

```
void main(int X1, int X2, int X3){  
    // initial values  ↑  
  
    // various commands involving  
    // variables X1, X2, X3  
  
    // X1', X2', X3' (final values)  
}
```

$\forall n$, is $X_n \rightsquigarrow X'_n$ polynomially bounded in inputs?

```

void main(int X1, int X2, int X3){
    X1 = X2 + X3;
    X1 = X1 + X1;
}

```

$$\begin{array}{c}
 \frac{}{\vdash X2 : \begin{pmatrix} 0 \\ m \\ 0 \end{pmatrix}} E1 \quad \frac{}{\vdash X3 : \begin{pmatrix} 0 \\ 0 \\ m \end{pmatrix}} E1 \\
 \hline
 \vdash X2+X3 : \begin{pmatrix} 0 \\ p \\ m \end{pmatrix} E3 \\
 \hline
 \vdash X1:=X2+X3 : \begin{pmatrix} 0 & 0 & 0 \\ p & m & 0 \\ m & 0 & m \end{pmatrix} A \\
 \vdots \\
 \hline
 \vdash X1:=X1+X1 : \begin{pmatrix} p & 0 & 0 \\ 0 & m & 0 \\ 0 & 0 & m \end{pmatrix} A \\
 \vdots \\
 \hline
 \vdash X1:=X2+X3; X1:=X1+X1 : \begin{pmatrix} 0 & 0 & 0 \\ p & m & 0 \\ p & 0 & m \end{pmatrix} C
 \end{array}$$

$$X1' \leq X2 + X3 \quad \wedge \quad X2' \leq X2 \quad \wedge \quad X3' \leq X3$$

```

void main(int X1; int X2){
    X1 = 1;
    loop X2 {
        X1 = X1 + X1;
    }
}

```

$$\begin{array}{c}
 \frac{}{\vdash X1:=1 : \begin{pmatrix} m \\ 0 \end{pmatrix}} E1 \\
 \vdots \\
 \frac{}{\vdash X1:=X1+X1 : \begin{pmatrix} p & 0 \\ 0 & m \end{pmatrix}} A \\
 \vdots \\
 \times
 \end{array}$$

Implicit
Computational
Complexity



Static program analysis

 statycc/pymwp

Program transformation

Formally verified complexity analysis



theory and beyond!