Problems 6: Reaching definitions

In the following code (quadruples), state which definition(s) reach line *i* and which definitions reach line *ii*.

First step (gen and kill sets):

			gen	kill
1:	c = 6;		1	13
2:	d = 7;		2	14
3:	e = 1;		3	
4:	i = 100;		4	15
5:	if (i>0) goto 17;			
6:	t1 = i*4;	(*i*)	6	
7:	t2 = a+t1;		7	
8:	t3 = M[t2];		8	
9:	t4 = t3-c;		9	
10:	M[t2] = t4;			
11:	b = 5;		11	
12:	t5 = b*4;		12	
13:	c = M[t5];		13	1
14:	d = b-e;	(*ii*)	14	2
15:	i = i-1;		15	4
16:	goto 5;			
17:	write(d);			

pred(5) = {4,16}, pred(17) = {5}

Find the *in* and *out* sets:

in			out
	1: c = 6;		1
1	2: d = 7;		1,2
1,2	3: e = 1;		1,2,3
1,2,3	4: i = 100;		1,2,3,4
1,2,3,4,6,7,8,9,11,12,13,14,15	5: if (i>0) goto 17;		1,2,3,4,6,7,8,9,11,12,13,14,15
1,2,3,4,6,7,8,9,11,12,13,14,15	6: t1 = i*4;	(*i*)	1,2,3,4,6.....
1,2,3,4,6	7: t2 = a+t1;		1,2,3,4,6,7
1,2,3,4,6,7	8: t3 = M[t2];		1,2,3,4,6,7,8
1,2,3,4,6,7,8	9: t4 = t3-c;		1,2,3,4,6,7,8,9
1,2,3,4,6,7,8,9	10: M[t2] = t4;		1,2,3,4,6,7,8,9
1,2,3,4,6,7,8,9	11: b = 5;		1,2,3,4,6,7,8,9,11
1,2,3,4,6,7,8,9,11	12: t5 = b*4;		1,2,3,4,6,7,8,9,11,12
1,2,3,4,6,7,8,9,11,12	13: c = M[t5];		2,3,4,6,7,8,9,11,12,13
2,3,4,6,7,8,9,11,12,13	14: d = b-e;	(*ii*)	3,4,6,7,8,9,11,12,13,14
3,4,6,7,8,9,11,12,13,14	15: i = i-1;		3,6,7,8,9,11,12,13,14,15
3,6,7,8,9,11,12,13,14,15	16: goto 5;		3,6,7,8,9,11,12,13,14,15
1,2,3,4	17: write(d);		1,2,3,4

To save time (in exam?), look only at the variables that are used in lines (i) and (ii), {i, b, e}, and ignore definitions of other variables:

in			**out**
	1: c = 6;		
	2: d = 7;		
	3: e = 1;		3
3	4: i = 100;		3,4
3,4,11,15	5: if (i>0) goto 17;		3,4,11,15
3,4,11,15	6: t1 = i*4;	(*i*)	3,4,11,15
3,4,11,15	7: t2 = a+t1;		3,4,11,15
3,4,11,15	8: t3 = M[t2];		3,4,11,15
3,4,11,15	9: t4 = t3-c;		3,4,11,15
3,4,11,15	10: M[t2] = t4;		3,4,11,15
3,4,11,15	11: b = 5;		3,4,11,15
3,4,11,15	12: t5 = b*4;		3,4,11,15
3,4,11,15	13: c = M[t5];		3,4,11,15
3,4,11,15	14: d = b-e;	(*ii*)	3,4,11,15
3,4,11,15	15: i = i-1;		3,11,15
3,11,15	16: goto 5;		3,11,15
3,4	17: write(d);		3,4