Local Value Numbering

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Sources of Redundancy
Data Abstractions

• Is there any redundancy in the code below?

9-point stencil computation
\( a[i,j] = \ldots \)

Macros

• Is there redundancy in the code below?

```c
#define larger(x,y) ((x)>=(y)? (x): (y))
#define smaller(x,y) ((x)>=(y)? (y): (x))

... ...

l = larger(a+b, a-b)
s = smaller(a+b, a-b)
```
Function Abstraction

• Is there redundancy in the code below?

```c
if (find_min(list) > 0)
    return find_max(list);
```

Other Sources

• Program monitoring
  • for optimization, parallelization, correctness, or security
• Libraries
  • interpreted languages
  • e.g. try the following in R

```r
# allocate 10 million data
n = 10000000
a = rep(0, n)

# compare the speed of this
a[1:n] = 1

# with this
for (i in 1:n)
a[i] = 1
```
Local Value Numbering

First Attempt

• Assumptions
  • straight line code
  • different names means different variables
• Example

\[
\begin{align*}
  m &= 2 \times y \times z \\
  n &= 3 \times y \times z \\
  o &= 2 \times y - z \\
\end{align*}
\]

• Representation?
Value Numbering

- Example
  
  \[
  \begin{align*}
  a &= b - c \\
  b &= a + d \\
  c &= b - c \\
  d &= a + d
  \end{align*}
  \]

- Algorithm
- Extensions
  - Stewart method

- Next: control flow