Super-local Value Numbering

Chen Ding

CS255/455 Advanced Programming Systems
Spring 2009

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)
```

```c
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
  
  
  \[
  m = 2 \times y + z \\
  n = 3 \times y + z \\
  b = 2 \times y - z
  \]

- Representation?
- Potential issues?

Value Numbering

- Example
  
  
  \[
  a = b - c \\
  b = a + d \\
  c = b - c \\
  d = a + d
  \]

- Algorithm
  - assuming finite-length statements
- Extensions
  - Stewart method
  - Next: control flow

Super-local Value Numbering

- Extended basic blocks
- An EBB is a set of blocks...
Introduction

EBB value numbering

Dominator-based VN