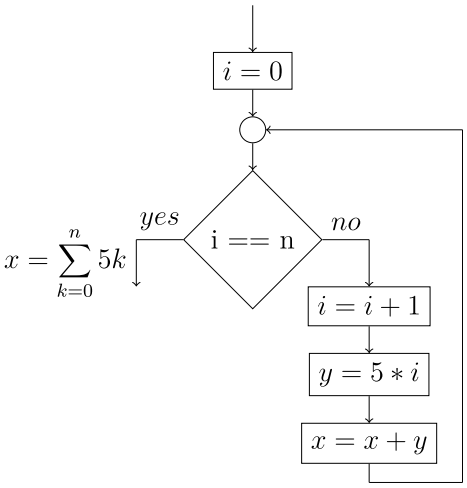
FPV 4 - FPV Summary for the week 4

Funktionale Programmierung (Technische Universität München)

$i \geq 0$ is already sufficient (to be shown below). Hint: sometimes the intuitive solution is already correct, so try with the intuitive one instead of struggling with non-intuitive solutions.



Here, we assume

$I :\equiv x = \sum_{k=0}^{i} 5k \wedge i \geq 0$

$\mathbf{WP}[\![x = x + y]\!](I) \equiv$

$x + y = \sum_{k=0}^{i} 5k \wedge i \geq 0 \equiv: A$

$\mathbf{WP}[\![y = 5 * i]\!](A) \equiv$

$x = \sum_{k=0}^{i-1} 5k \wedge i \geq 0 \equiv: B$

$\mathbf{WP}[\![i = i + 1]\!](B) \equiv x = \sum_{k=0}^{i} 5k \wedge i \geq -1 :\equiv: C$

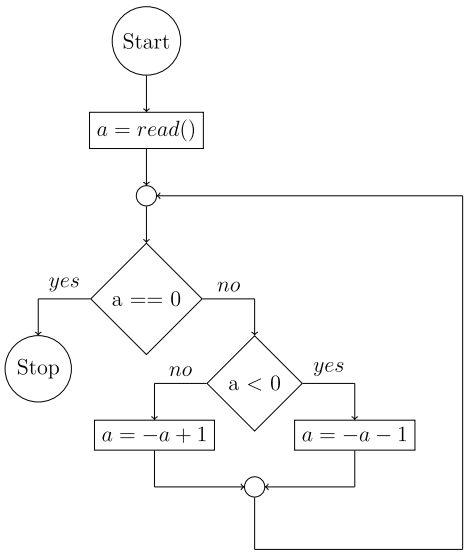
$\mathbf{WP}[\![i == n]\!](Z, C) \equiv (x = \sum_{k=0}^{n} 5k \wedge i = n) \vee (i < n \wedge x = \sum_{k=0}^{i} 5k \wedge i \geq -1) \Longleftarrow I$

Thus, we know that the assumption should hold and the program terminates.

2 Termination

Refer to the tutorial and the recap from the last sheet.

3 A wavy approach



In this exercise, no explicit indicator can be identified. In this case, we should find an indicator ourselves. Analyzing the program, we find that a converges against zero till the end, the absolute value of a decreases by 1 in each round of the loop. Hence we can insert our own indicator $r = a^2$. A full answer with the new graph can be found below. **An open question:** Why do we use the square instead of absolute value? *Hint: try to prove it use the absolute value and compare the simplification process.*

Some helpful info for the supplemental exercises: the supplemental ones should be similar to this exercise, but there are more variables and variates, e.g. 2 loops to care about or non-terminating programs. In such scenarios, don't expect to solve all at 1 step, but only deal with the corresponding vars in the corresponding loops.