

Formální Metody a Specifikace

Cvičení 5b (103)

21. duben 2011

1 Exercise 11

Write down and check all verification conditions for the following program:

```
 $x \leftarrow 0; i \leftarrow 1$   
 $@ x = 0 \wedge i = 1$   
while  $i \leq 10$  do  
   $@ x = \sum_{k=1}^{i-1} a[k]$   
   $x \leftarrow x + a[i]; i \leftarrow i + 1$   
   $@ x = \sum_{k=1}^{i-1} a[k]$   
 $@ x = \sum_{k=1}^{10} a[k]$   
return  $x$ 
```

(2 points)

2 Exercise 12

Try to show the correctness of the following algorithm by adding the necessary assertions and checking the corresponding verification conditions. If it is not correct, remove the mistake (keeping the general structure of the algorithm), and show the correctness of the changed algorithm.

- Input: $x, y \in \mathcal{N}$
- Output: xy

```
 $r \leftarrow x$   
for  $i \leftarrow 1$  to  $y$  do  
   $r \leftarrow r + x$   
return  $r$ 
```

(2 points)

3 Exercise 13

Try to show the correctness of the following algorithm by adding the necessary assertions and checking the corresponding verification conditions. If it is not correct, remove the mistake (keeping the general structure of the algorithm), and show the correctness of the changed algorithm.

- Input: $a \in \mathcal{A}_{10}$
- Output: $c \in \mathcal{A}_{10}, a = c$

```
for  $i \leftarrow 1$  to 10 do  
     $b[i] \leftarrow a[(i \bmod 10) + 1]$   
for  $i \leftarrow 1$  to 10 do  
     $a[(i \bmod 10) + 1] \leftarrow b[i]$   
return  $a$ 
```

(2 points)