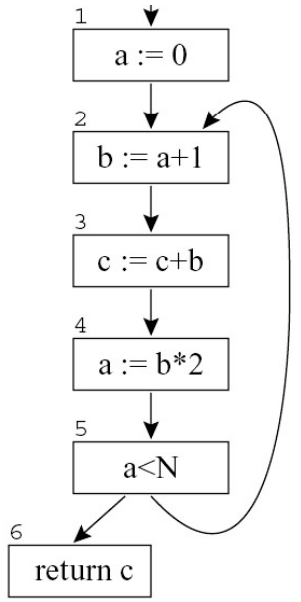
Use a worklist for liveness analysis

B	Use	Def
1		a
2	a	b
3	b,c	c
4	b	a
5	a	
6	c	

Example:

$$
\begin{aligned}
& a \leftarrow 0 \\
L_1 : \; & b \leftarrow a + 1 \\
& c \leftarrow c + b \\
& a \leftarrow b * 2 \\
& \text{if } a < N \text{ goto } L_1 \\
& \text{return } c
\end{aligned}
$$



Worklist initialization: {6, 5, 4, 4, 3, 1}
Steps:

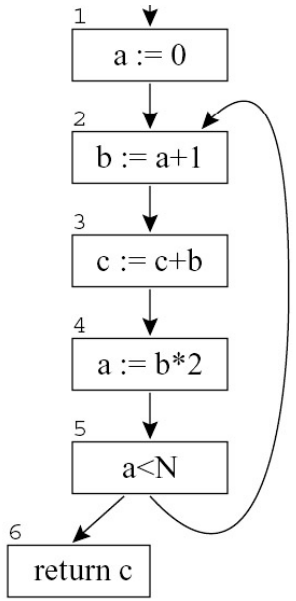
- Remove 6, In(6) = {c}
- Remove 5, out(5) = {c}, in(5)={c, a}
- Remove 4, out(4)={c,a}, in(4)={b,c}
- Remove 3, out(3)={b,c}, in(3)={c,b}
- Remove 2, out(2)={c,b}, in(2)={c,a}, add 5 to worklist
- Remove 1, out(1)={c,a}, in(1)={c}
- Remove 5, out(5)=in(6) U in(2) = {c,a} = in(5). Done.

Use a worklist for computing reaching defs

B	Gen	Kill
1	d1	d4
2	d2	
3	d3	
4	d4	d1
5		
6		

Example:

$$
\begin{aligned}
& a \leftarrow 0 \\
L_1 : \; & b \leftarrow a + 1 \\
& c \leftarrow c + b \\
& a \leftarrow b * 2 \\
& \text{if } a < N \text{ goto } L_1 \\
& \text{return } c
\end{aligned}
$$



Worklist initialization: {1,2,3,4,5,6}

Steps:

- Remove 1, Out(1) = {d1}
- Remove 2, in(2) = Out(1)Uout(5)={d1}, out(2))={d1,d2}}
- Remove 3, in(3)={d1,d2}, out(3)={d1,d2,d3}}
- Remove 4, in(4)={d1,d2,d3}, out(4)={d2,d3,d4}
- Remove 5, in(5)={d2,d3,d4}=out(5), add 2 to worklist
- Remove 6, in(6)={d2,d3,d4}=out(6)
- Remove 2, in(2)=out(1) U out(5) = {d1,d2,d3,d4} out(2)={d1,d2,d3,d4}. Add 3 to worklist
- Remove 3, in(3)={d1,d2,d3,d4}=out(3). Add 4 to worklist
- Remove 4, in(4)={d1,d2,d3,d4},out(4)={d2,d3,d4}. Done

Use a worklist for liveness analysis

Example 2:

Worklist initialization: {10, 9 ,8, 7, 6, 5, 4, 4, 3, 1}

Steps:

- Remove 10, In(10) = {d,k,b}
- Remove 9, in(9)={d,b,m}
- Remove 8, in(8)={b,m,c}
- Remove 7, in(7)={b,m,e}
- Remove 6, in(6)={m,e,f}
- Remove 5, in(5)={e,f,j}
- Remove 4, in(4)={f,j}
- Remove 3, in(3)={j,g,h}
- Remove 2, in(2) = {j,g,k}
- Remove 1, in(1)={j,k}

  Done.

```
live-in:  k j
          g := mem[j+12]
          h := k - 1
          f := g * h
          e := mem[j+8]
          m := mem[j+16]
          b := mem[f]
          c := e + 8
          d := c
          k := m + 4
          j := b
live-out: d k j
```