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.

   int x, y, t
   $\{\ ?\ \}\ t := x;\ x := y;\ y := t\ \{x = \mathtt{Y} \wedge y = \mathtt{X}\ \}$

   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 $P1$: $x = (\Sigma\, k \mid i \le k < n : b[k])$ 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
   int $i, x, b[n]$
   $\{x = (\Sigma\, k \mid i \le k < n : b[k])\ \}$
   $i, x := i - 1, E$
   $\{x = (\Sigma\, k \mid i \le k < n : b[k])\ \}$

3. Caution: In this exercise, the unknown expression is in the second assignment statement. So, you must use the technique described here.
   const int n
   int $i, x, b[n]$
   $\{x = (\Sigma\, k \mid 0 \le k < i : b[k])\ \}$
   $i := i + 1;\ x := E$
   $\{x = (\Sigma\, k \mid 0 \le k < i : b[k])\ \}$

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