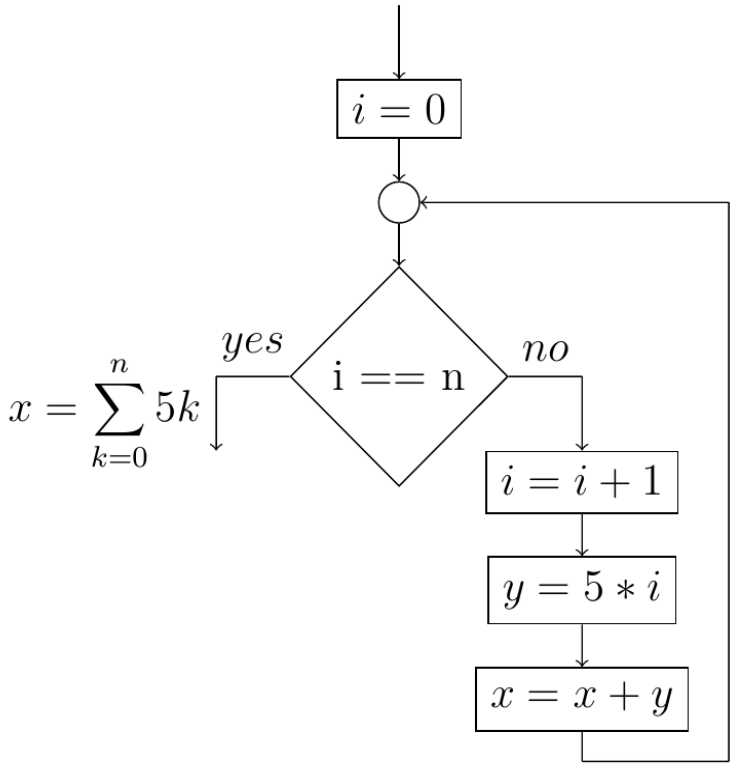
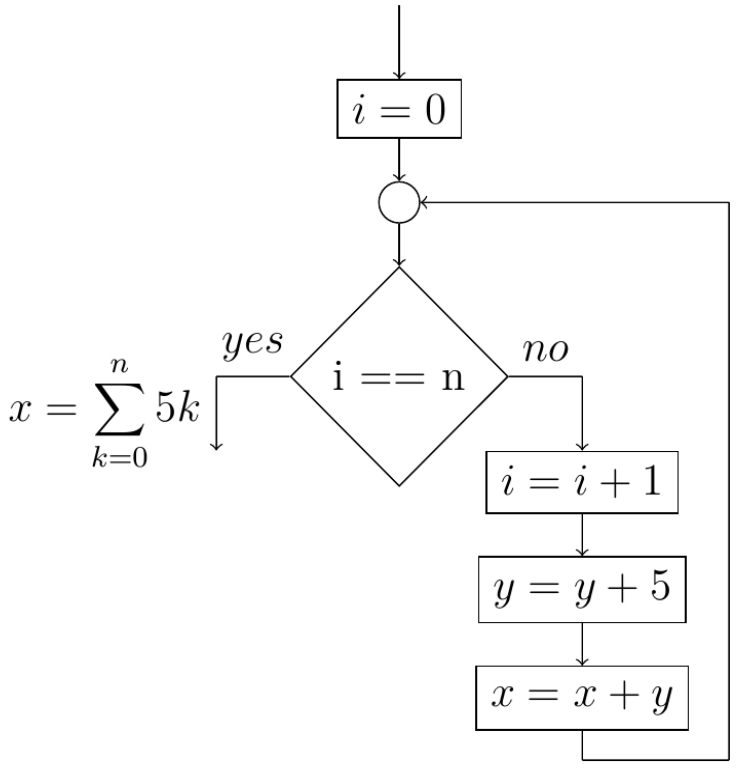
Consider these control flow graph fragments (assume x and y to be 0 initially):

1.

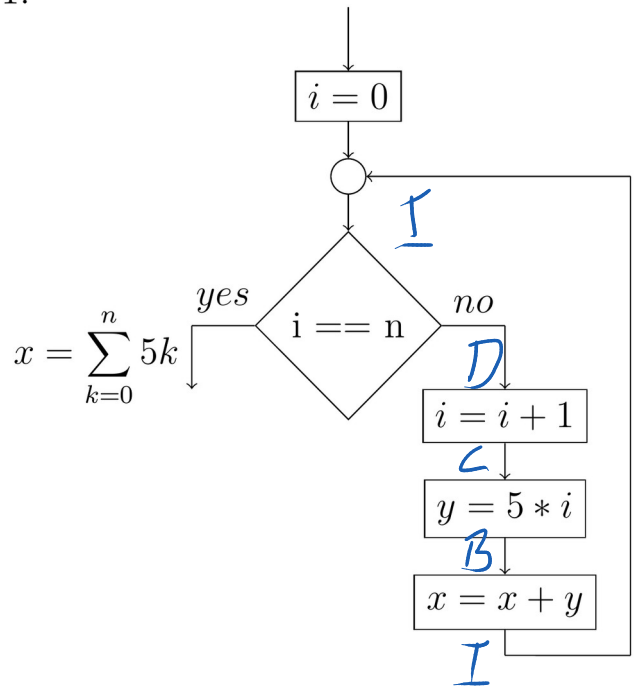


2.



Find suitable loop invariants and prove them locally consistent. Discuss, why these invariants have to be like that.

1.



$I :\equiv X = \sum_{k=0}^{i} 5k$

$B :\equiv wp[\![x := x + y]\!](I) = X + y = \sum_{k=0}^{i} 5k$

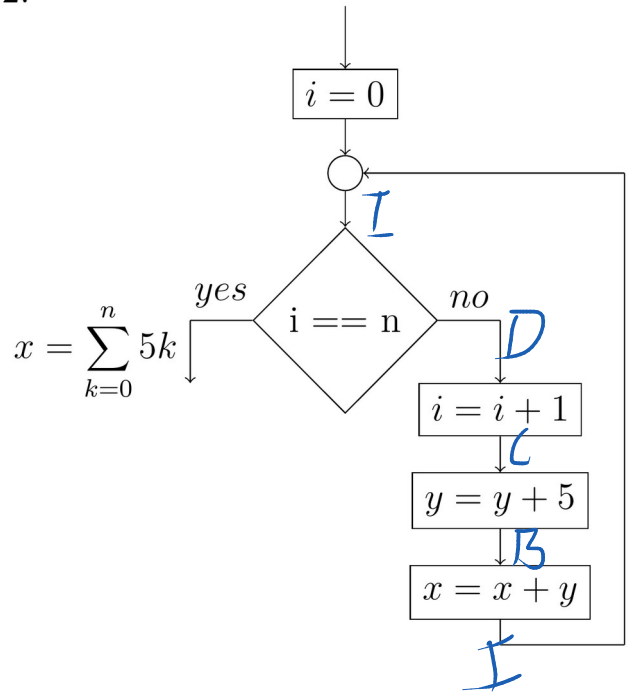
$C :\equiv wp[\![y := 5i]\!](A) = x + 5i = \sum_{k=0}^{i} 5k$

$D :\equiv X + 5(i+1) = \sum_{k=0}^{i+1} 5k$

$= \quad -''- \quad = 5(i+1) + \sum_{k=0}^{i} 5k$

$\equiv X = \sum_{k=0}^{i} 5k$

2.



1. Try the same loop invariant again
2. Why didn't it work? What information are we missing?
3. How can add that information to out proof?

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

$B :\equiv wp[\![x := x + y]\!](I) = x + y = \sum_{k=0}^{i} 5k \wedge y = 5i$

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

$D :\equiv x + y + 5 = \sum_{k=0}^{i+1} 5k \wedge y = 5i$

$x = \sum_{k=0}^{i} 5k \wedge i \neq n \wedge y = 5i \stackrel{?}{\Longrightarrow} x + y + 5 = \sum_{k=0}^{i+1} 5k \wedge y = 5i$