MQ 27-30 Solutions

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April 2022

1 Miniquiz 27

Q: Reaching definitions Dataflow Analysis setup

- Set: set/bitvector of all definitions in the program

- Partial order operator: subset

- Top: set of all definitions

- Bottom: empty set

Q: What is the least upper bound operator?
Set union / bitwise OR
Q: What is the transfer function for each node?
$f(b) = GEN(b) \cup (IN[b] - KILL[b])$

2 Miniquiz 28

Q: Example of a lattice that is not complete:
    set of all integers/rationals/reals, since there is no least upper bound (lub)
or greatest lower bound (glb)
    Q: Example of a lattice that is complete and infinite:
    $Z \cup$ -inf, inf
    In this case we have upper and lower bounds.

3 Miniquiz 29

Q; What does AF stand for?
    AF is the abstraction function which maps program states to the abstract
values defined by the analysis. For example, in an integer sign analysis:
    AF(n, m1) = m2
    n = program point m1 = mapping from variables to concrete values e.g
$[a- > 1, b- > 0, c- > -1]$ m2 = mapping from variables to abstract values (in
this analysis, signs) e.g $[a- > +, b- > 0, c- > -]$

4   Miniquiz 30

Looking at the program, we can tell that c will always be negative, since in either case it is the result of multiplying a positive and a negative number.

However, our sign analysis cannot determine this precisely. The abstract values for the left branch are $[a- > +, b- > -]$ and for the right branch $[a- > -, b- > +]$. When these are merged, we get $[a- > TOP, b- > TOP]$. Hence, we only know c is TOP as well.

We can obtain the precise result that $[a- > TOP, b- > TOP < c- > -]$ by using the meet-over-paths solution.