 bis 17 Uhr

Readme

0 stars

1 watching

0 forks

Releases

No releases published

[Create a new release](#)

Packages

No packages published

[Publish your first package](#)

https://github.com/Funky-Punky/FPV_SoSe23_Mo-15-17

Quiz

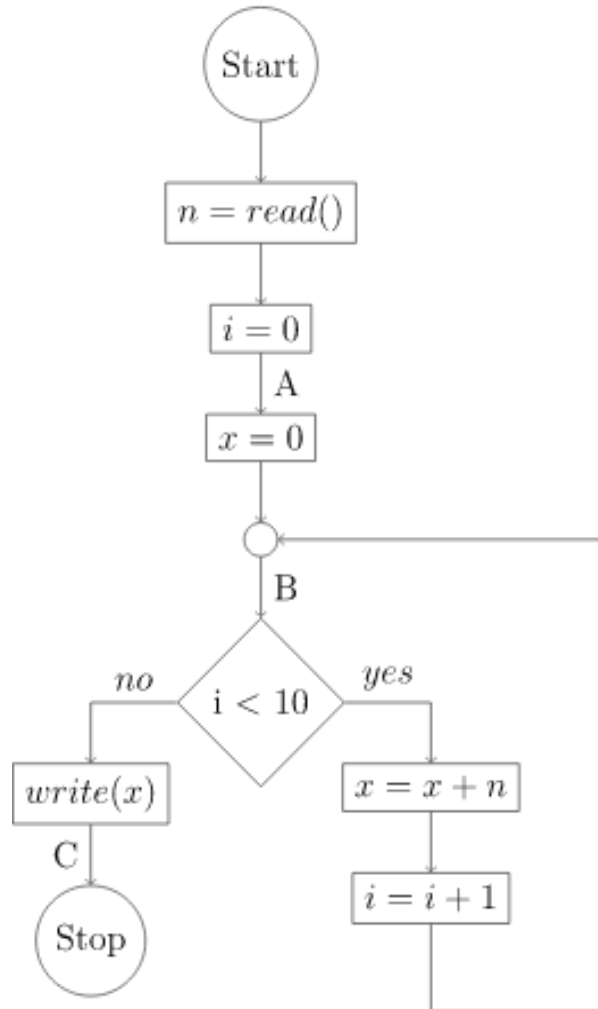
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Week 01 Tutorial 01 Recap: Implications

1. $x = 1 \implies 0 < x$ ✓
2. $x < 6 \implies x = 3$ ✗
3. $x > 0 \implies x \geq 0$ ✓
4. $x = -2 \implies x < -1 \vee x > 1$ ✓
5. $x = 0 \vee x = 7 \implies 4 \neq x$ ✓
6. $x = 1 \implies x \leq 3 \wedge y > 0$ ✗
7. $x < 8 \wedge y = x \implies y \neq 12$ ✓
8. $x = 1 \vee y = 1 \implies x > 0$ ✗
9. $x \neq 5 \implies \text{false}$ ✗
10. $\text{true} \implies x \neq y$ ✗
11. $\text{false} \implies x = 1$ ✓
12. $x \geq 1 \implies 2x + 3 = 5$ ✗
13. $A \wedge x = y \implies A$ ✓
14. $B \implies A \vee B$ ✓
15. $A \implies (B \implies A)$ ✓
16. $(A \implies B) \implies A$ ✗
true \rightarrow false $A \equiv \text{false}$
 $B \equiv \text{false}$

A	B	$A \implies B$
0	0	1
0	1	1
1	0	0
1	1	1

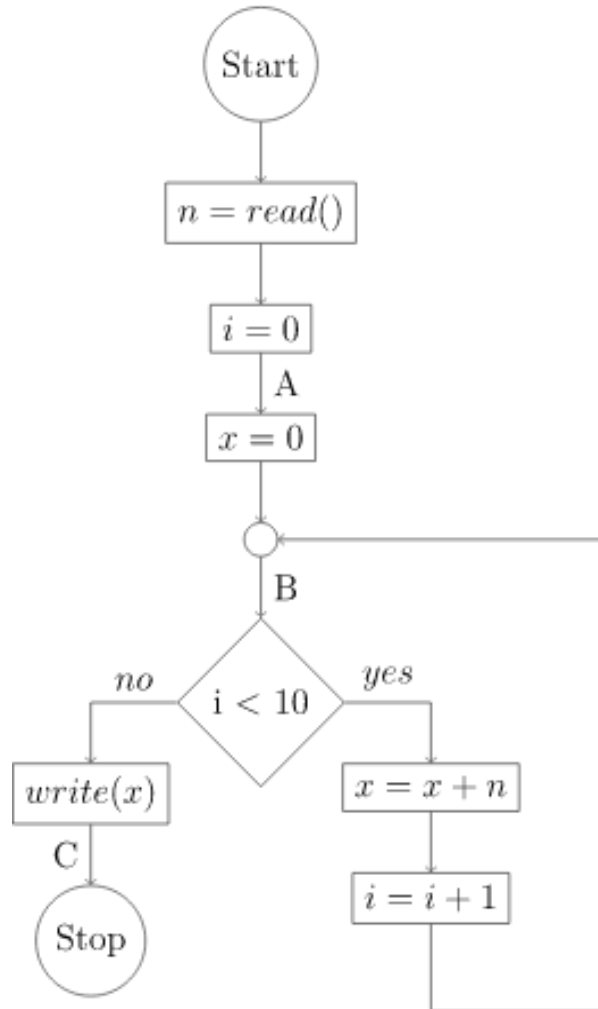
Week 01 Tutorial 02 Assertions



1. Which of the following assertions hold at point **A**?

- ☐ a) $i \geq 0$ ✓
- ☐ b) $x = 0$
- ☐ c) $i \leq 10 \wedge x \neq 0$
- ☐ d) *true* ✓
- ☒ e) $i = 0$ ✓
- ☐ f) $x = i$

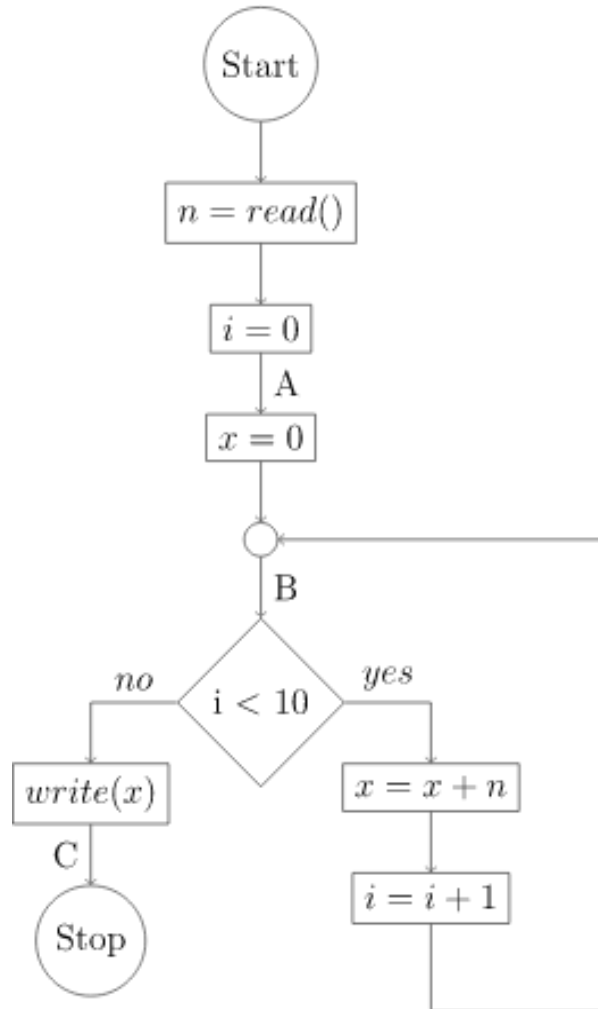
Week 01 Tutorial 02 Assertions



2. Which of the following assertions hold at point B ?

- a) $x = 0 \wedge i = 0$
- b) $x = i$
- c) $i < x$
- d) $0 \leq i \leq 10$ ✓
- e) $i \geq 0 \wedge x \geq 0$
- f) $n = 1 \implies x = i$ ✓

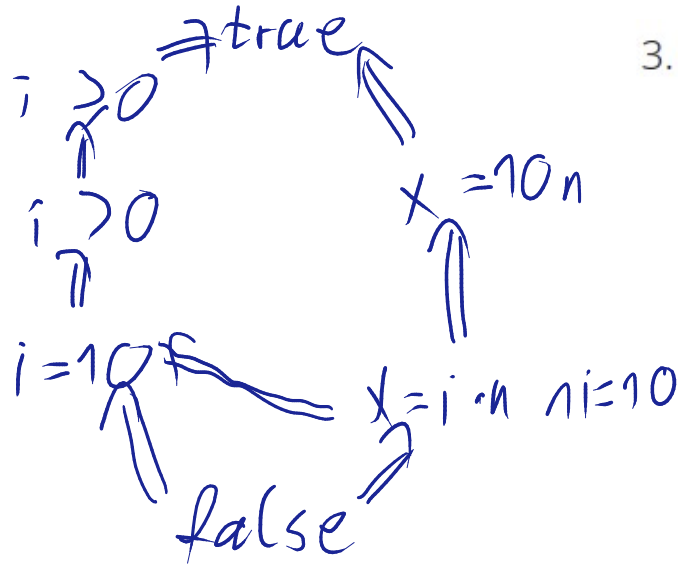
Week 01 Tutorial 02 Assertions



3. Which of the following assertions hold at point C ?

- a) $i \geq 0$
- b) $i = 10$
- c) $i > 0$
- d) $x \neq n$
- e) $x = 10n$
- f) $x = i * n \wedge i = 10$

Week 01 Tutorial 03 The Strong and the Weak



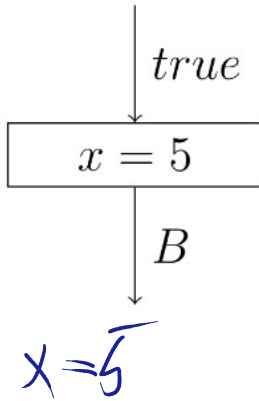
3. Which of the following assertions hold at point *C*?

- a) $i \geq 0$
- b) $i = 10$
- c) $i > 0$
- d) $x \neq n$
- e) $x = 10n$
- f) $x = i * n \wedge i = 10$

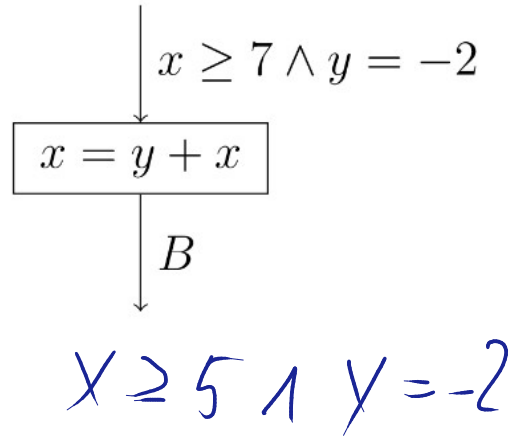
1. When annotating the control flow graph, can you say that one of the given assertions is "better" than the others?
2. Can you arrange the given assertions in a meaningful order?
3. How can you define a *stronger than* relation formally?
4. How do *true* and *false* fit in and what is their meaning as an assertion?
5. What are the strongest assertions that still hold at *A*, *B* and *C*?

Week 01 Tutorial 04 Strongest Postconditions

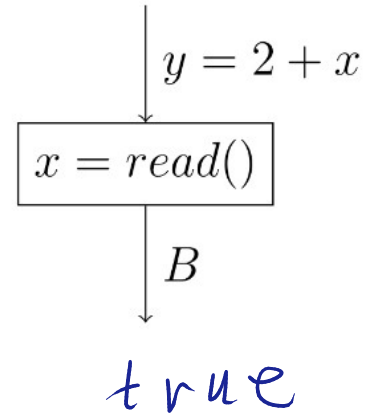
1.



3.

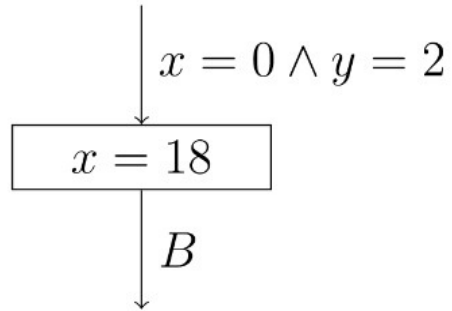


5.



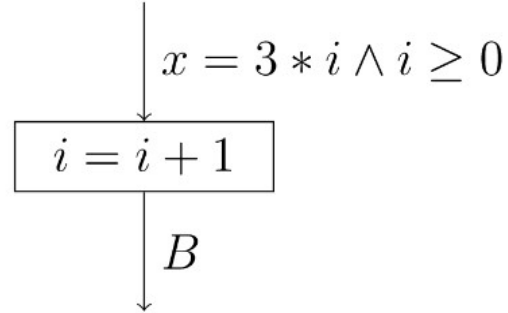
Week 01 Tutorial 04 Strongest Postconditions

2.



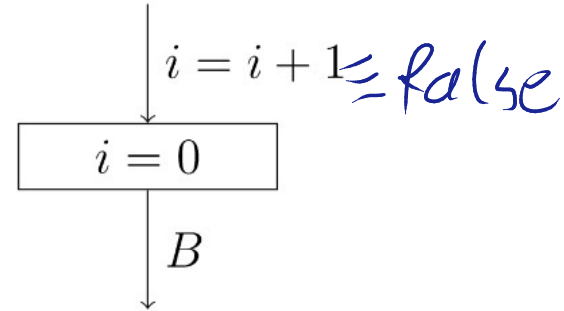
$x = 18 \wedge y = 2$

4.



$x = 3 \cdot (i - 1) \wedge i > 0$

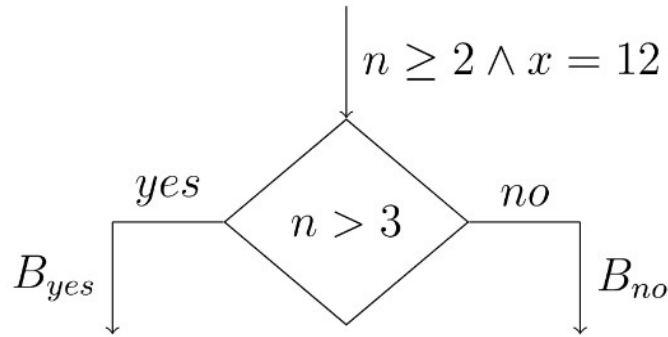
6.



~~$i = 0$~~
 false

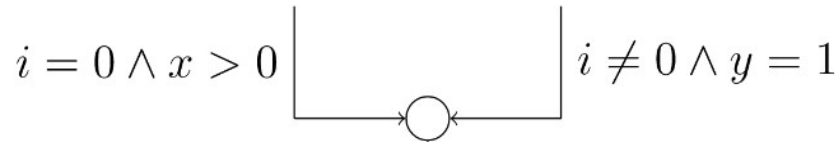
Week 01 Tutorial 04 Strongest Postconditions

7.



$$\wedge \begin{matrix} n > 3 \\ x = 12 \end{matrix}$$

9.



$$\left(\begin{matrix} i = 0 \\ \wedge x > 0 \end{matrix} \right) \vee \left(\begin{matrix} i \neq 0 \\ \wedge y = 1 \end{matrix} \right)$$

8.

