Code Construction

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The State of a Program

- As program runs, its state changes. The state of a program is characterized by the values of its variables.

- Example:
  
  x = 1;
  y = 2;
  x ++;
  y = x + y;
A Little Logic

//{P} P: the precondition.
S1;
S2;
...
Sn;
//{Q} Q: quantifies the target state we want.
\{ x+1 == 11 \} x = x + 1 \{ x == 11 \}

This is an easy example, for more complex cases, to prove \{P\} x = e \{Q\}

We just need to show P => \{Q in which all x are replaced by e \}
More Examples

- \{x^2 = 100\} x = x^2 \{ x = 100 \}

- \{2x + 1 > 11\} x = 2x + 1 \{ x > 11 \}
The If statement

if (B)
    S1;
else
    S2;

{P} if (B) S1; else S2; {Q}

if P and B, after executing S1, we have Q
if P and !B, after executing S2, we have Q
A Loop

// { P: the pre-condition }
S0;
while (B)
{
    S1;
}
// { Q: the post-condition }

The Detailed Logic Structure of a Loop

// { P }
S0;
// { I : loop invariant }
while (B)
{
  // { I & B}
  S1;
  // { I }
}
// { I & !B => Q }