

Induction Variable Elimination

Two types of induction variables *basic and additional* :

Basic induction variable is increased/decreased by a constant in every iteration. Ex: $I = I + C$ or $I = I - C$

Additional induction variable is a linear function of another induction variable of the form: $J = C1 * I + C2$

If there are multiple induction variables in a loop, we can eliminate all but one to reduce number of variable in the program which ultimately reduce time and storage requirement.

1. Find all basic induction variable (b) in loop
2. Find all additional induction variable (a)
3. For every induction variable a in the family of b :
 1. Create new variable, $temp$
 2. Replace the assignment to a in loop with $a = temp$
 3. Set $temp = c1 * b + c2$ in preheader by adding statement:
 $temp = c1 * b$ and $temp = temp + c2$ (if $c2 \neq 0$)
 - d. After each assignment $b = b + d$ append: $temp = temp + c1 * d$
 1. Replace conditions: $b \text{ relop } x \text{ goto } y$ by :
 $temp2 = c1 * x$
 $temp2 = temp2 + c2$ (if $c2 \neq 0$)
 $\text{if } temp \text{ relop } temp2 \text{ go to } y$
 delete all assignments to b from loop
 - f. Apply copy propagation and constant propagation.