活跃变量分析算法

1. 活跃变量

   Live variable(about variable) : A variable **v** is live at point **p** if the value of **v** is used along some path in the flow graph starting at **p**

   For variable **v** and program point **p**, if the value of **v** at **p** can still be used along some path starting at **p** we say **v** is live at **p**.

   - for each basic block, determine if each variable is live in this block.

   For statement s(d : x = y + z)

   - Use[s] = {y,z}
   - Def[s] = {x}

2. 算法步骤

   对于每个程序节点n，找到如下定义：

   - pred[n]：当前节点的前驱
   - succ[n]：当前节点的后继
   - def[n]：在当前节点定义的变量量
   - use[n]：在当前节点使用用的变量量

   输出：

   - in[n]：在当前节点属于live-in的变量量
   - out[n]：在当前节点属于live-out的变量量

   算法：

   - 数据流方方程
     - in[n] = use[n] U (out[n] - def[n])
     - out[n] = U in[s] (s是n的所有后继)

```
for each node n in CFG
  in[n] = {};
  out[n] = {};
do {
  for each node n in CFG (reverse order)
      { in'[n] = in[n];
      out'[n] = out[n];
      out[n] = U in[s] (s是n的所有后继);
```

```
      in[n] = use[n] ∪ (out[n] - def[n]);
  }
} until (in'[n] == in[n] && out'[n] == out[n]) // 收敛
```