

```
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;
}

```

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

```

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



theory and beyond!

Static program analysis

 statycc/pymwp

Program transformation

Formally verified complexity analysis 