FPV Week 1: Implications, Assertions and Conditions

Exercises

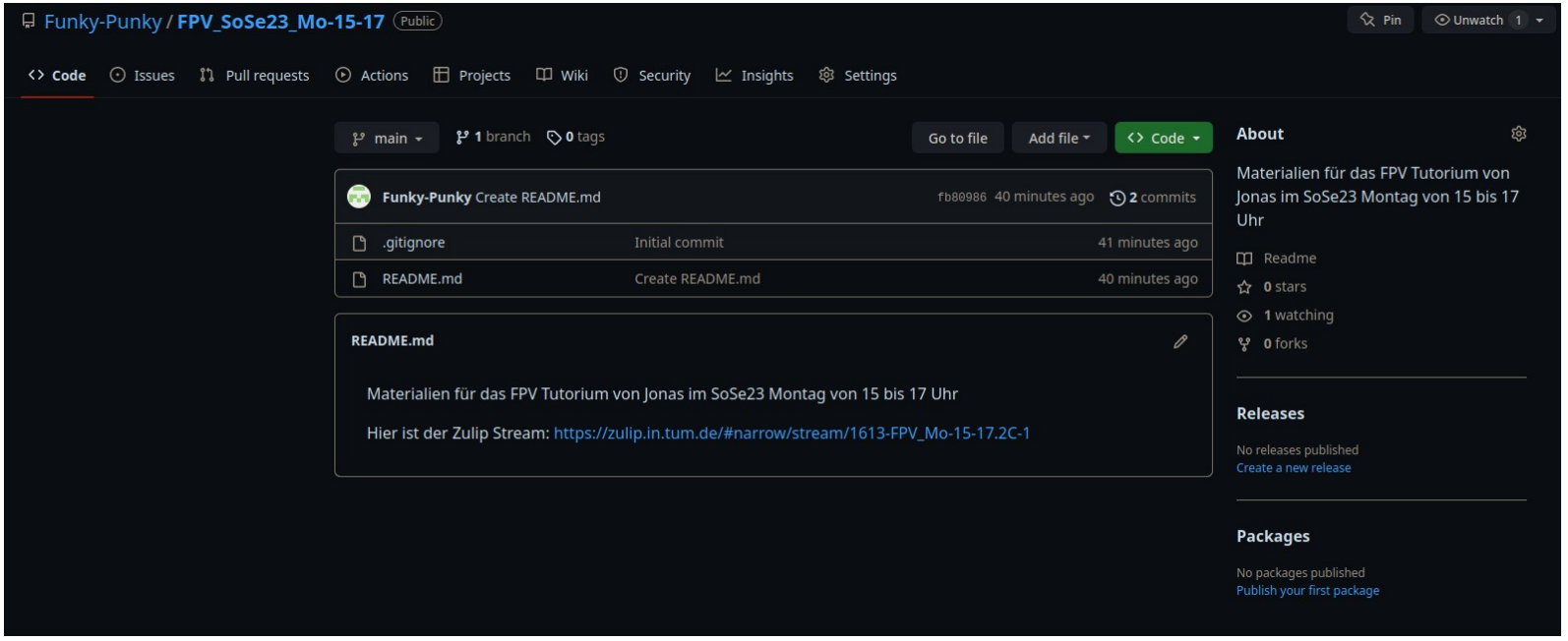
- There will be tutorial exercises every week
- In non-programming weeks, there will be quizzes to be solved during tutorials
- In programming weeks, there will be homework
- All exercises will be managed on Artemis artemis.ase.in.tum.de

- 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”)

Grade Bonus

- 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



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

Quiz

32505830

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. $x \neq 5 \implies false$
10. $true \implies x \neq y$
11. $false \implies x = 1$
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. $(A \implies B) \implies A$

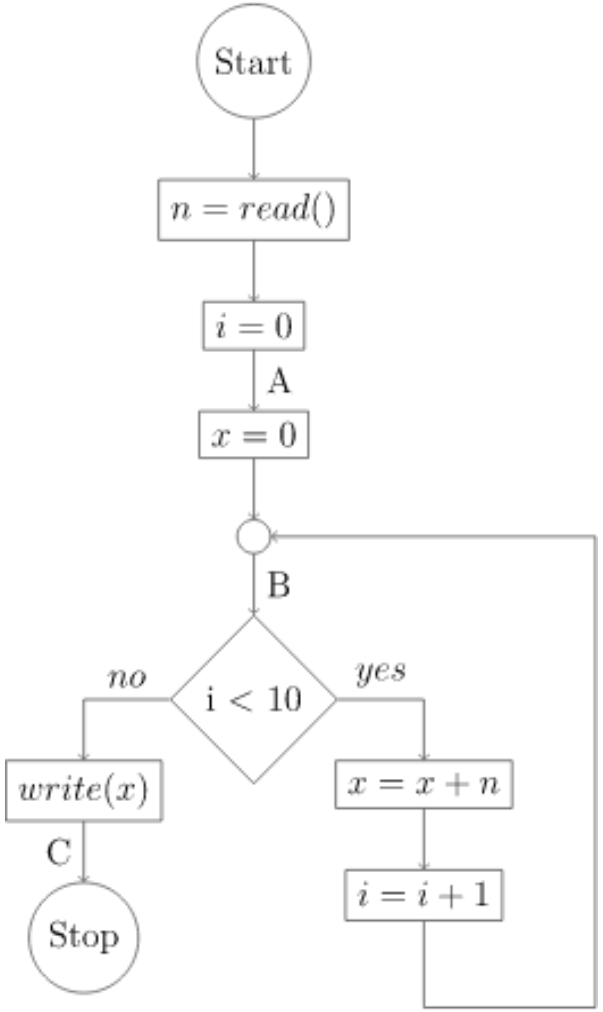
true → false

$A \equiv false$

$B \equiv false$

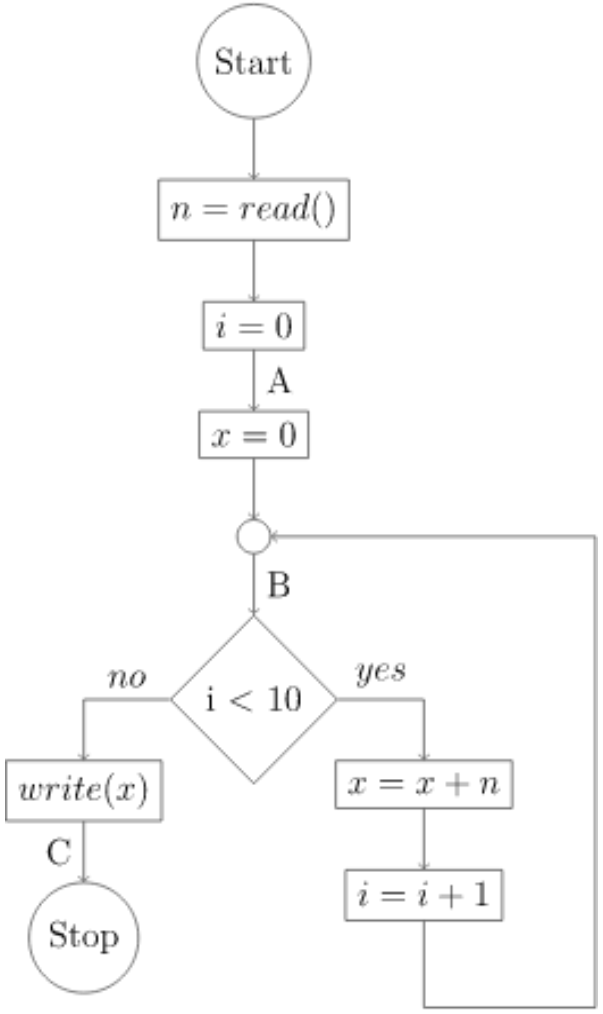
A	B	$A \Rightarrow B$
0	0	1
0	1	1
1	0	0
1	1	1

Week 01 Tutorial 02 Assertions



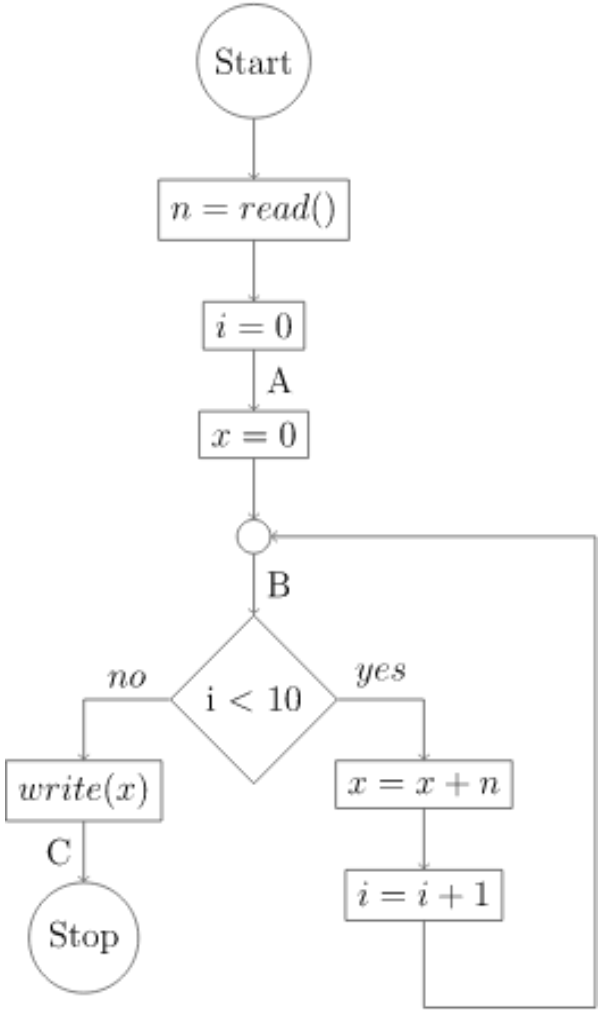
1. Which of the following assertions hold at point A?
   - a) $i \geq 0$
   - b) $x = 0$
   - c) $i \leq 10 \wedge x \neq 0$
   - d) $true$
   - e) $i = 0$
   - f) $x = i$

Week 01 Tutorial 02 Assertions



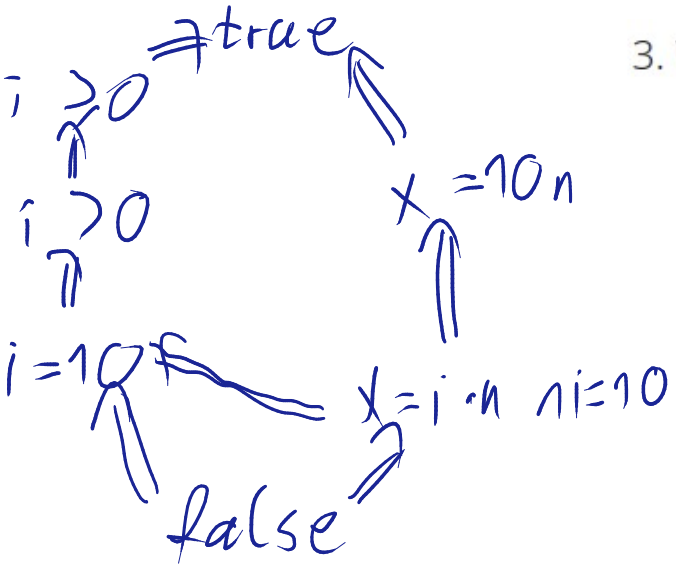
2. Which of the following assertions hold at point B?
   - a) $x = 0 \wedge i = 0$
   - b) $x = i$
   - c) $i < x$
   - d) $0 \leq i \leq 10$ ✓
   - e) $i \geq 0 \wedge x \geq 0$
   - f) $n = 1 \implies x = i$ ✓

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

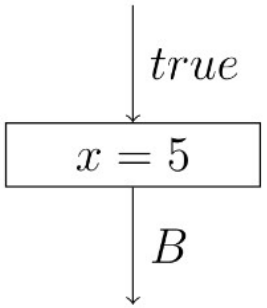


3. Which of the following assertions hold at point C?
   - a) $i \geq 0$
   - b) $i = 10$
   - c) $i > 0$
   - d) $x \neq n$
   - e) $x = 10n$
   - f) $x = i * n \wedge i = 10$

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 $\boldsymbol{true}$ and $\boldsymbol{false}$ fit in and what is their meaning as an assertion?
5. What are the strongest assertions that still hold at A, B and C?

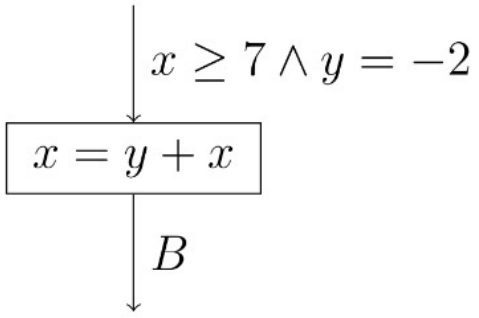
Week 01 Tutorial 04 Strongest Postconditions

1.



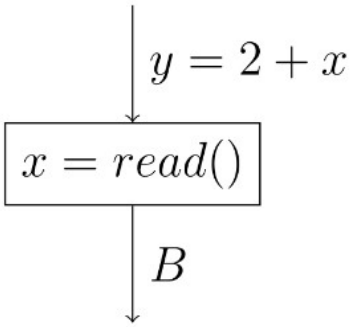
$x = 5$

3.



$x \geq 5 \wedge y = -2$

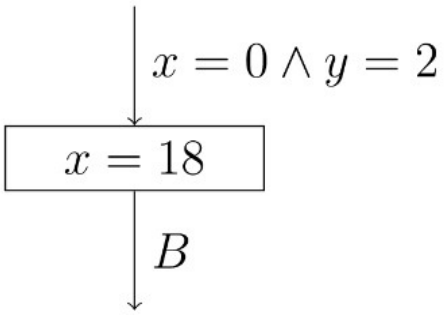
5.



true

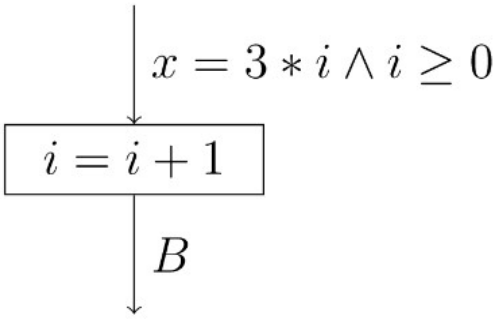
Week 01 Tutorial 04 Strongest Postconditions

2.



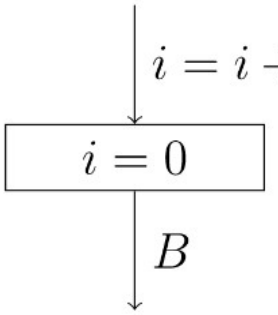
$x = 18 \wedge y = 2$

4.



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

6.



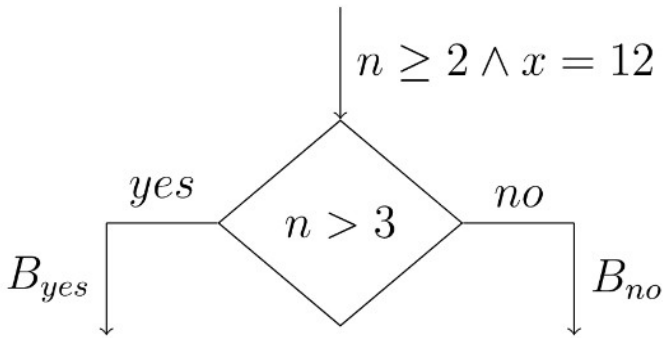
$= \text{false}$

~~$i = 0$~~

false

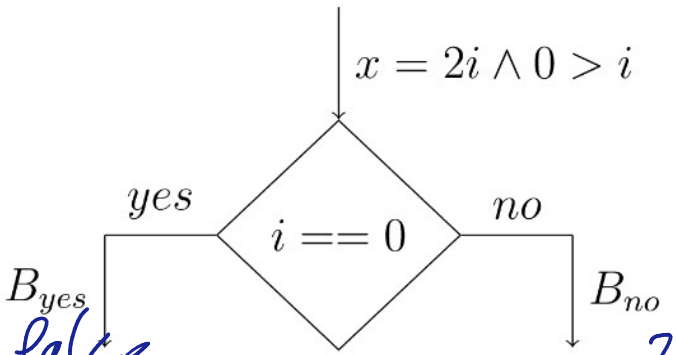
Week 01 Tutorial 04 Strongest Postconditions

7.



$n > 3$
$\wedge x = 12$

8.

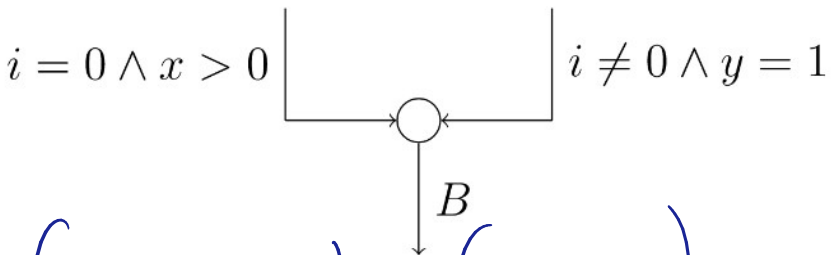


false

$x = 2i \wedge 0 > i$

9.

$2 \leq n \leq 3 \wedge x = 12$



$(i = 0 \wedge x > 0) \vee (i \neq 0 \wedge y = 1)$