In the exercises that have class composition with ; , you must use (p.14) before you use (p.18), and (p.18) before you assume any conjunct of the antecedent.

1. Prove that the following three statements swap the values of $x$ and $y$ by showing that the original value of variable $x$ is indeed rigid variable $x$ and the same for $y$.

```c
int x, y, t
{ ?} t := x; x := y; y := t \{ x = y \land y = x \}
```

In each of the following exercises, calculate the expression $E$ so that the program meets its specification. Begin each calculation with $wp.S.post$ and write the final program with preconditions and postconditions after your calculation. To save writing, you can abbreviate the invariant. For example, in 2. you can define $P1: x = (\sum k \mid i \leq k < n : b[k])$ and then use $P1$ in your proof and the final statement of your program. You must state your definition of $P1$ in each exercise in which you use this technique.

2. const int $n$
   ```c
   int i, x, b[n]
   \{ x = (\sum k \mid i \leq k < n : b[k]) \}
   i, x := i - 1, E
   \{ x = (\sum k \mid i \leq k < n : b[k]) \}
   ```

3. const int $n$
   ```c
   int i, x, b[n]
   \{ x = (\sum k \mid 0 \leq k < i : b[k-1]) \}
   i := i + 1; x := E
   \{ x = (\sum k \mid 0 \leq k < i : b[k-1]) \}
   ```

4. const int $n$
   ```c
   int i, x, b[n]
   \{ x = (\sum k \mid 0 \leq k < i : b[k]) \}
   x := E; i := i + 1
   \{ x = (\sum k \mid 0 \leq k < i : b[k]) \}
   ```