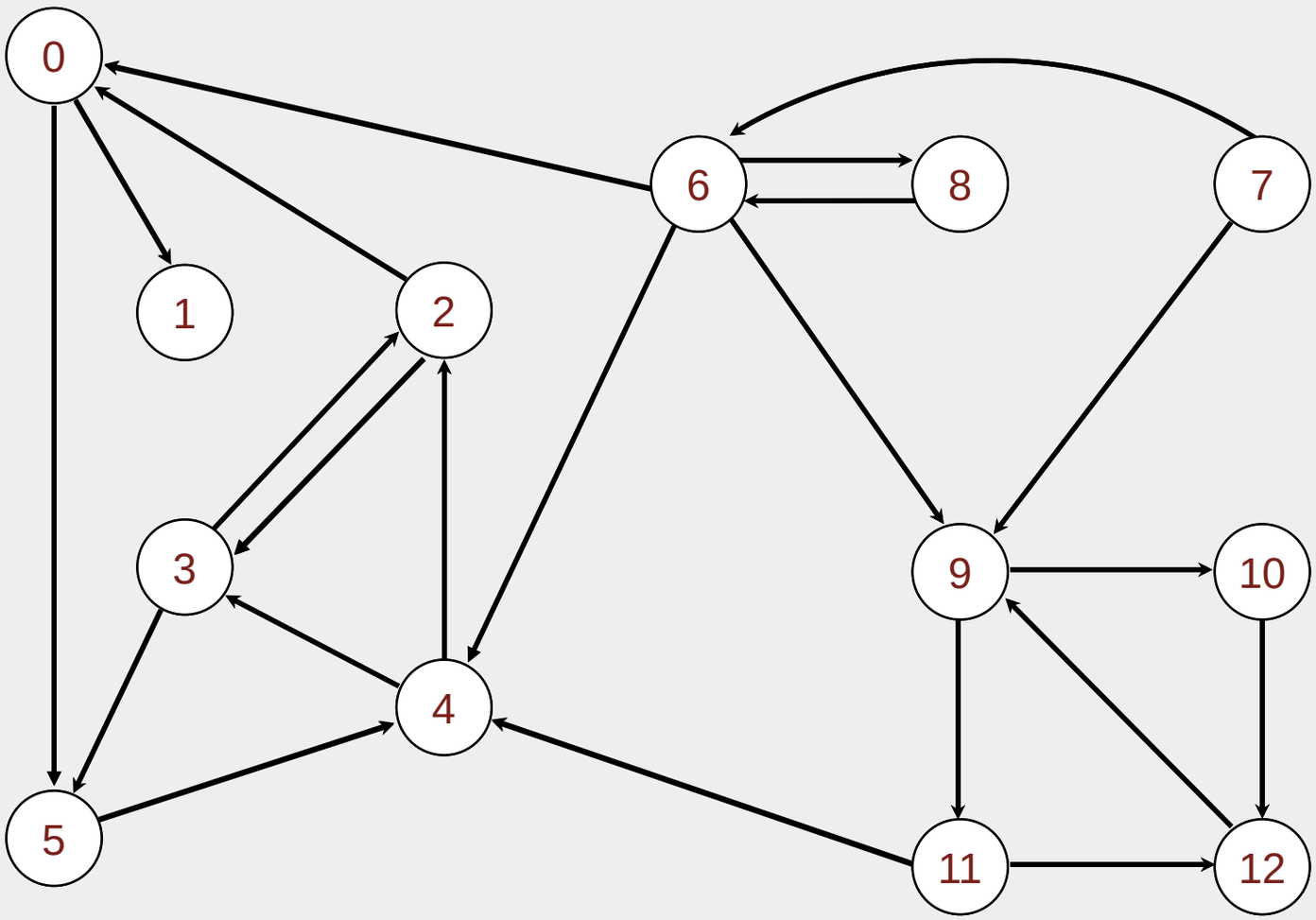
4.2 Kosaraju-Sharir Algorithm

click to begin demo

Kosaraju-Sharir

Phase 1. Compute reverse postorder in G^R.

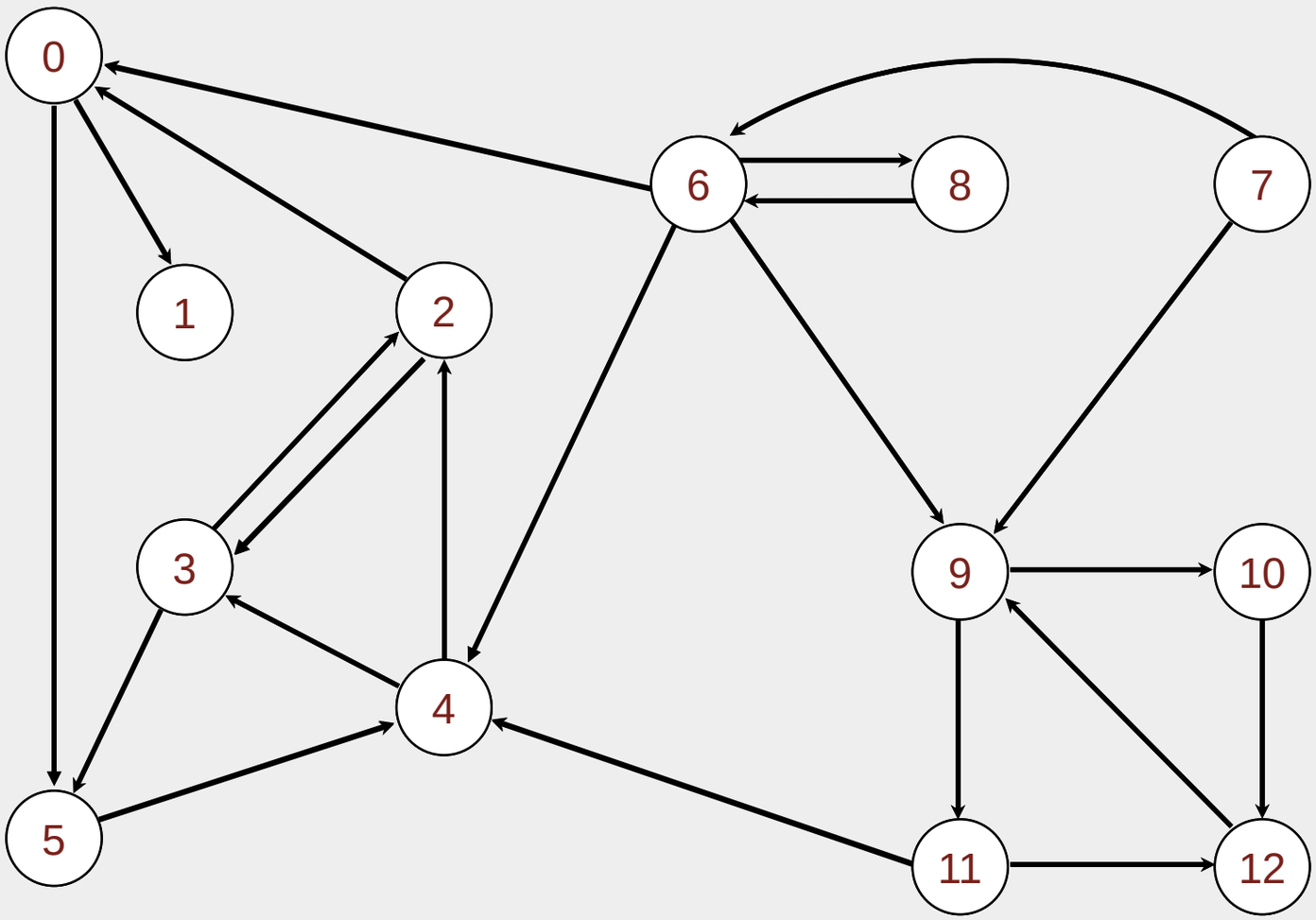
Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.



digraph G

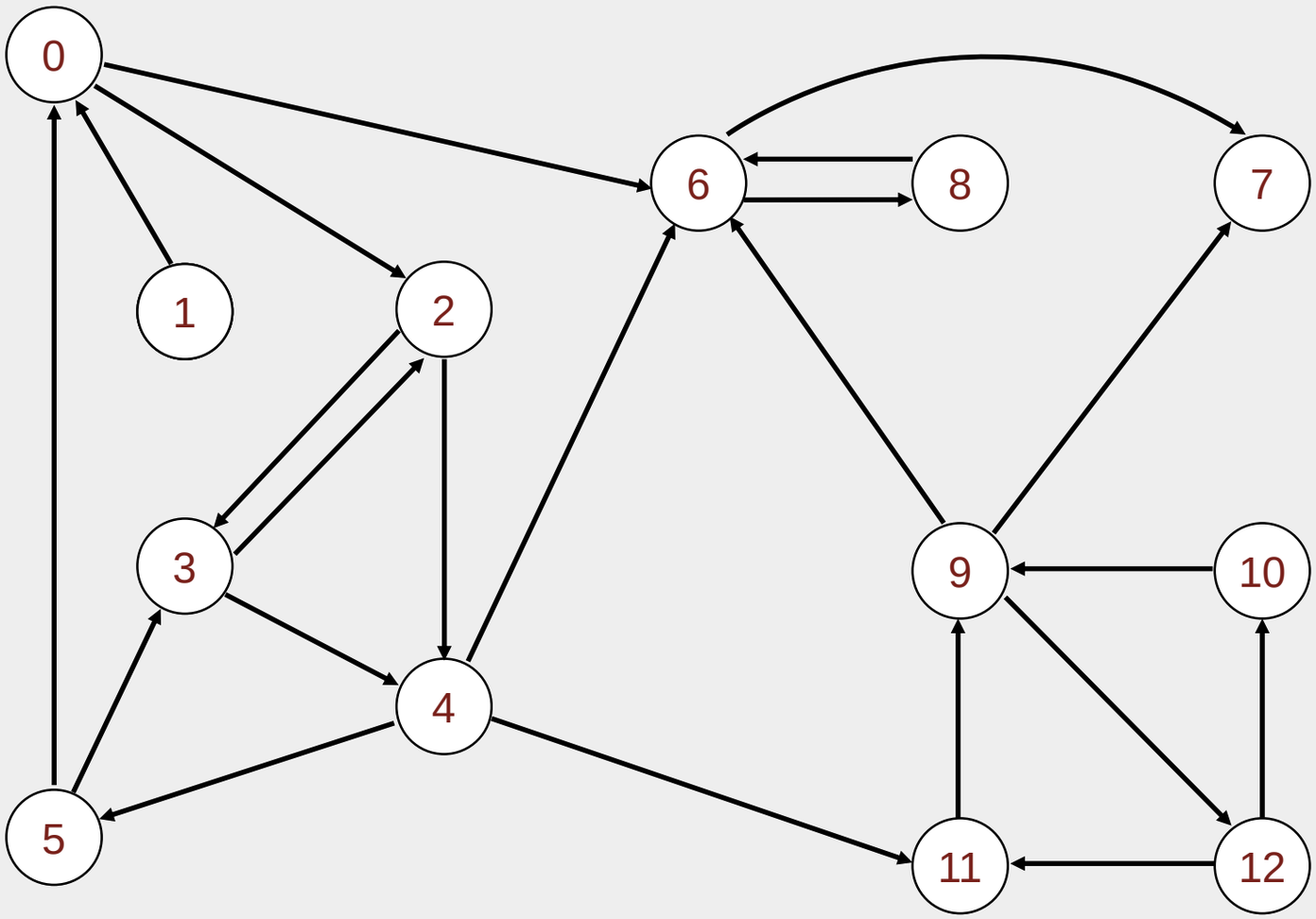
- DFS in reverse graph
- DFS in original graph

Phase 1. Compute reverse postorder in G^R.



digraph G

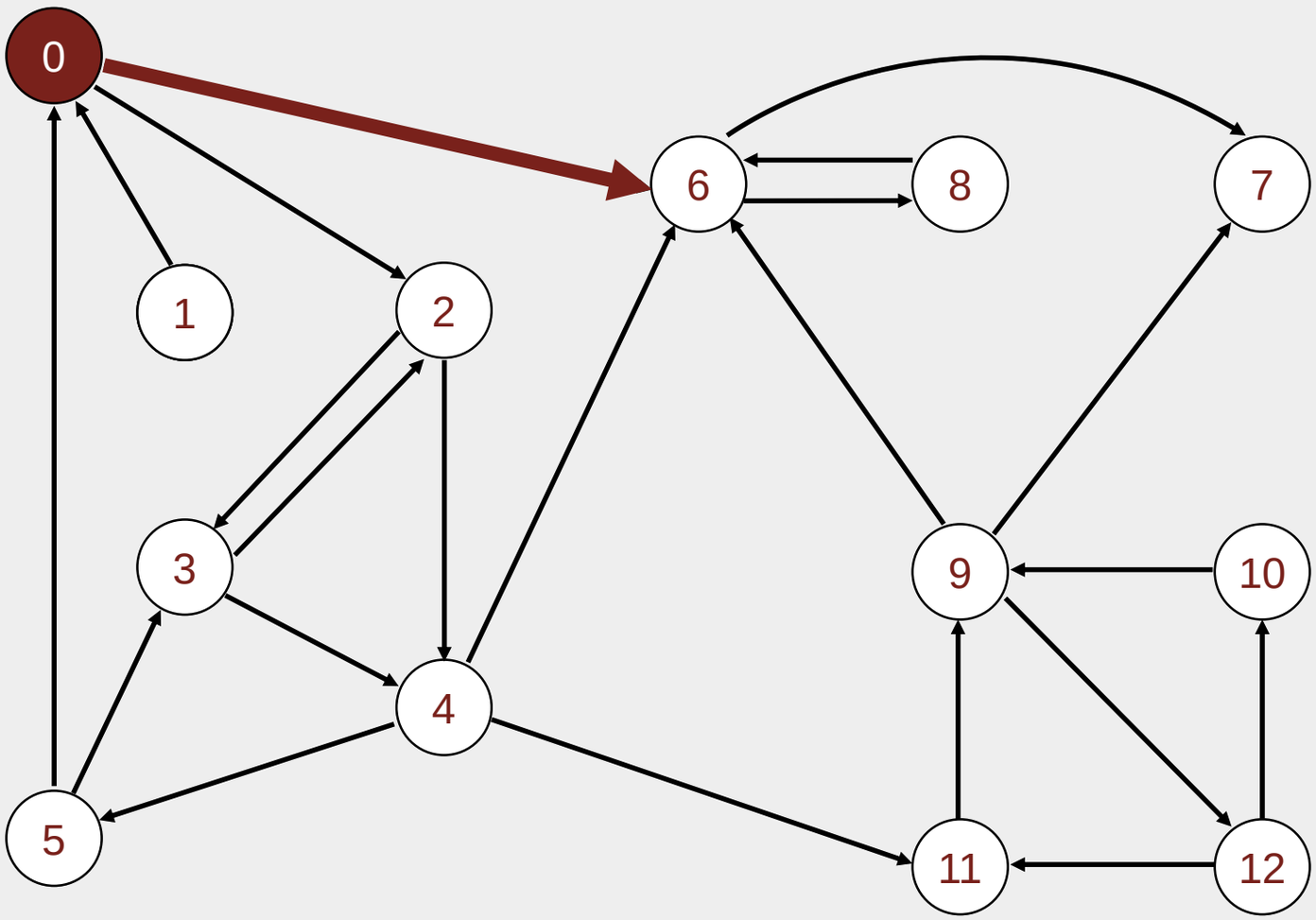
Phase 1. Compute reverse postorder in G^R.



reverse digraph G^R

v	marked[v]
0	–
1	–
2	–
3	–
4	–
5	–
6	–
7	–
8	–
9	–
10	–
11	–
12	–

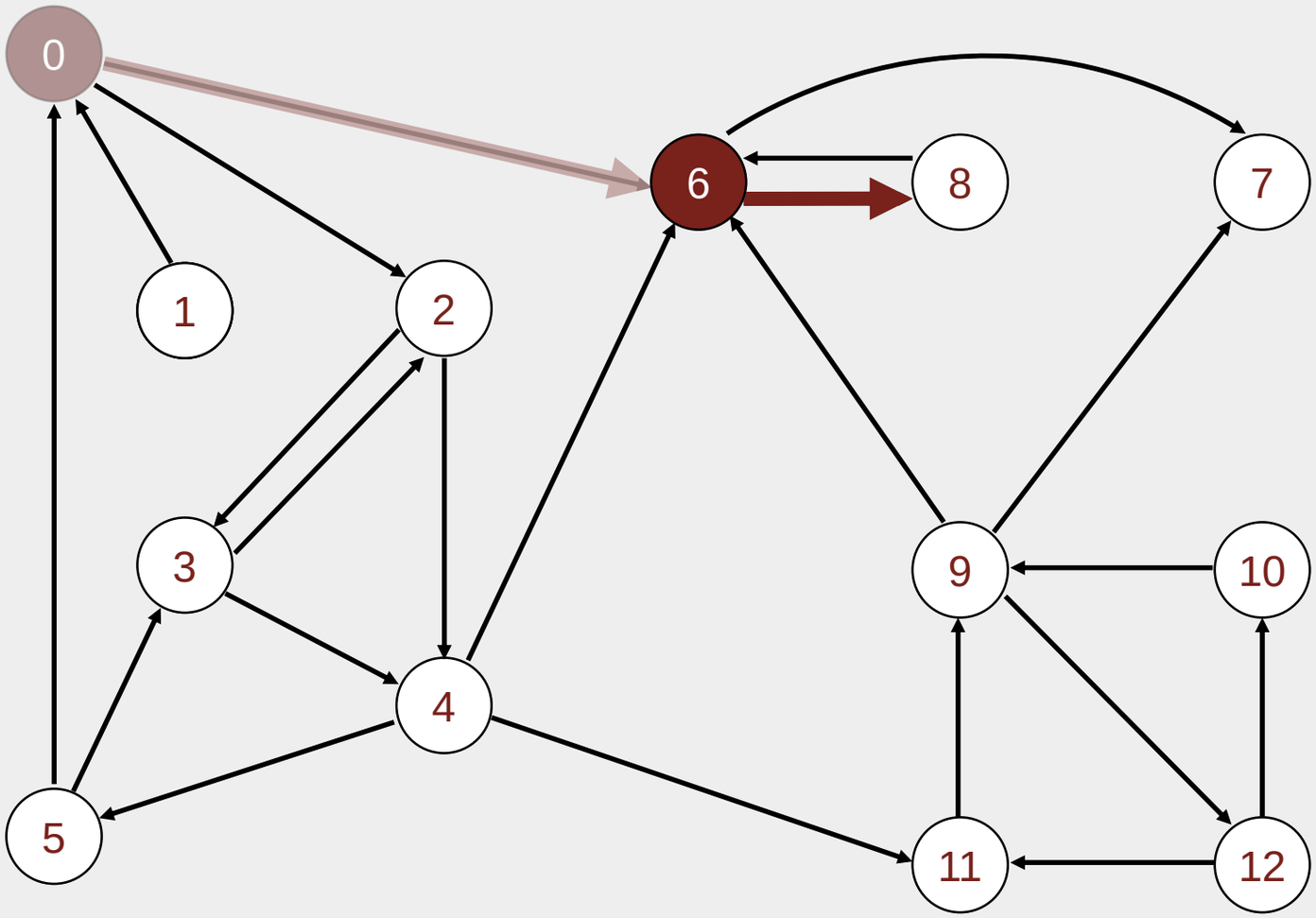
Phase 1. Compute reverse postorder in G^R.



v	marked[v]
0	T
1	F
2	F
3	F
4	F
5	F
6	F
7	F
8	F
9	F
10	F
11	F
12	F

visit 0

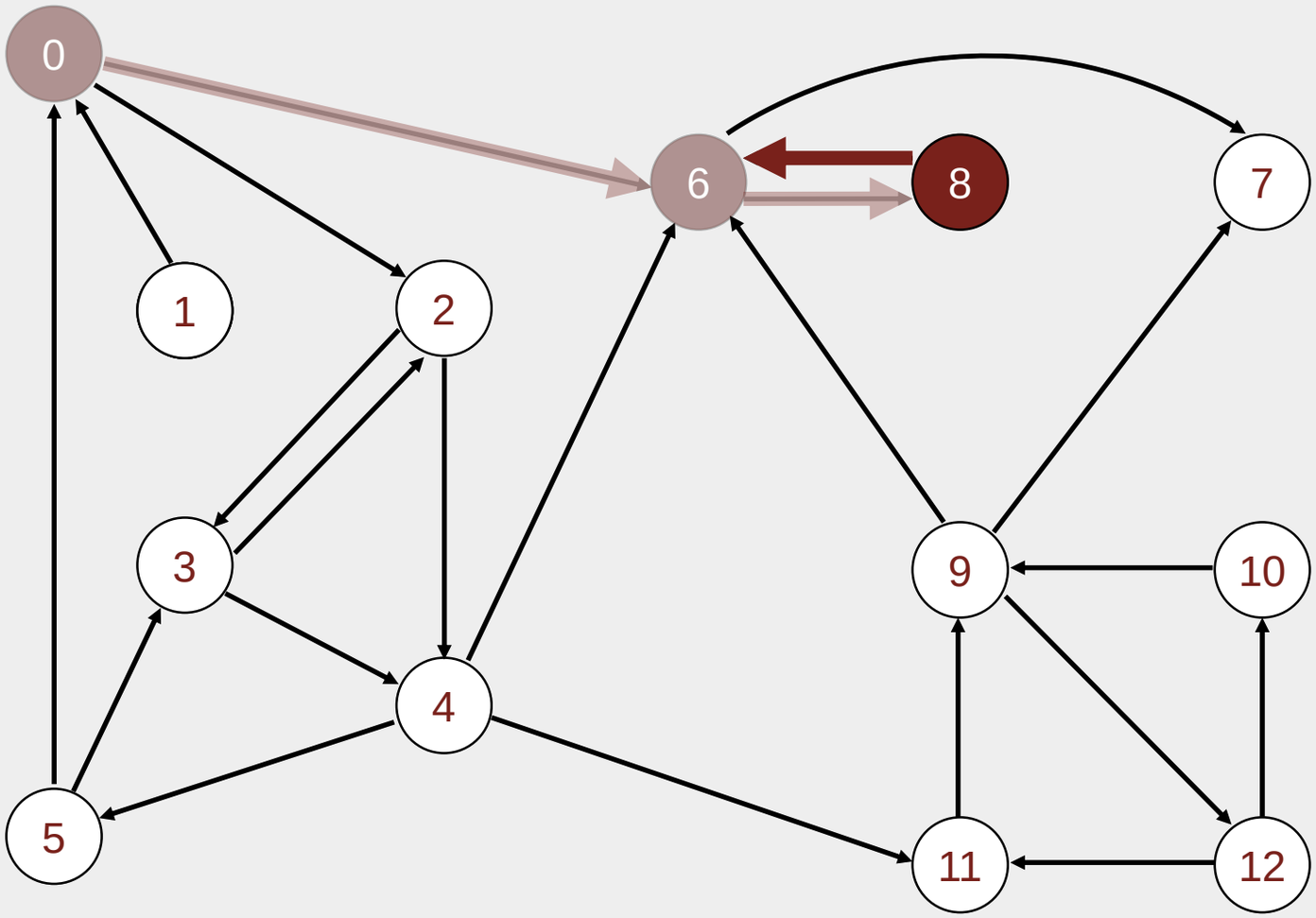
Phase 1. Compute reverse postorder in G^R.



v	marked[v]
0	T
1	F
2	F
3	F
4	F
5	F
6	T
7	F
8	F
9	F
10	F
11	F
12	F

visit 6

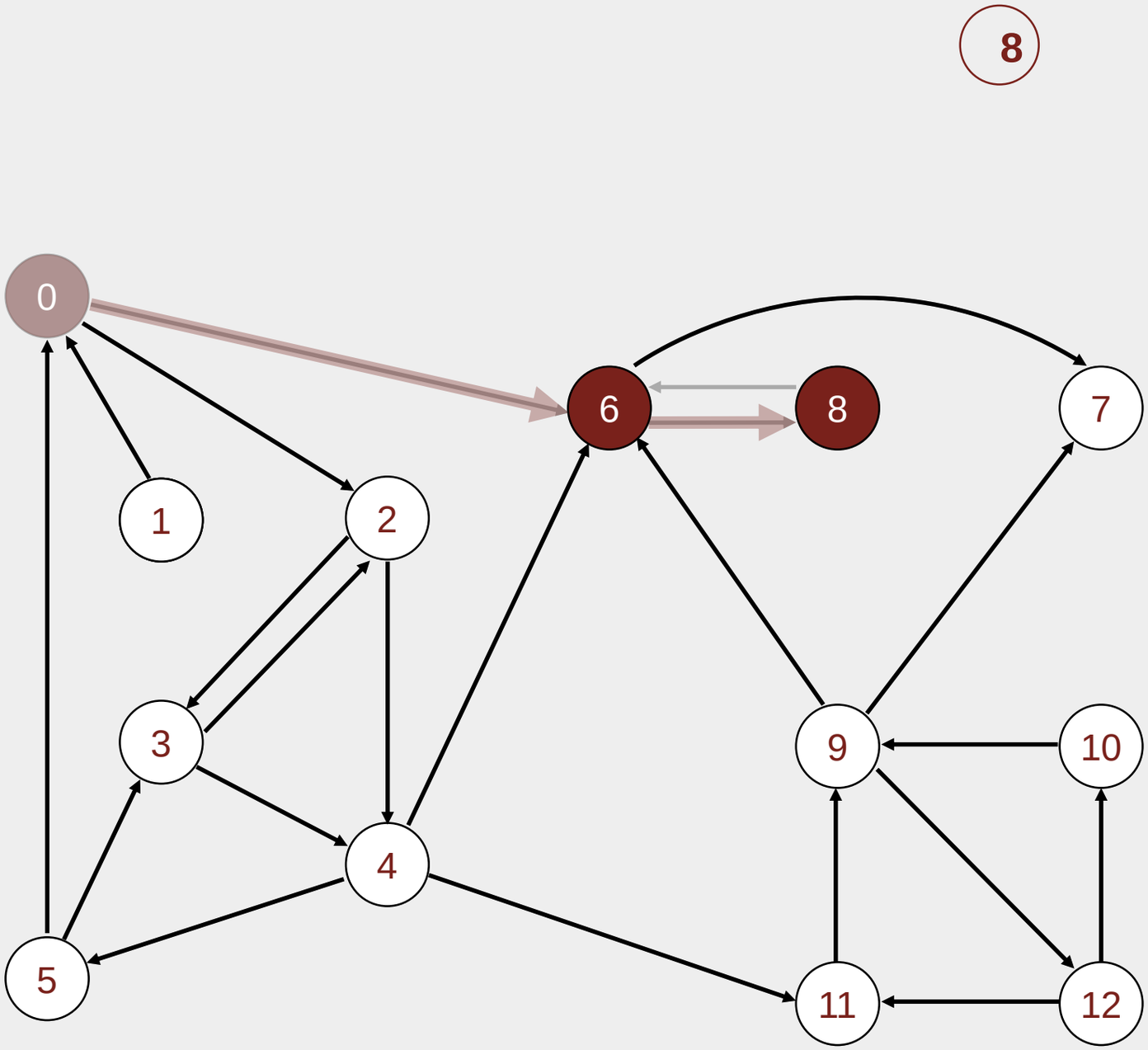
Phase 1. Compute reverse postorder in G^R.



v	marked[v]
0	T
1	F
2	F
3	F
4	F
5	F
6	T
7	F
8	T
9	F
10	F
11	F
12	F

visit 8

Phase 1. Compute reverse postorder in G^R.

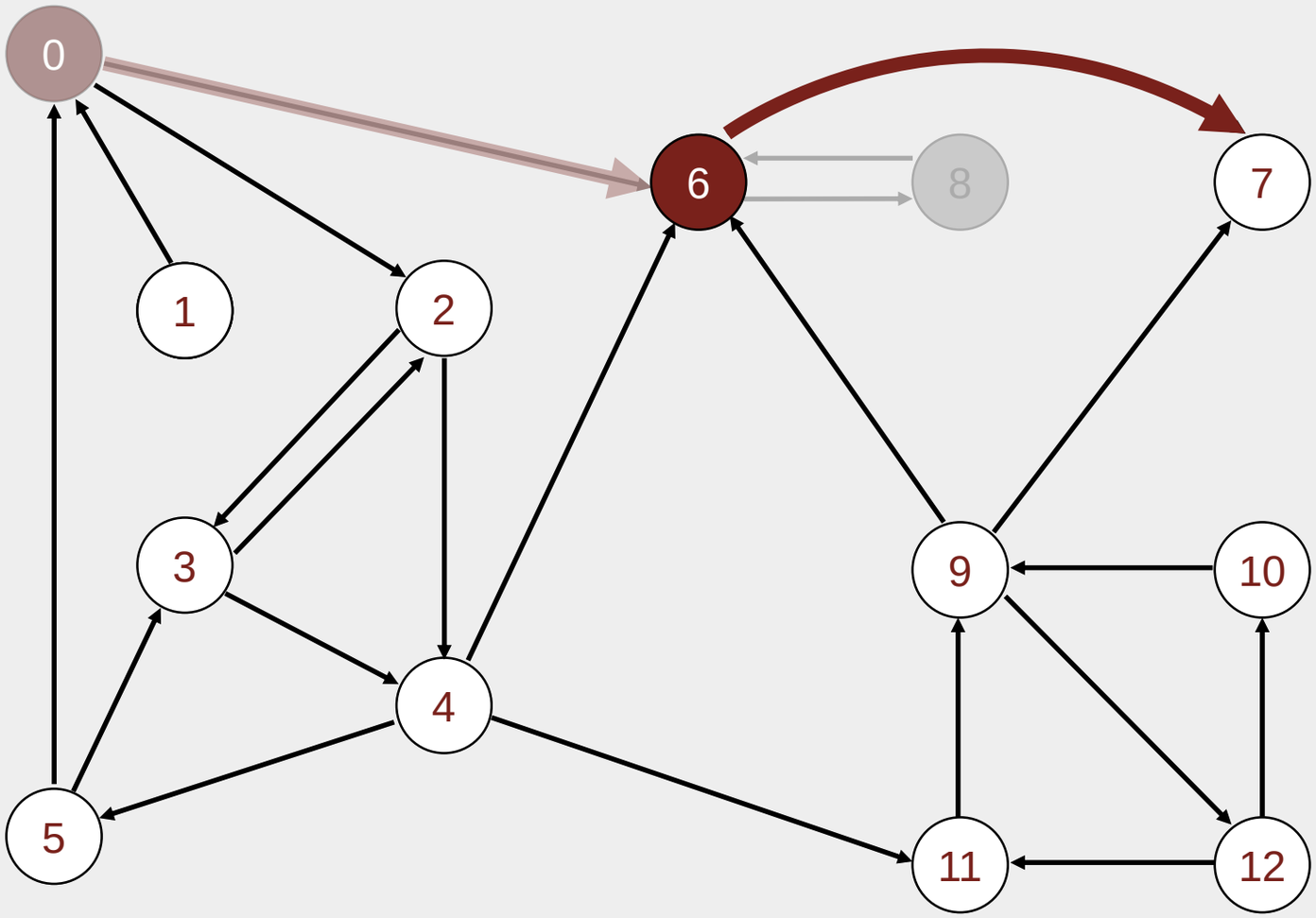


v	marked[v]
0	T
1	F
2	F
3	F
4	F
5	F
6	T
7	F
8	T
9	F
10	F
11	F
12	F

8 done

Phase 1. Compute reverse postorder in G^R.

8

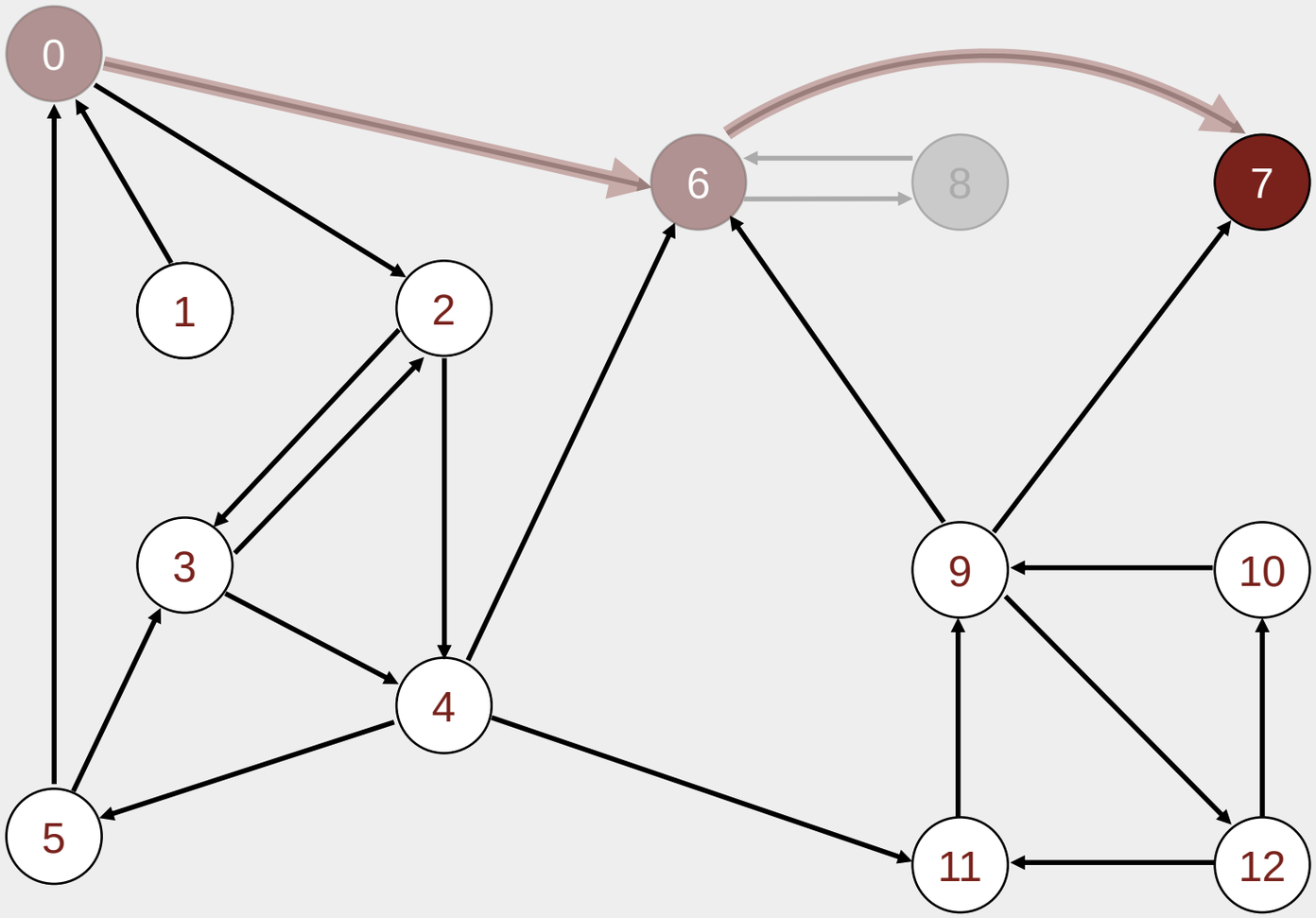


v	marked[v]
0	T
1	F
2	F
3	F
4	F
5	F
6	T
7	F
8	T
9	F
10	F
11	F
12	F

visit 6

Phase 1. Compute reverse postorder in G^R.

8

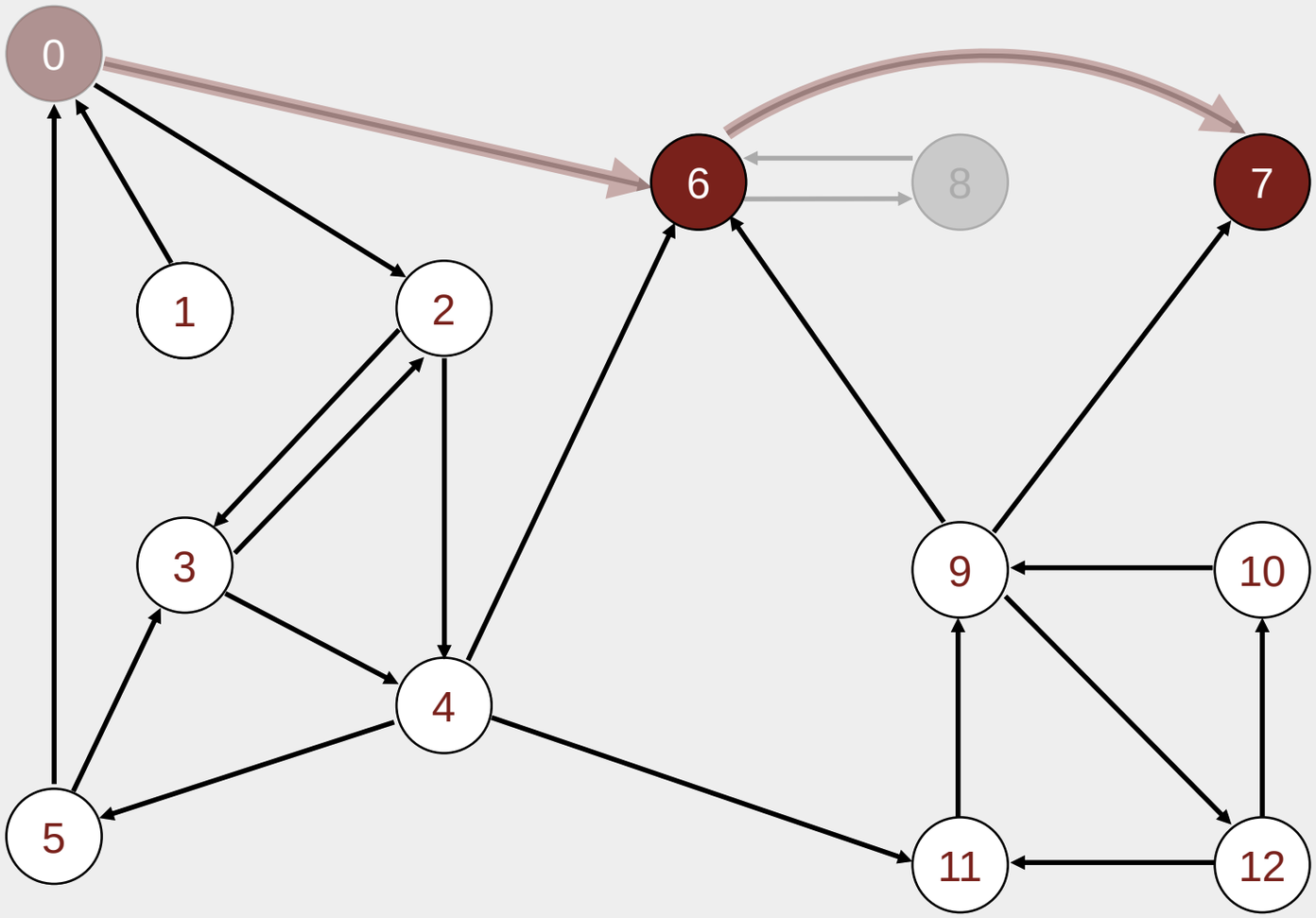


v	marked[v]
0	T
1	F
2	F
3	F
4	F
5	F
6	T
7	T
8	T
9	F
10	F
11	F
12	F

visit 7

Phase 1. Compute reverse postorder in G^R.

7 8

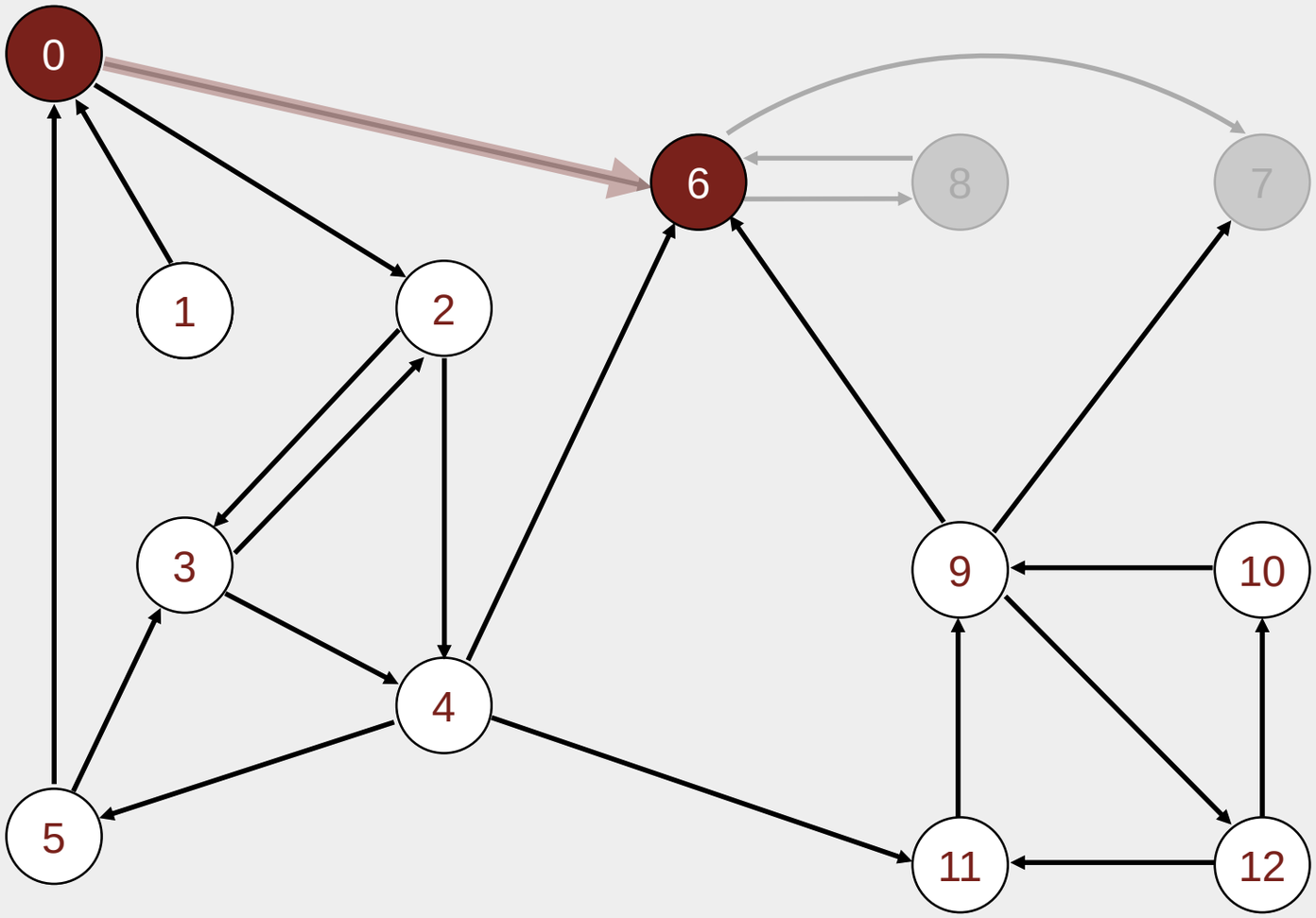


v	marked[v]
0	T
1	F
2	F
3	F
4	F
5	F
6	T
7	T
8	T
9	F
10	F
11	F
12	F

7 done

Phase 1. Compute reverse postorder in G^R.

6 7 8

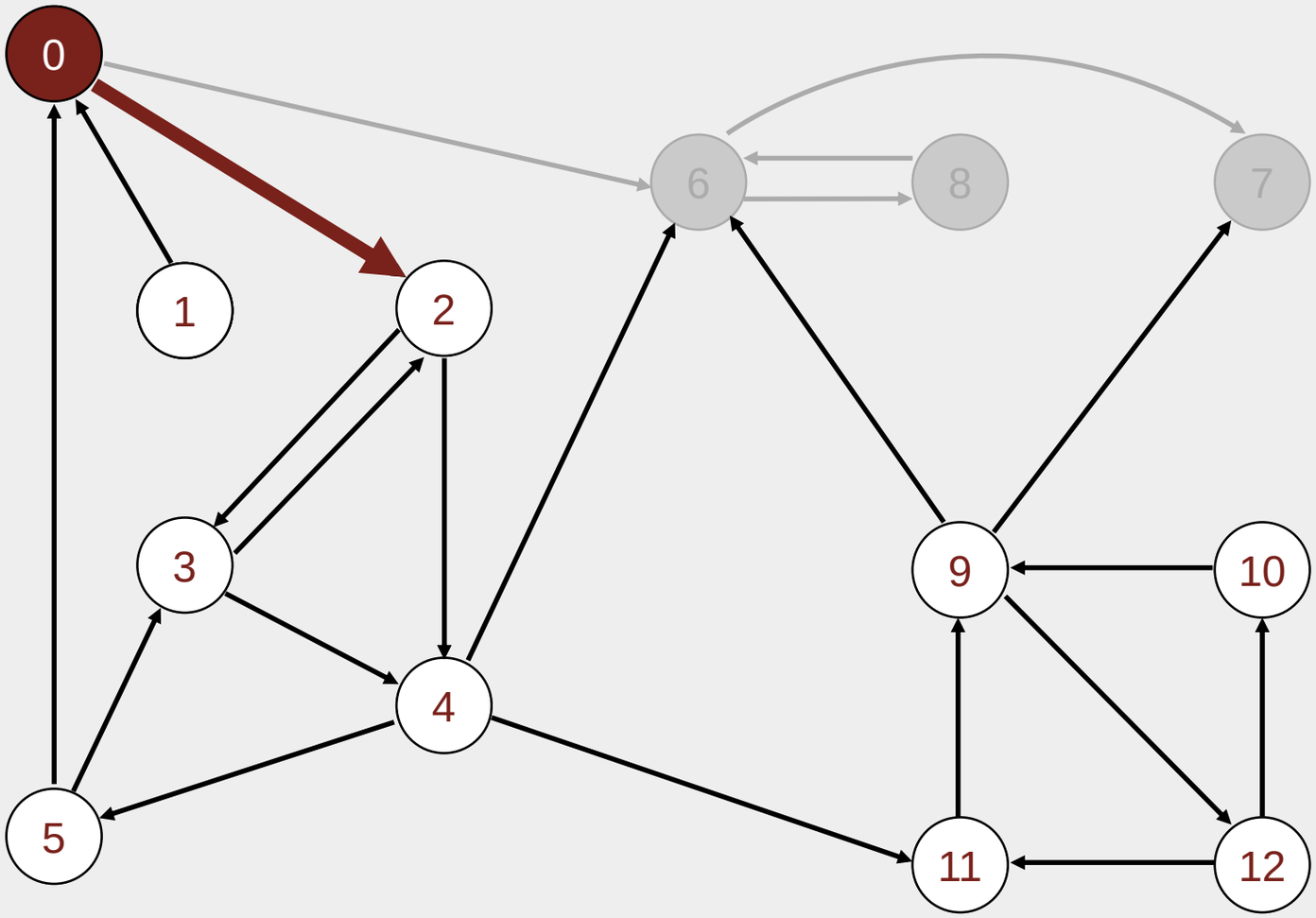


v	marked[v]
0	T
1	F
2	F
3	F
4	F
5	F
6	T
7	T
8	T
9	F
10	F
11	F
12	F

6 done

Phase 1. Compute reverse postorder in G^R.

6 7 8

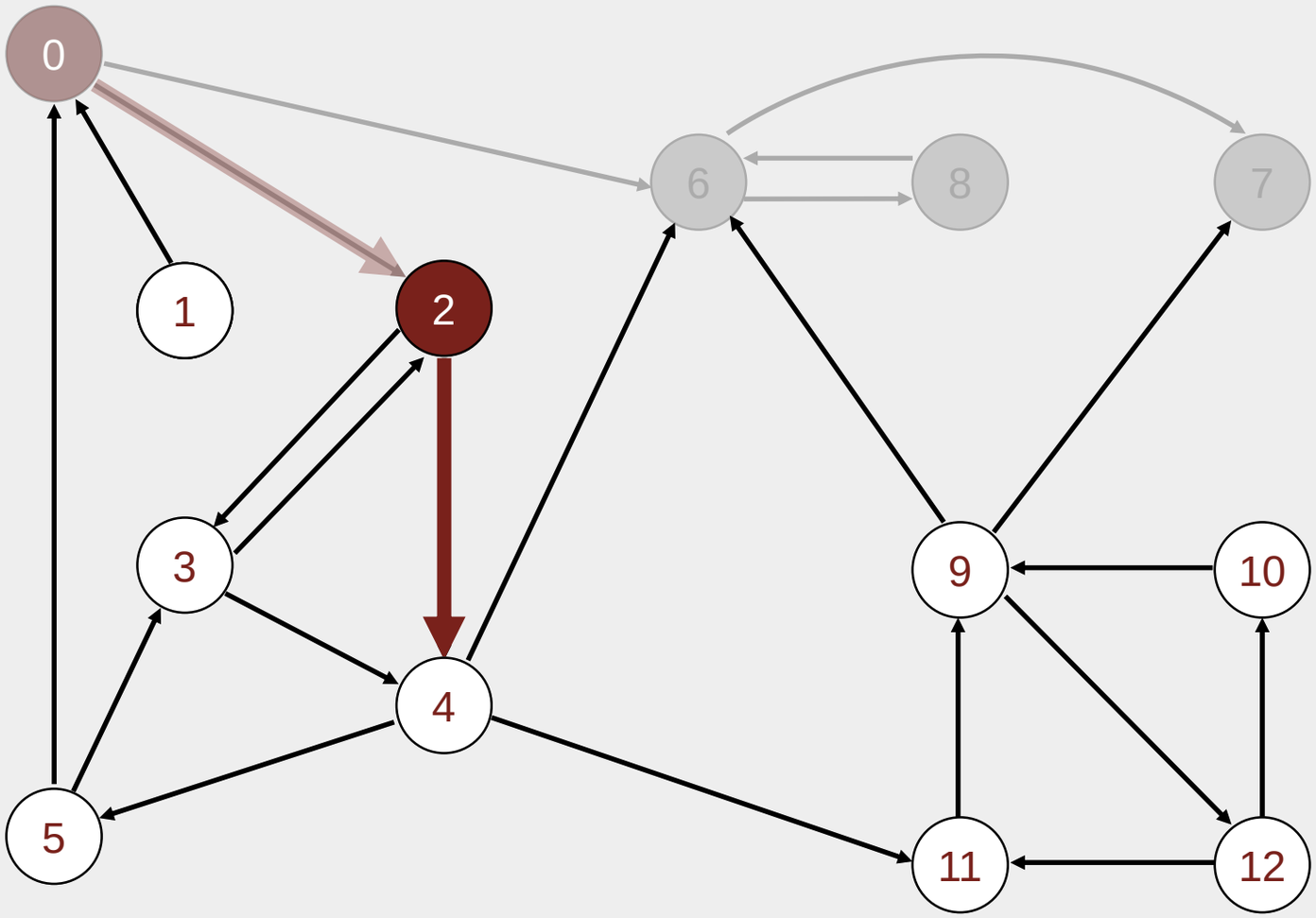


v	marked[v]
0	T
1	F
2	F
3	F
4	F
5	F
6	T
7	T
8	T
9	F
10	F
11	F
12	F

visit 0

Phase 1. Compute reverse postorder in G^R.

6 7 8

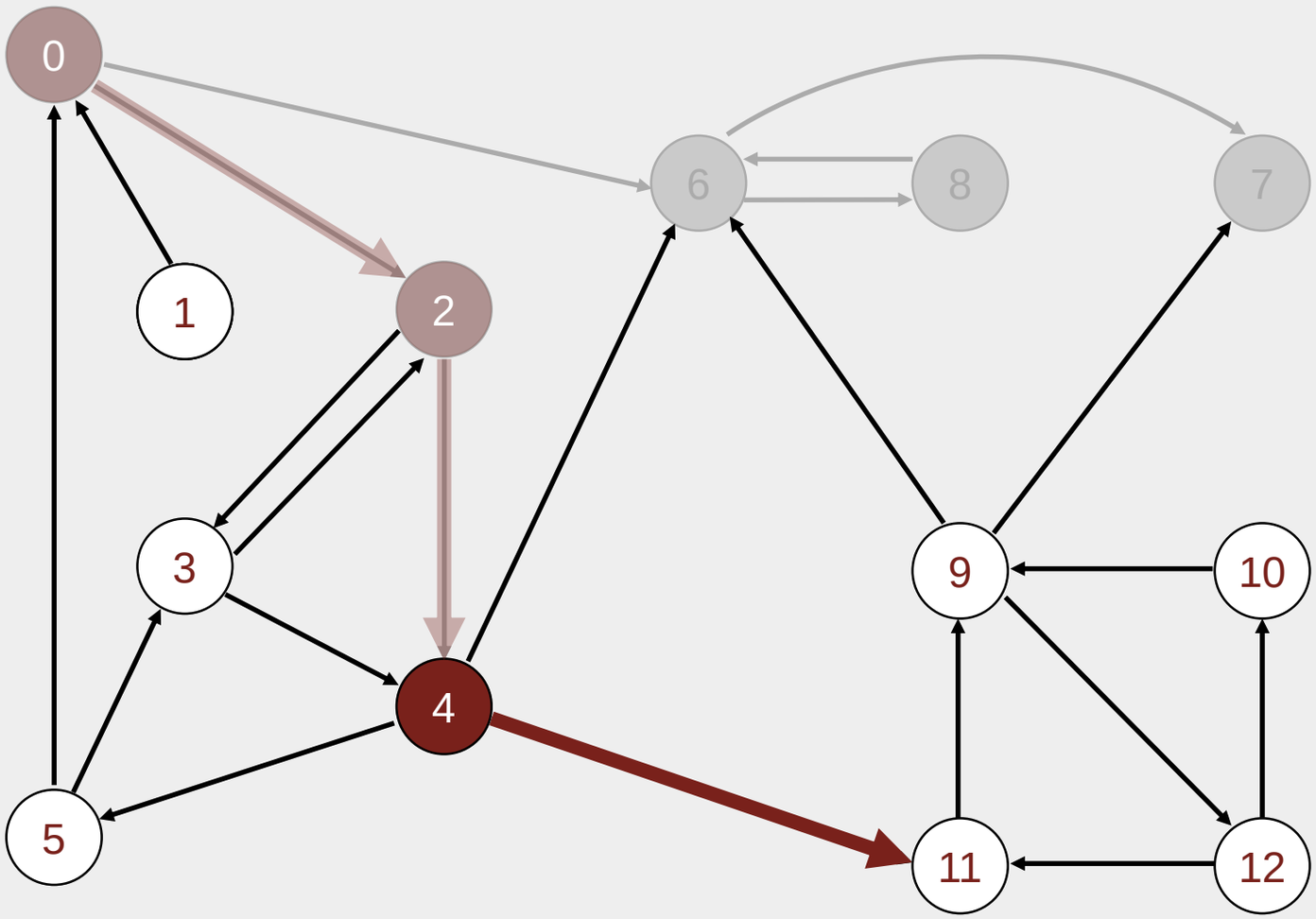


v	marked[v]
0	T
1	F
2	T
3	F
4	F
5	F
6	T
7	T
8	T
9	F
10	F
11	F
12	F

visit 2

Phase 1. Compute reverse postorder in G^R.

6 7 8

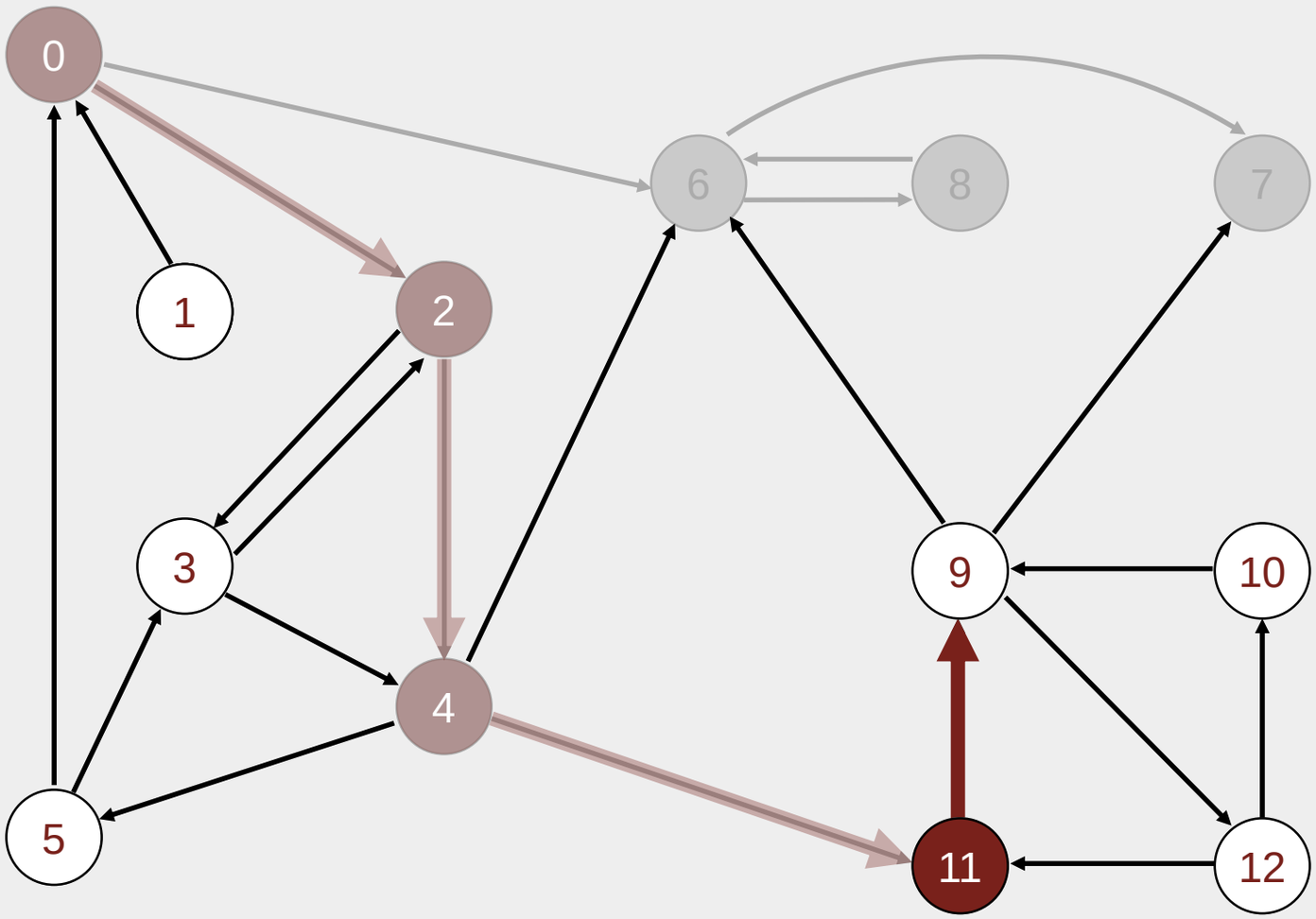


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	F
10	F
11	F
12	F

visit 4

Phase 1. Compute reverse postorder in G^R.

6 7 8

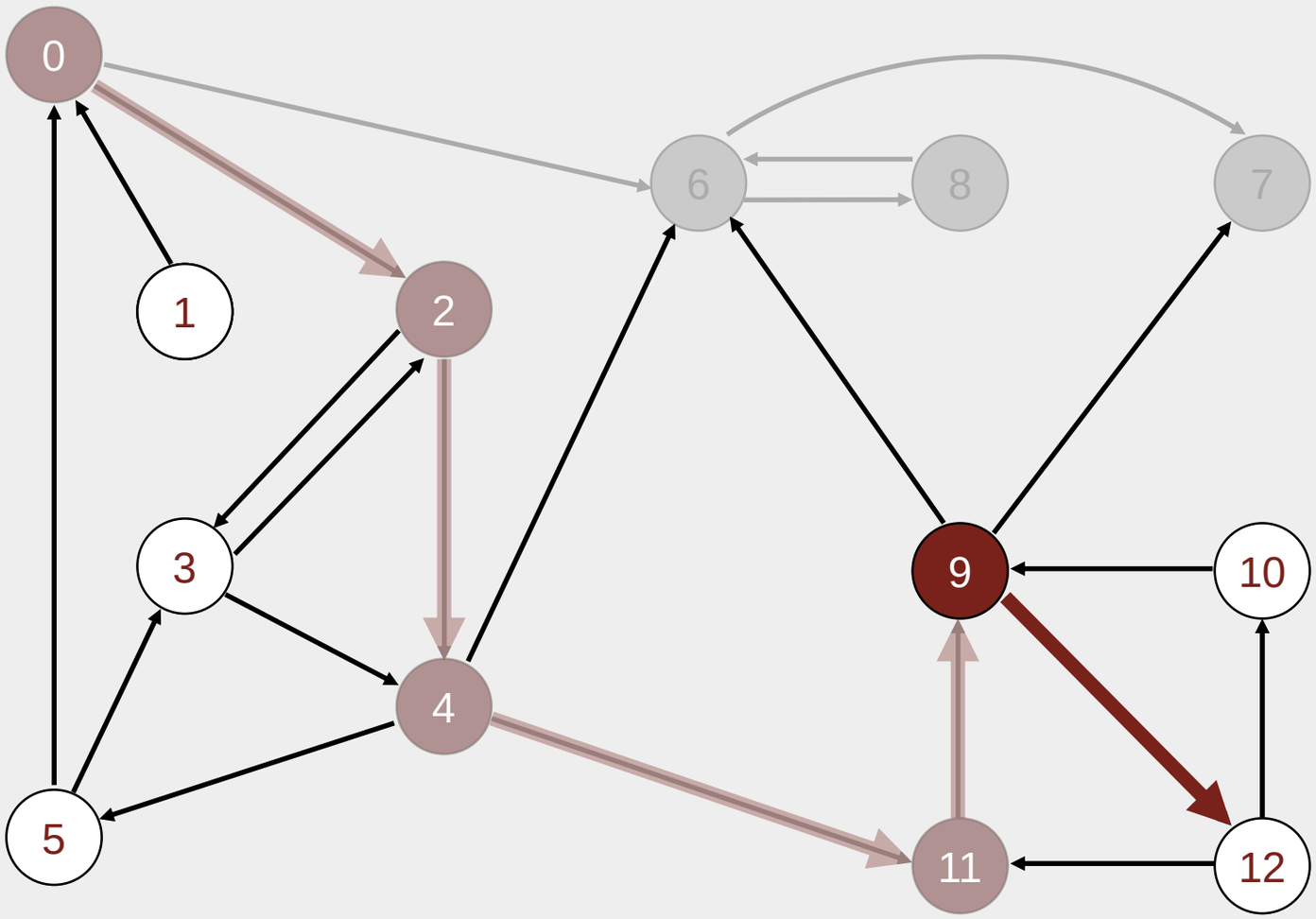


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	F
10	F
11	T
12	F

visit 11

Phase 1. Compute reverse postorder in G^R.

6 7 8

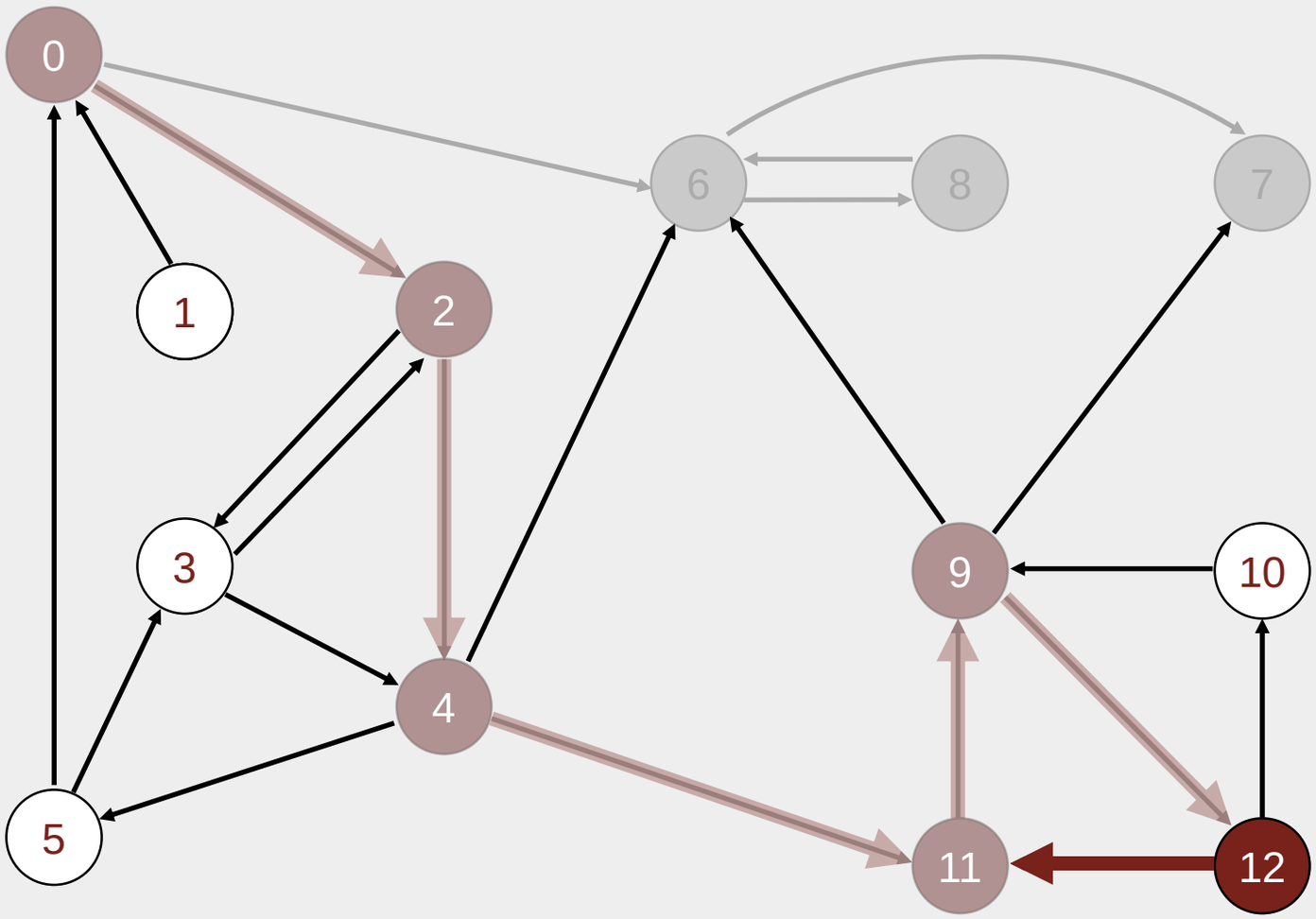


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	F
11	T
12	F

visit 9

Phase 1. Compute reverse postorder in G^R.

6 7 8

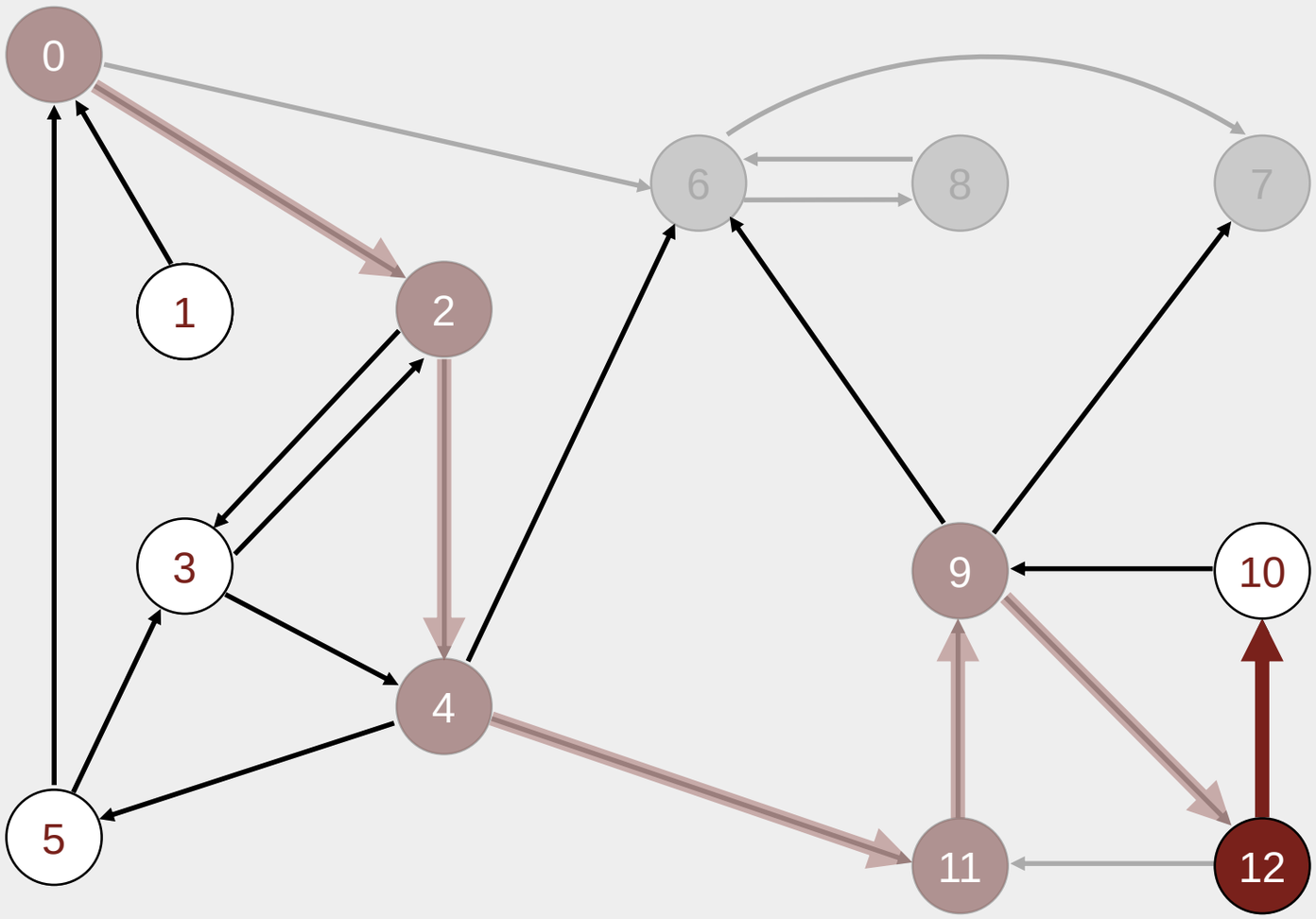


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	F
11	T
12	T

visit 12

Phase 1. Compute reverse postorder in G^R.

6 7 8

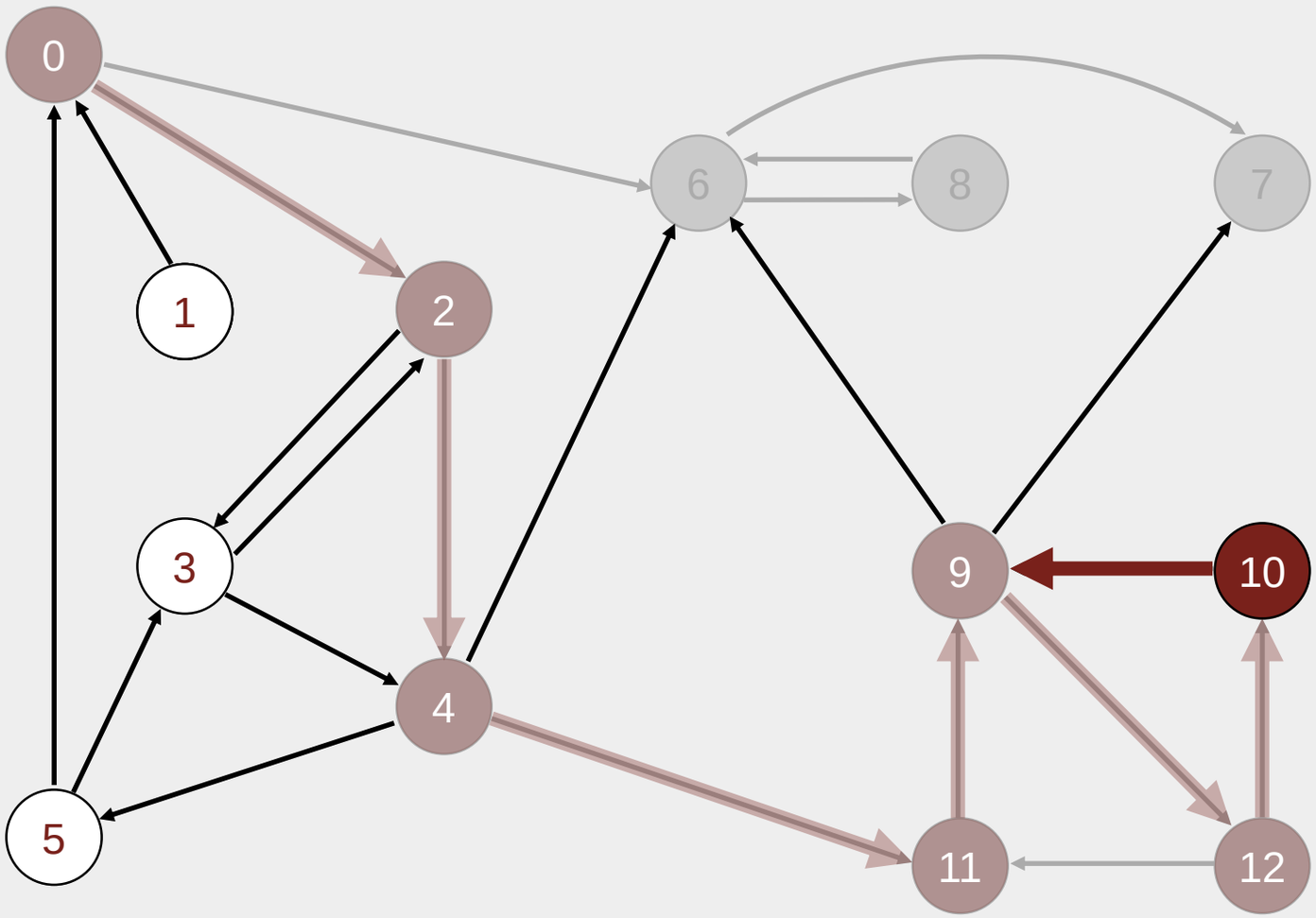


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	F
11	T
12	T

visit 12

Phase 1. Compute reverse postorder in G^R.

6 7 8

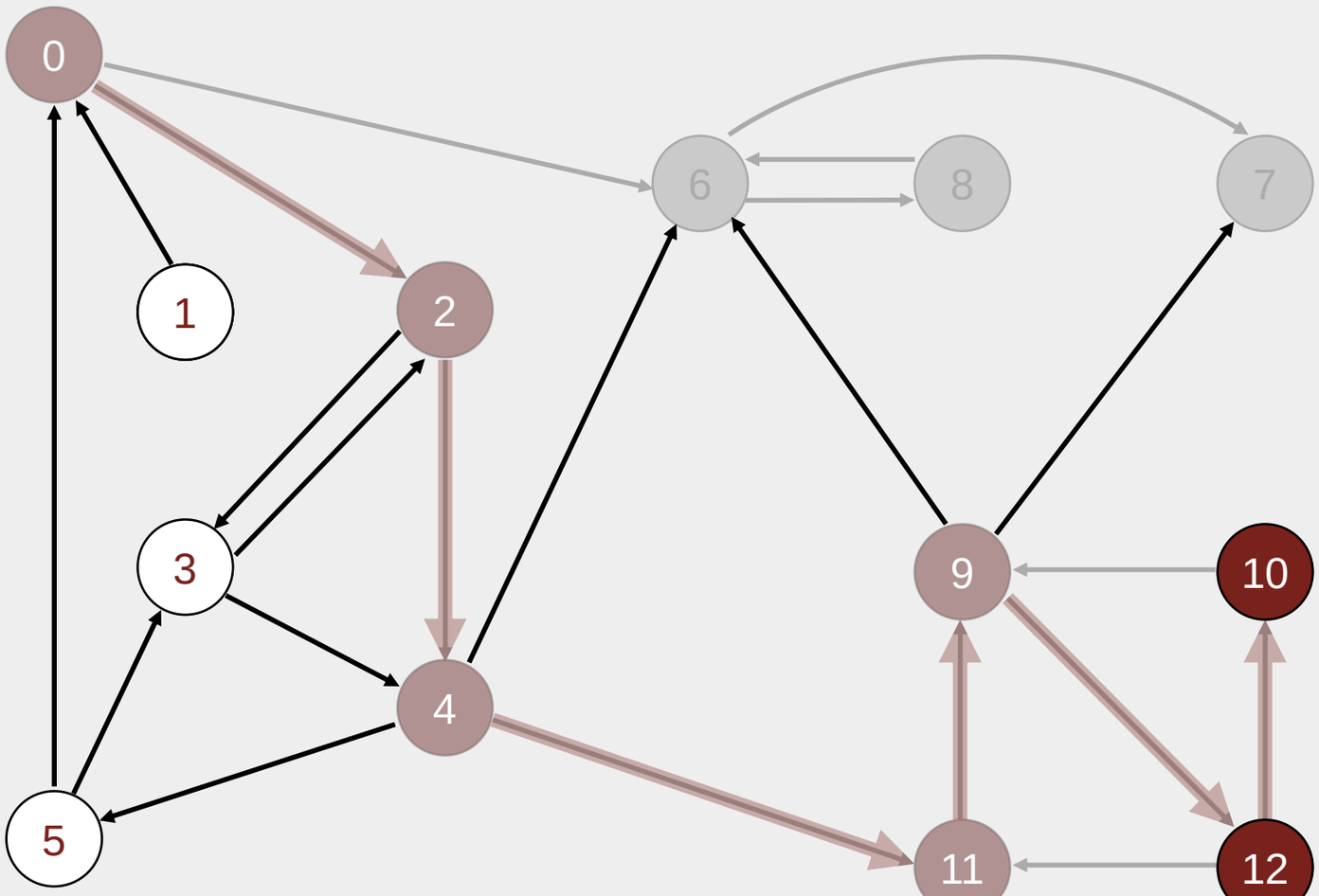


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	T
11	T
12	T

visit 10

Phase 1. Compute reverse postorder in G^R.

10 6 7 8

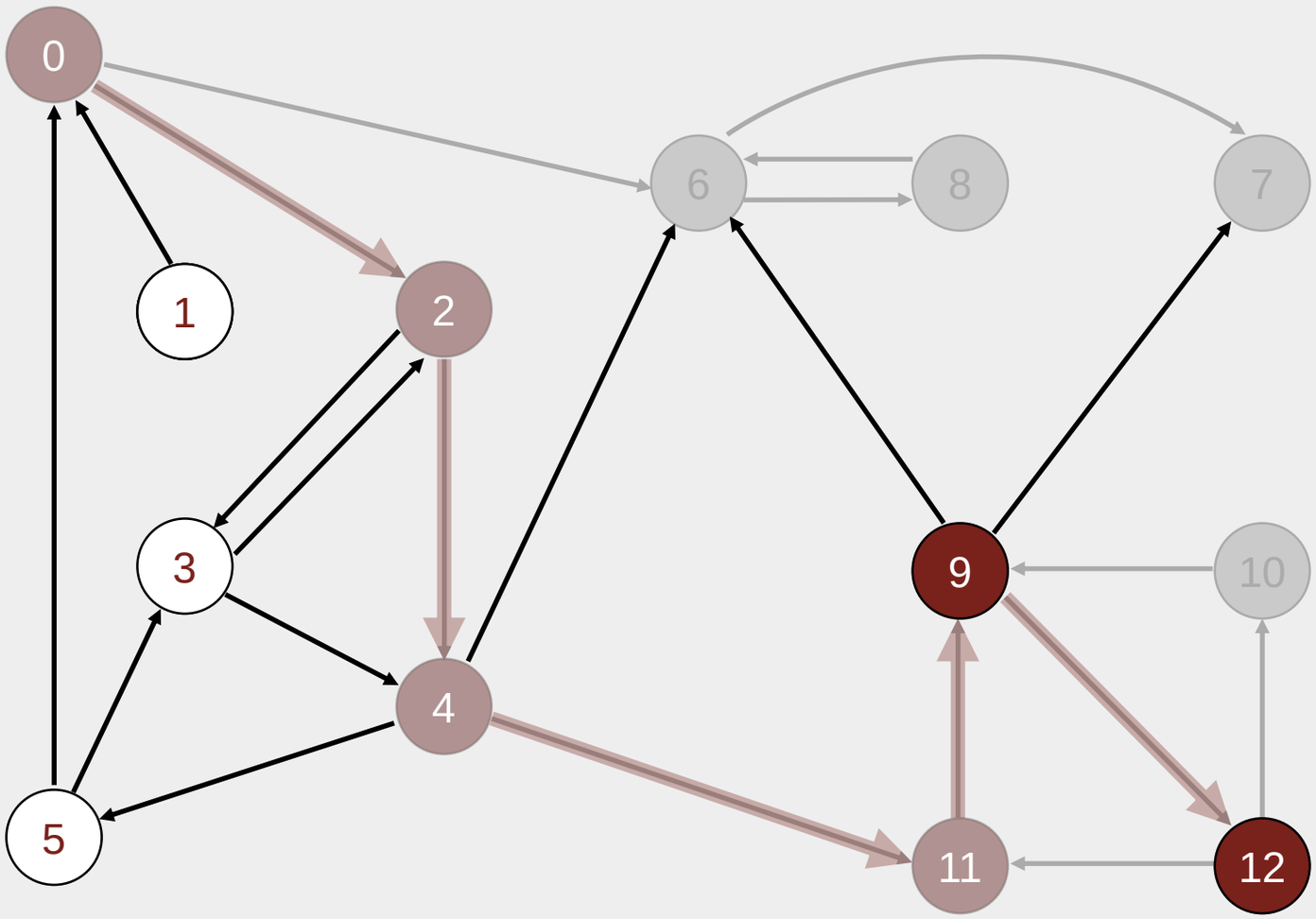


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	T
11	T
12	T

10 done

Phase 1. Compute reverse postorder in G^R.

12 10 6 7 8

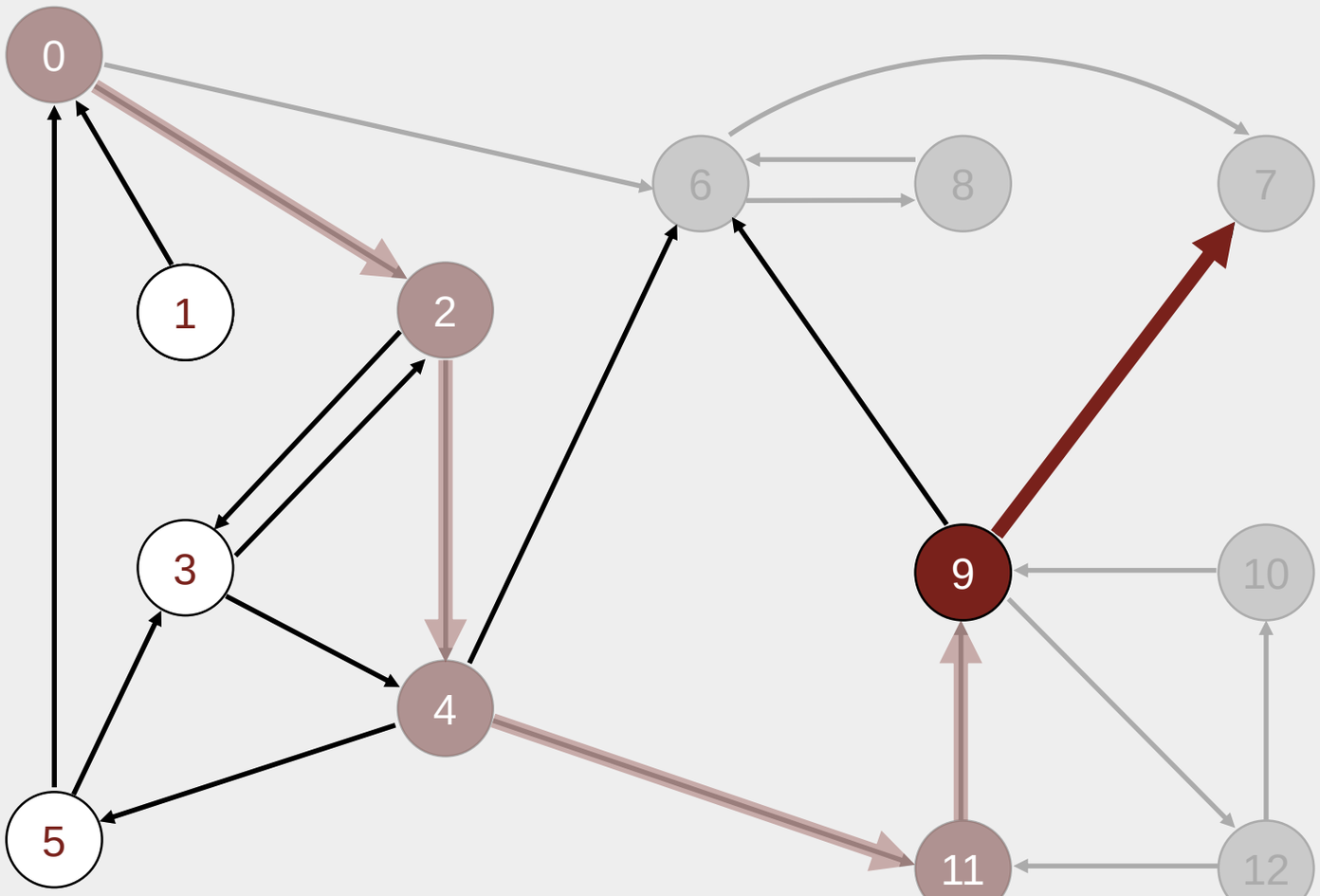


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	T
11	T
12	T

12 done

Phase 1. Compute reverse postorder in G^R.

12 10 6 7 8

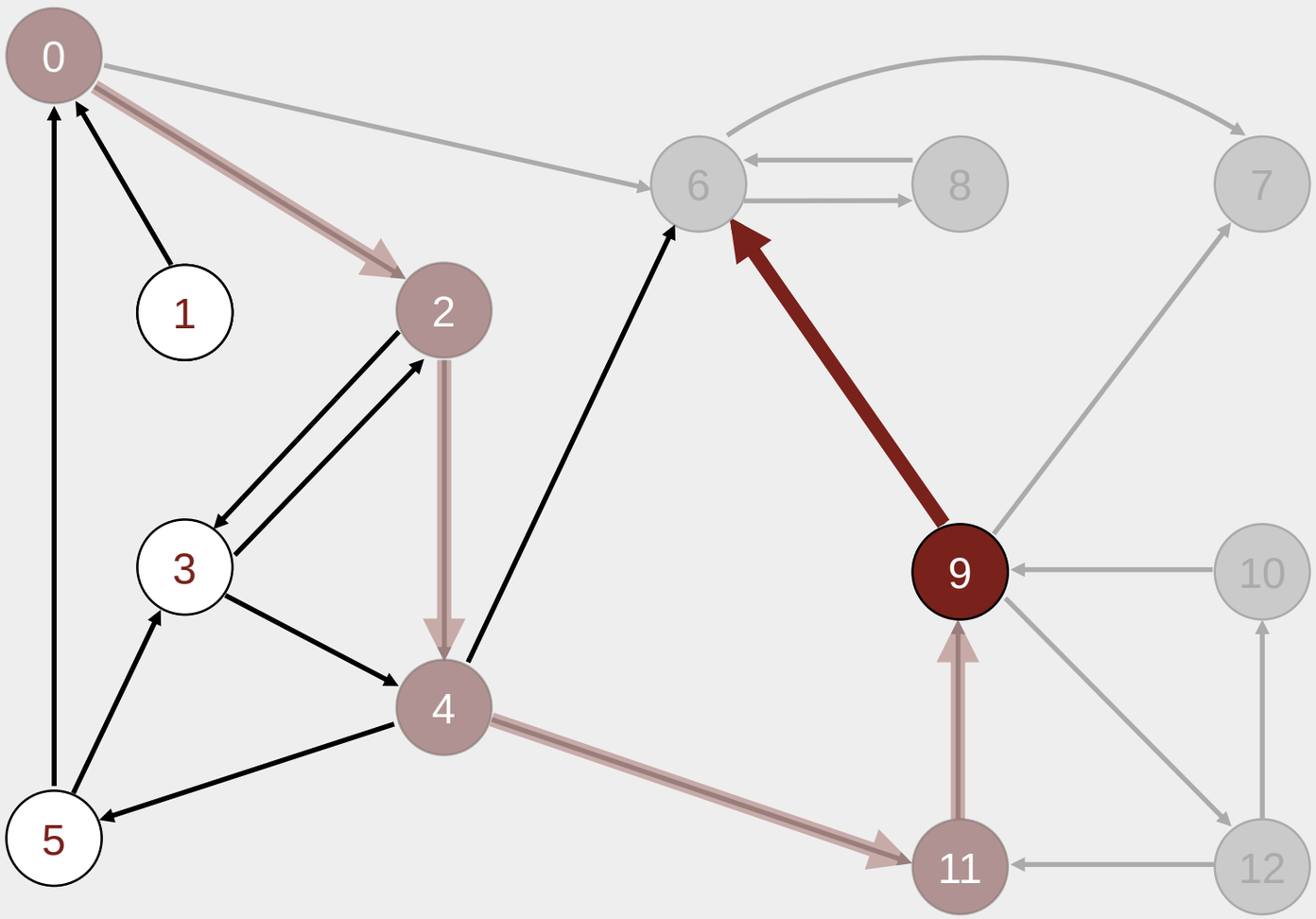


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	T
11	T
12	T

visit 9

Phase 1. Compute reverse postorder in G^R.

12 10 6 7 8

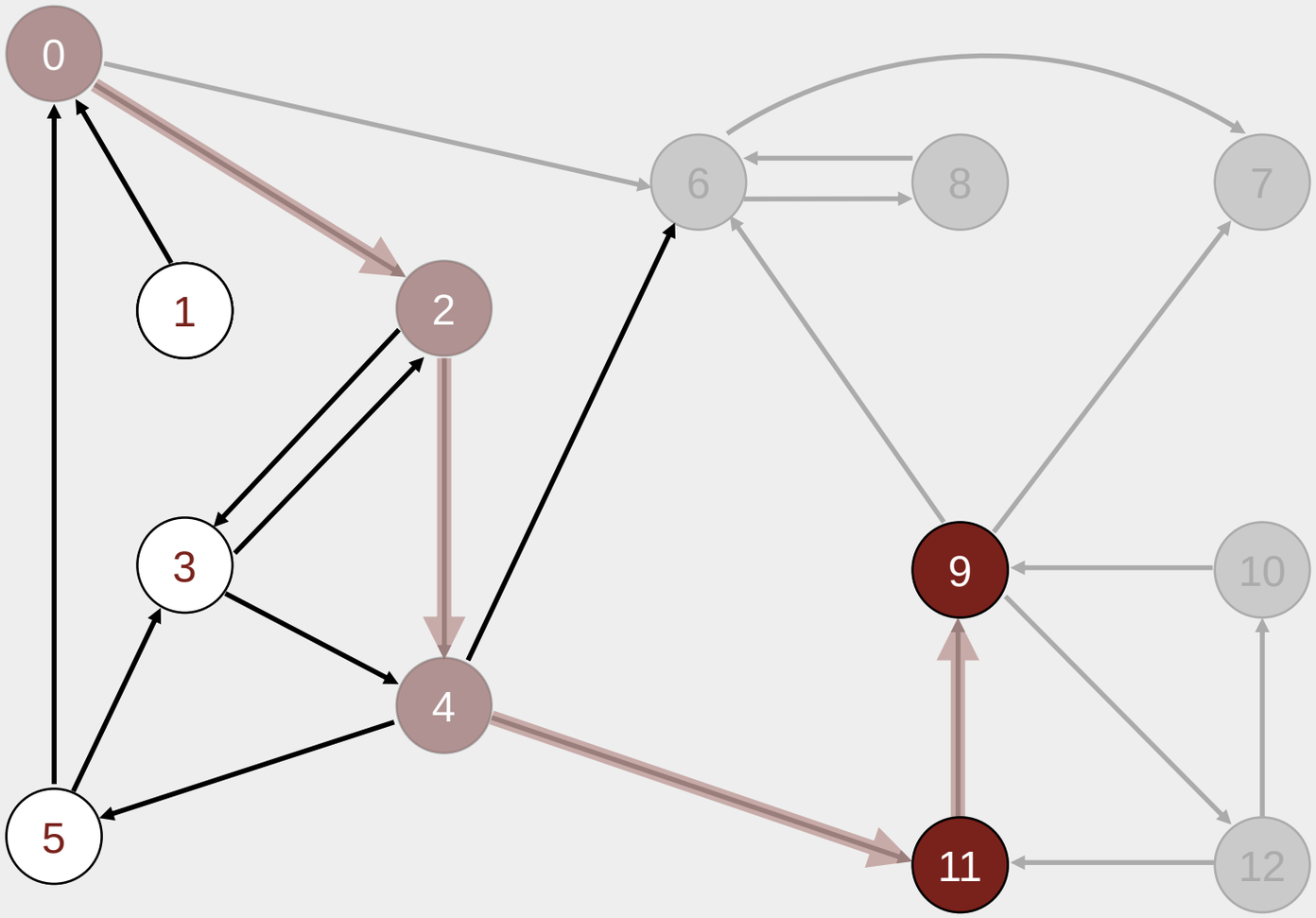


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	T
11	T
12	T

visit 9

Phase 1. Compute reverse postorder in G^R.

9 12 10 6 7 8

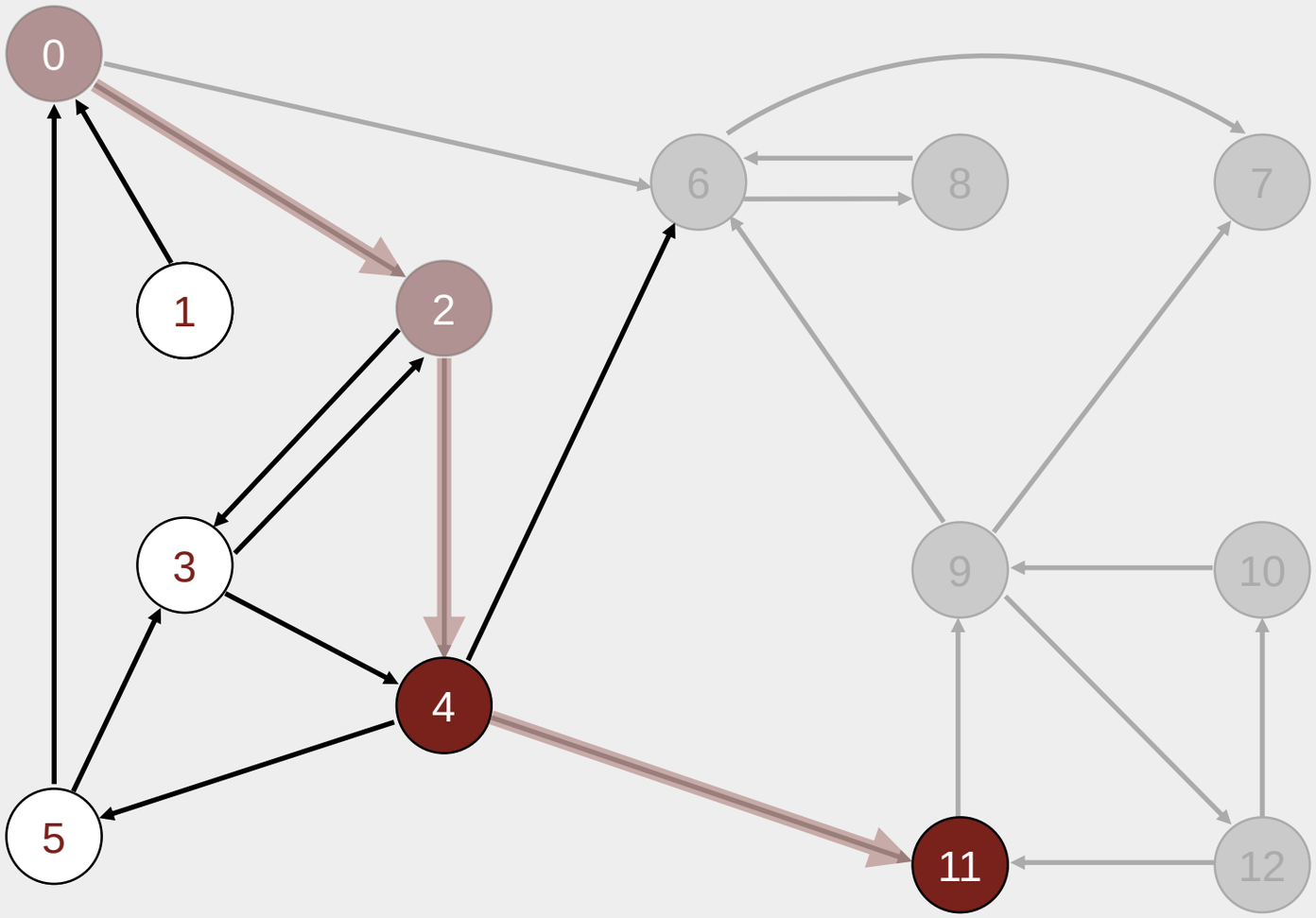


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	T
11	T
12	T

9 done

Phase 1. Compute reverse postorder in G^R.

11 9 12 10 6 7 8

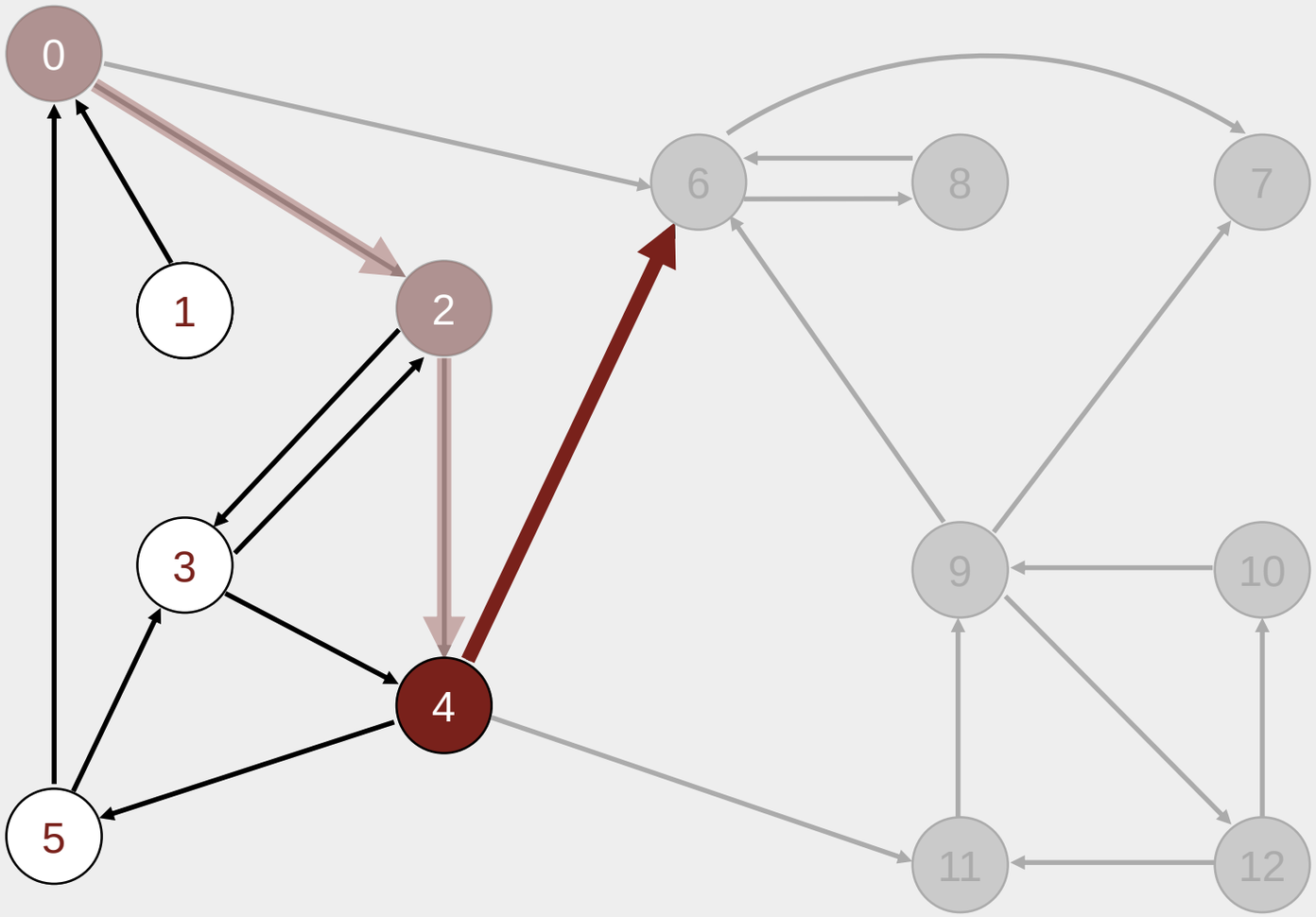


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	T
11	T
12	T

11 done

Phase 1. Compute reverse postorder in G^R.

11 9 12 10 6 7 8

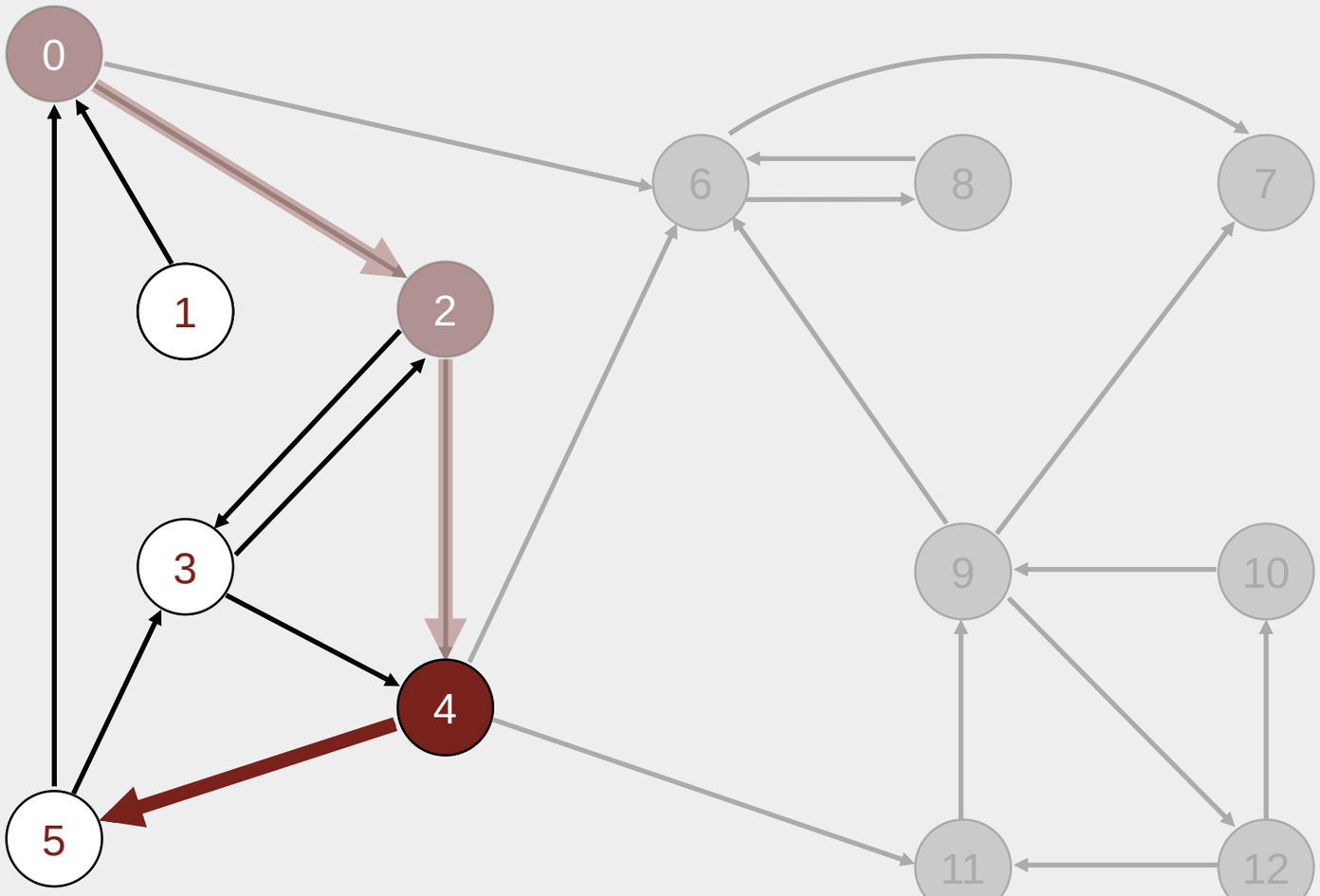


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	T
11	T
12	T

visit 4

Phase 1. Compute reverse postorder in G^R.

11 9 12 10 6 7 8

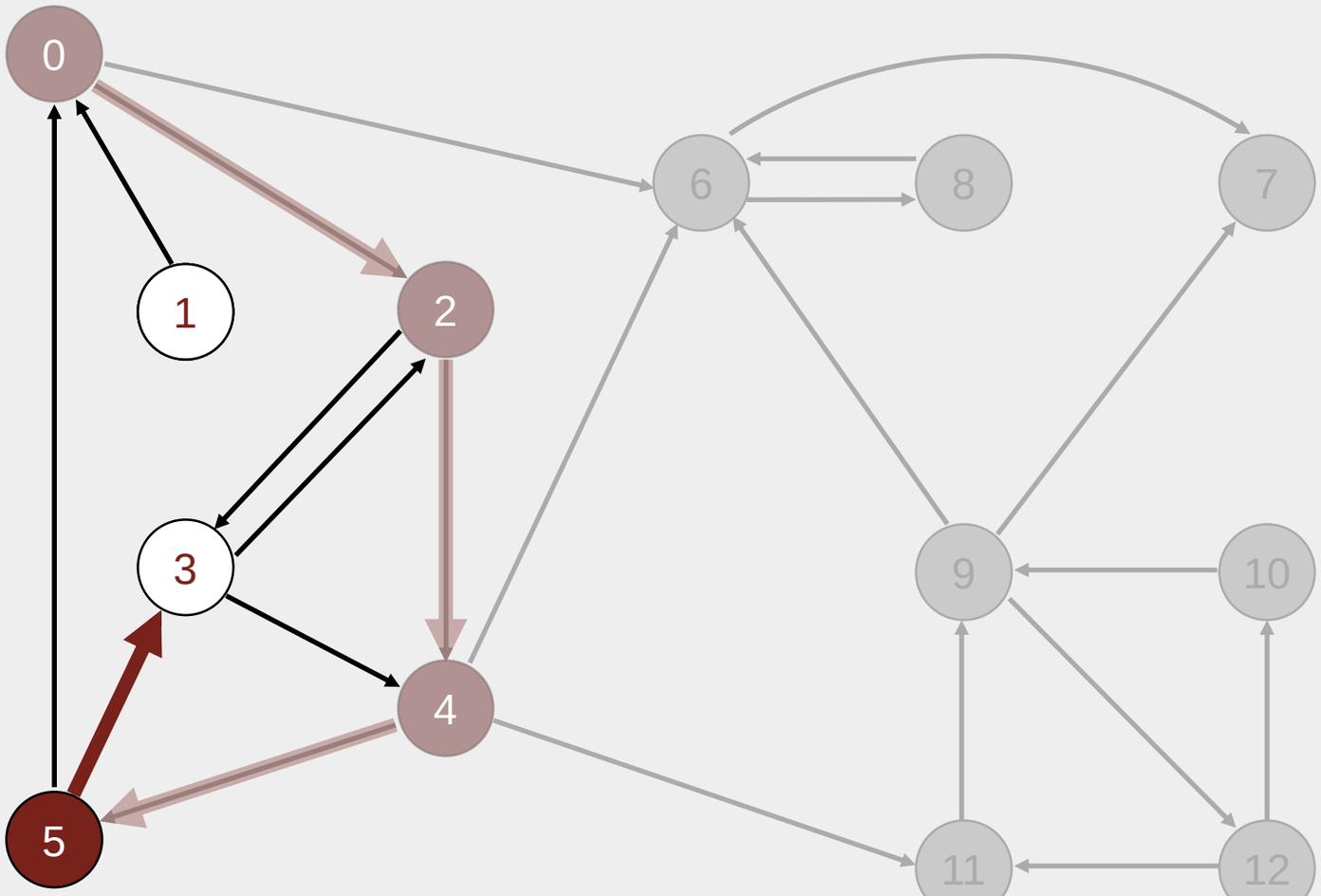


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	F
6	T
7	T
8	T
9	T
10	T
11	T
12	T

visit 4

Phase 1. Compute reverse postorder in G^R.

11 9 12 10 6 7 8

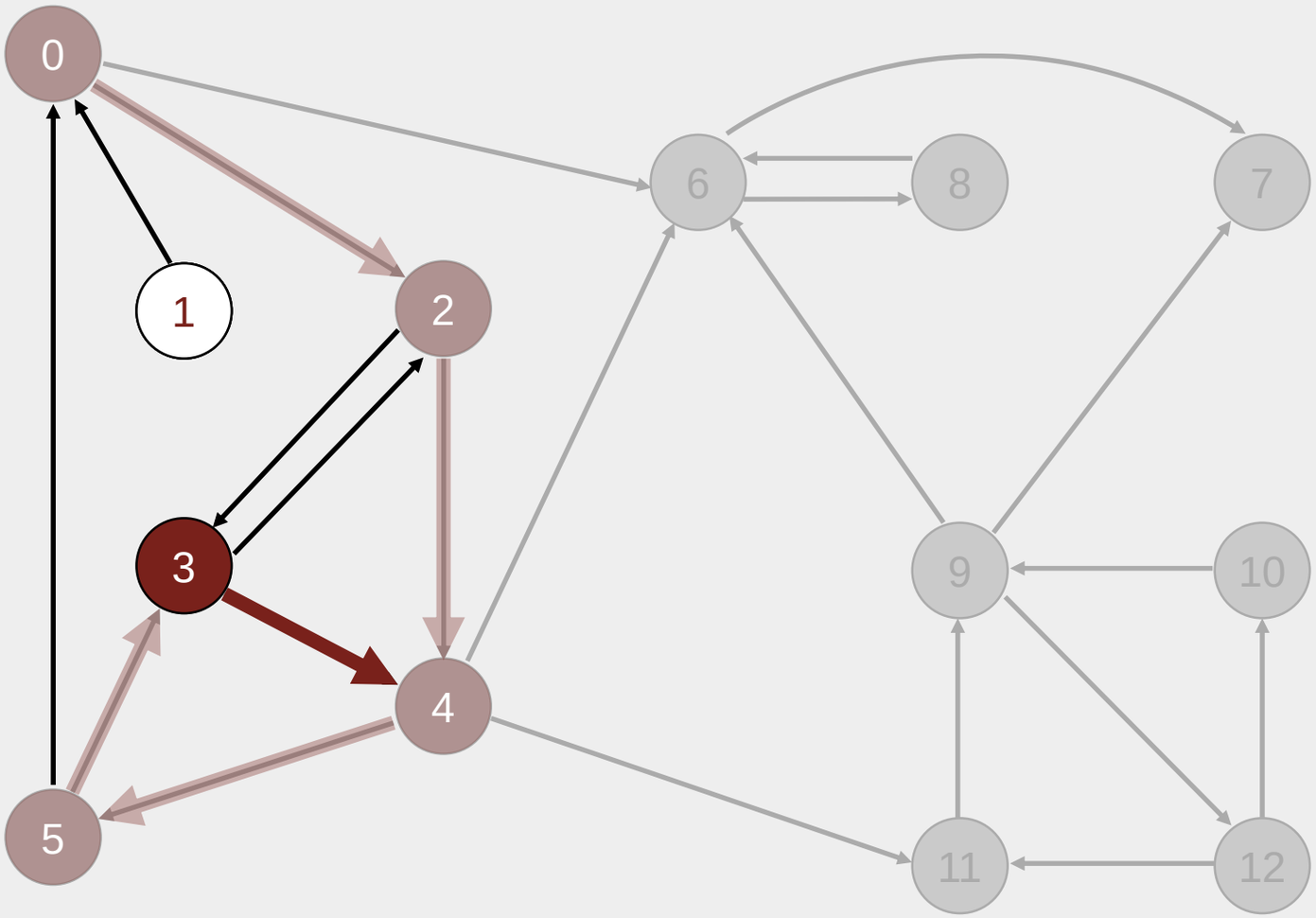


v	marked[v]
0	T
1	F
2	T
3	F
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

visit 5

Phase 1. Compute reverse postorder in G^R.

11 9 12 10 6 7 8

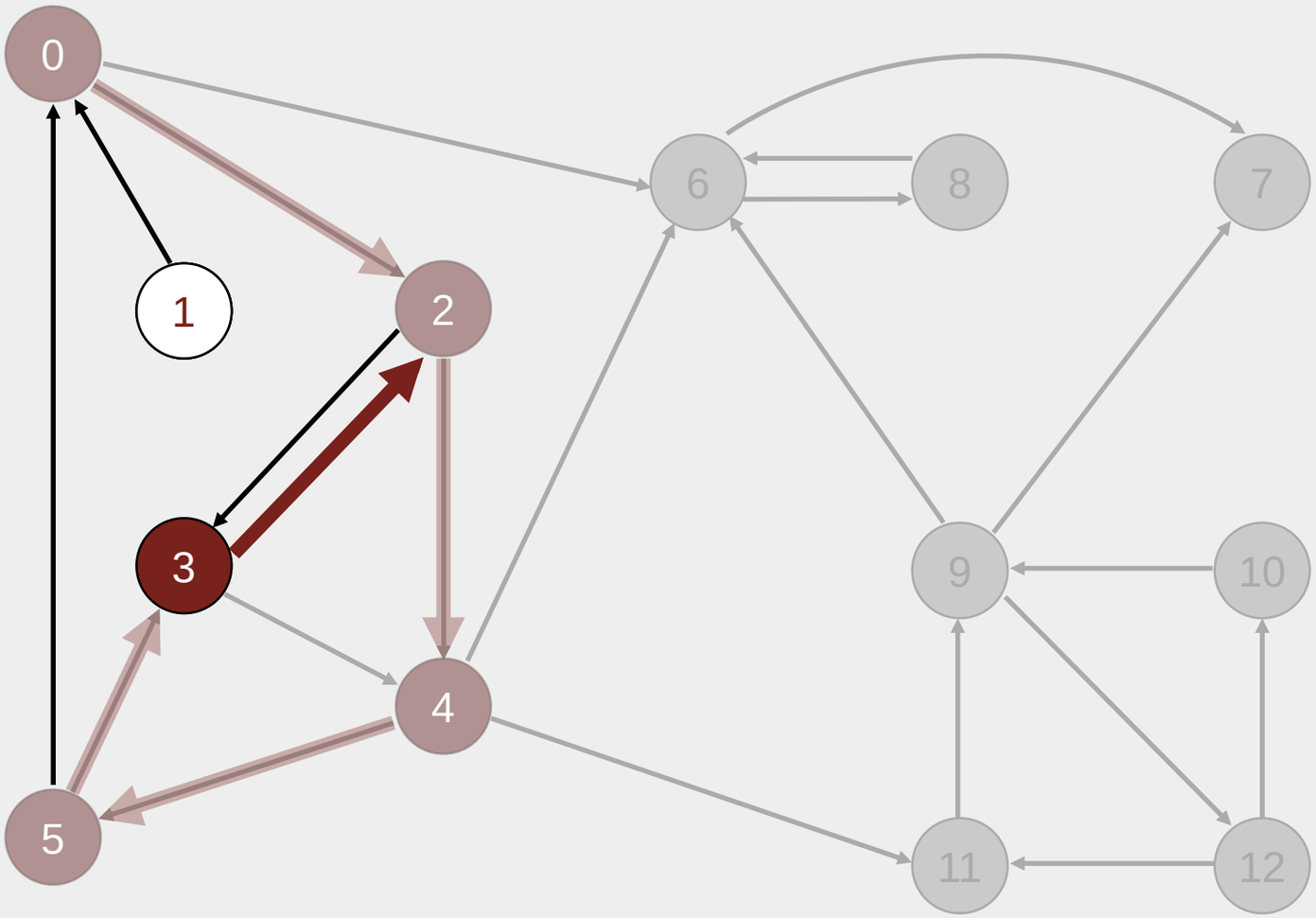


v	marked[v]
0	T
1	F
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

visit 3

Phase 1. Compute reverse postorder in G^R.

11 9 12 10 6 7 8

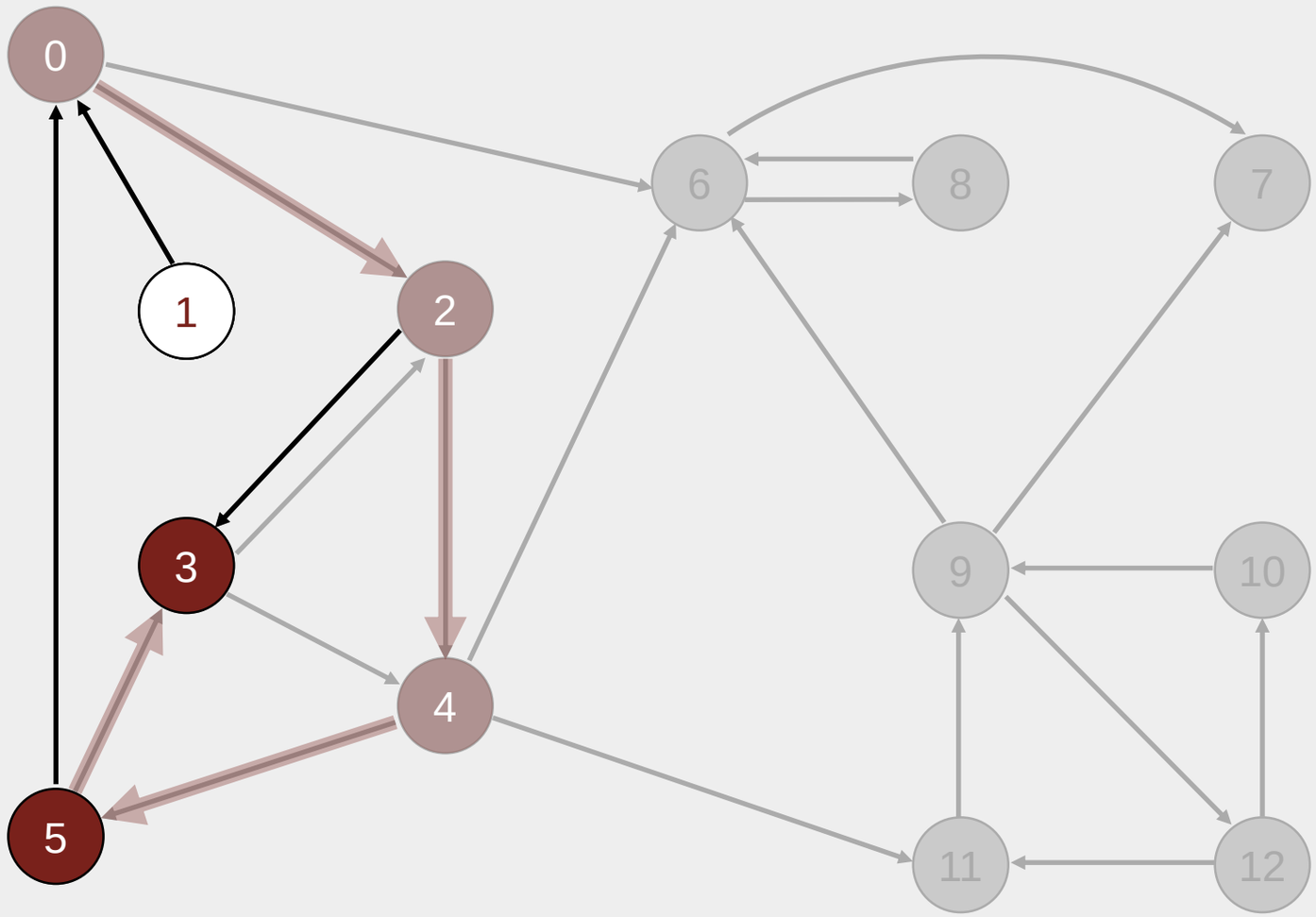


v	marked[v]
0	T
1	F
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

visit 3

Phase 1. Compute reverse postorder in G^R.

3 11 9 12 10 6 7 8

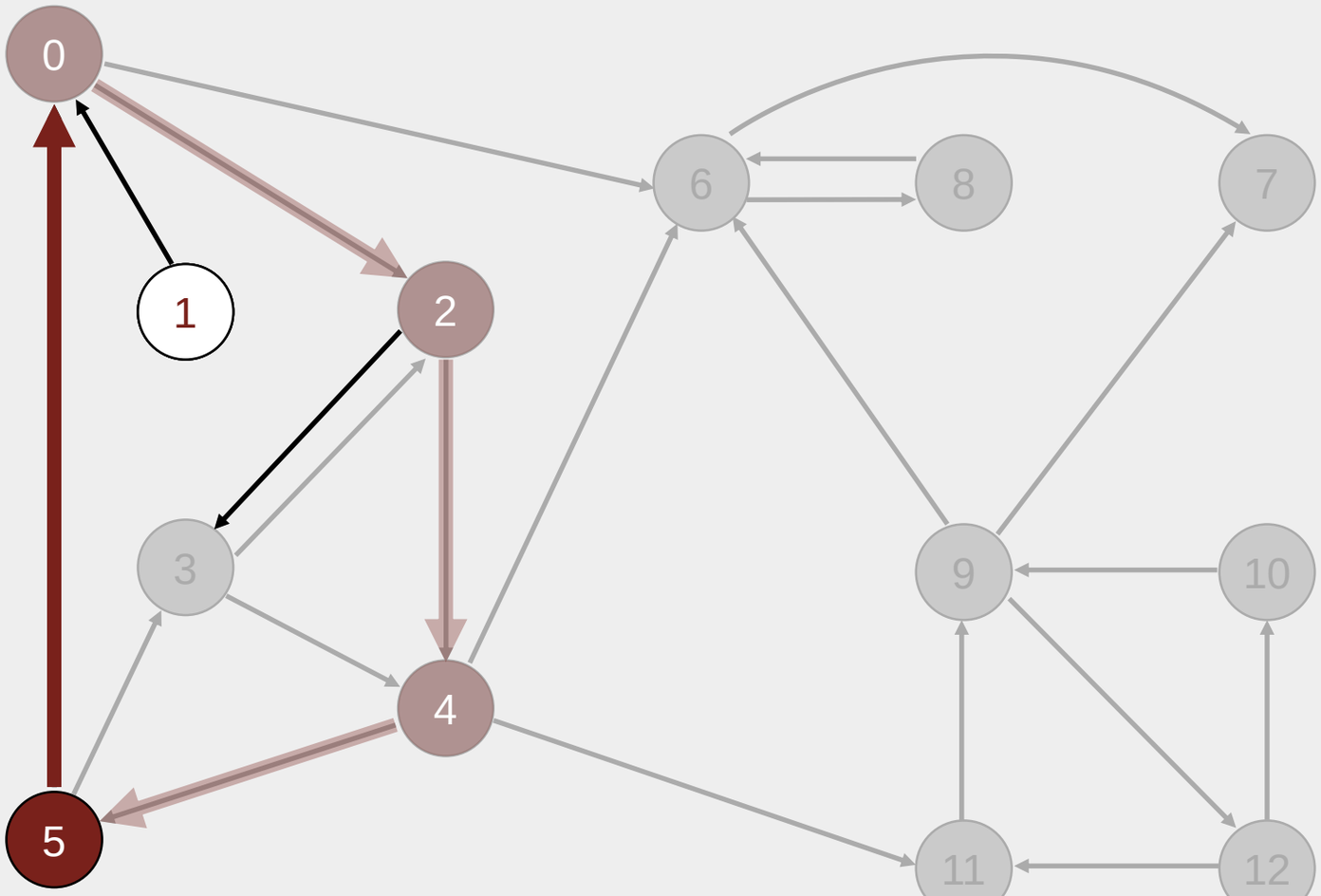


v	marked[v]
0	T
1	F
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

3 done

Phase 1. Compute reverse postorder in G^R.

3 11 9 12 10 6 7 8

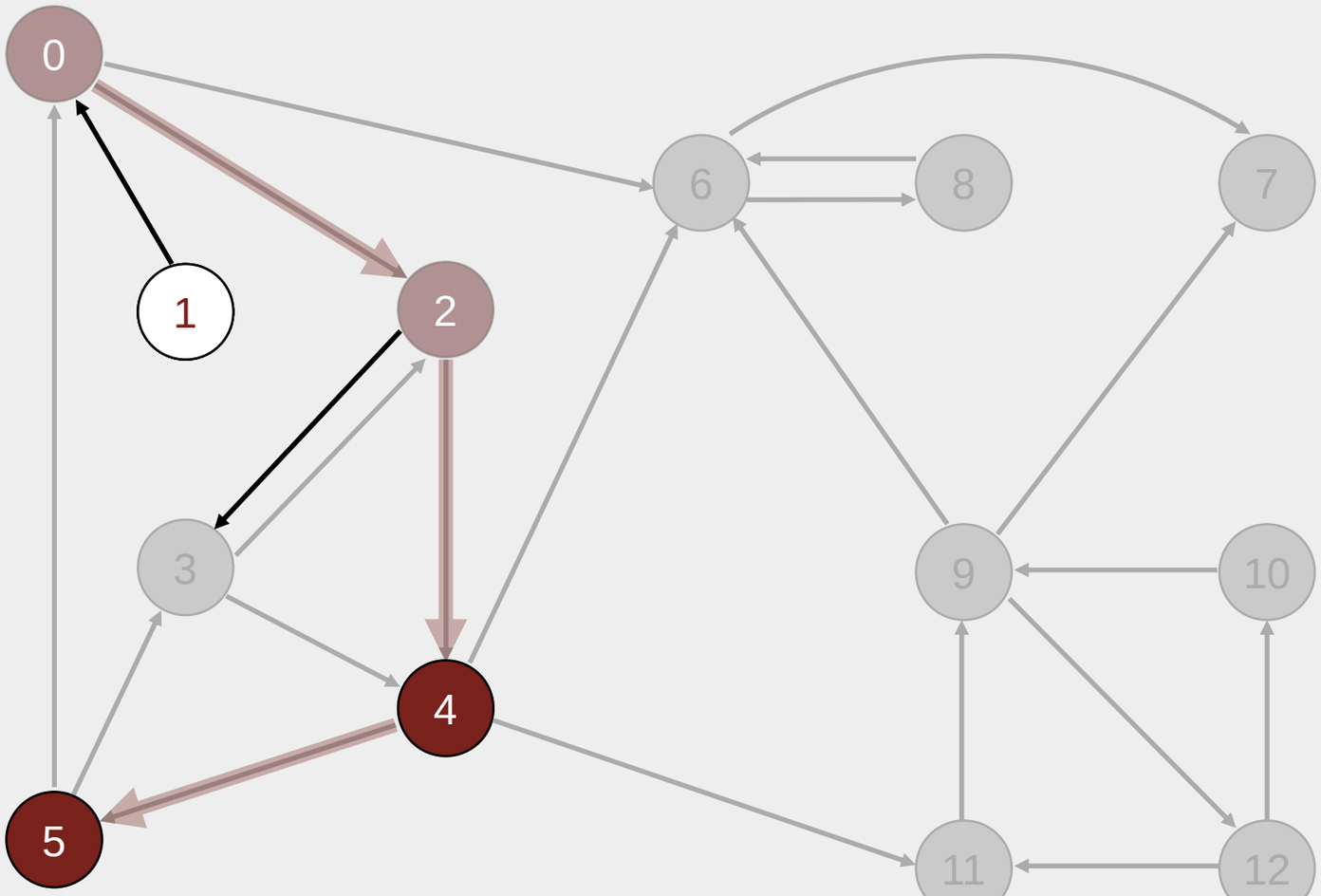


v	marked[v]
0	T
1	F
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

visit 5

Phase 1. Compute reverse postorder in G^R.

5 3 11 9 12 10 6 7 8

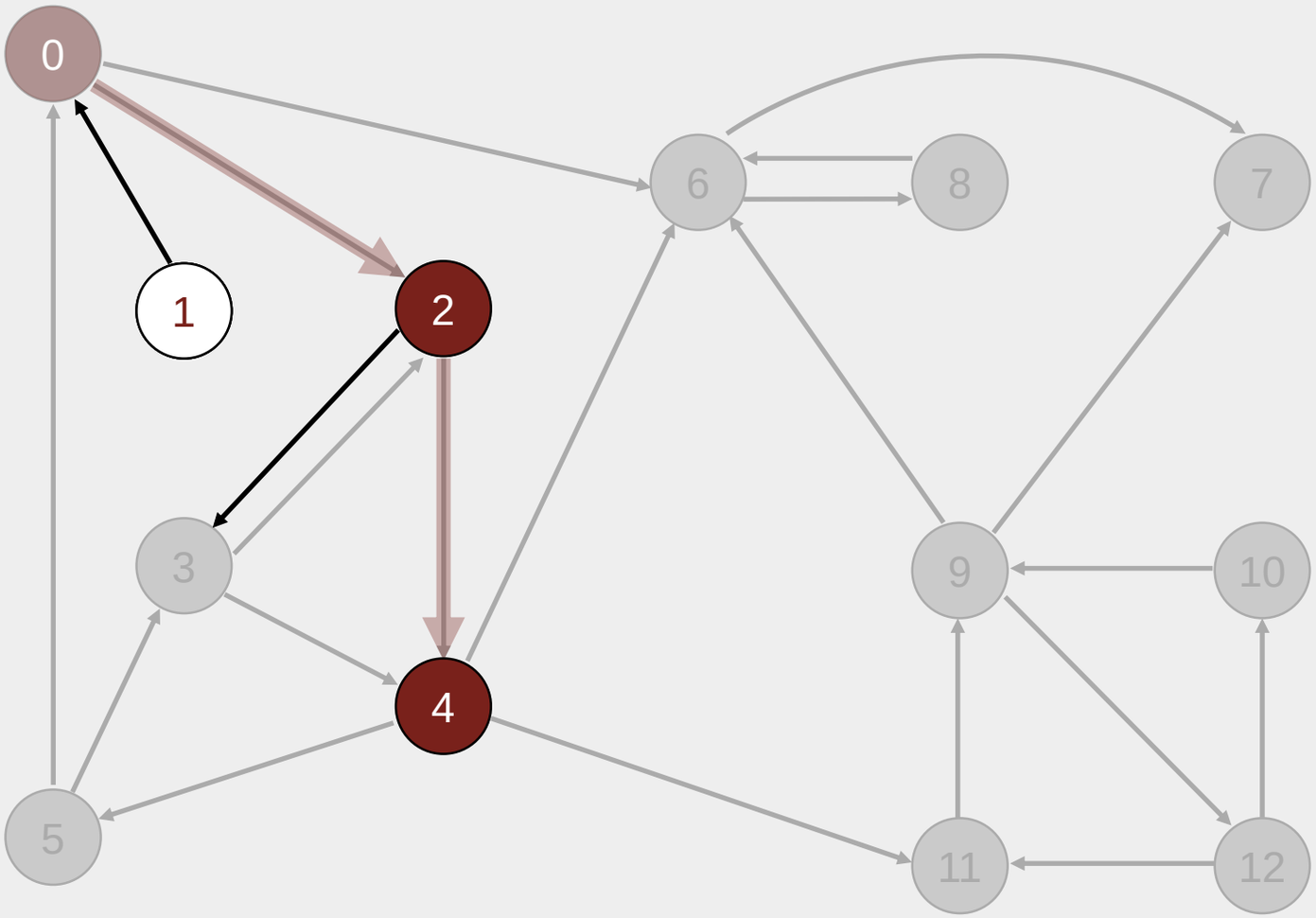


v	marked[v]
0	T
1	F
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

5 done

Phase 1. Compute reverse postorder in G^R.

4 5 3 11 9 12 10 6 7 8

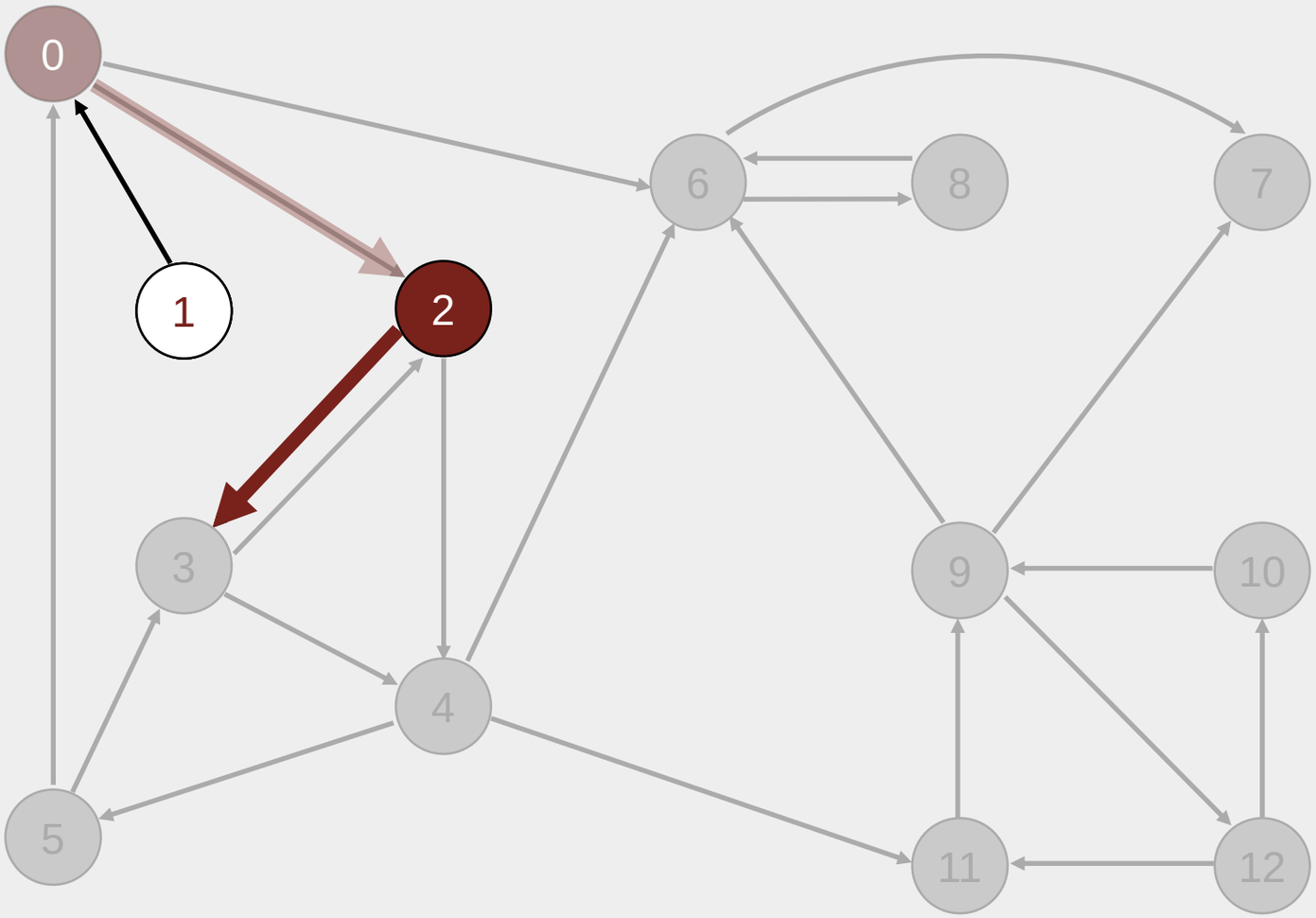


v	marked[v]
0	T
1	F
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

4 done

Phase 1. Compute reverse postorder in G^R.

4 5 3 11 9 12 10 6 7 8

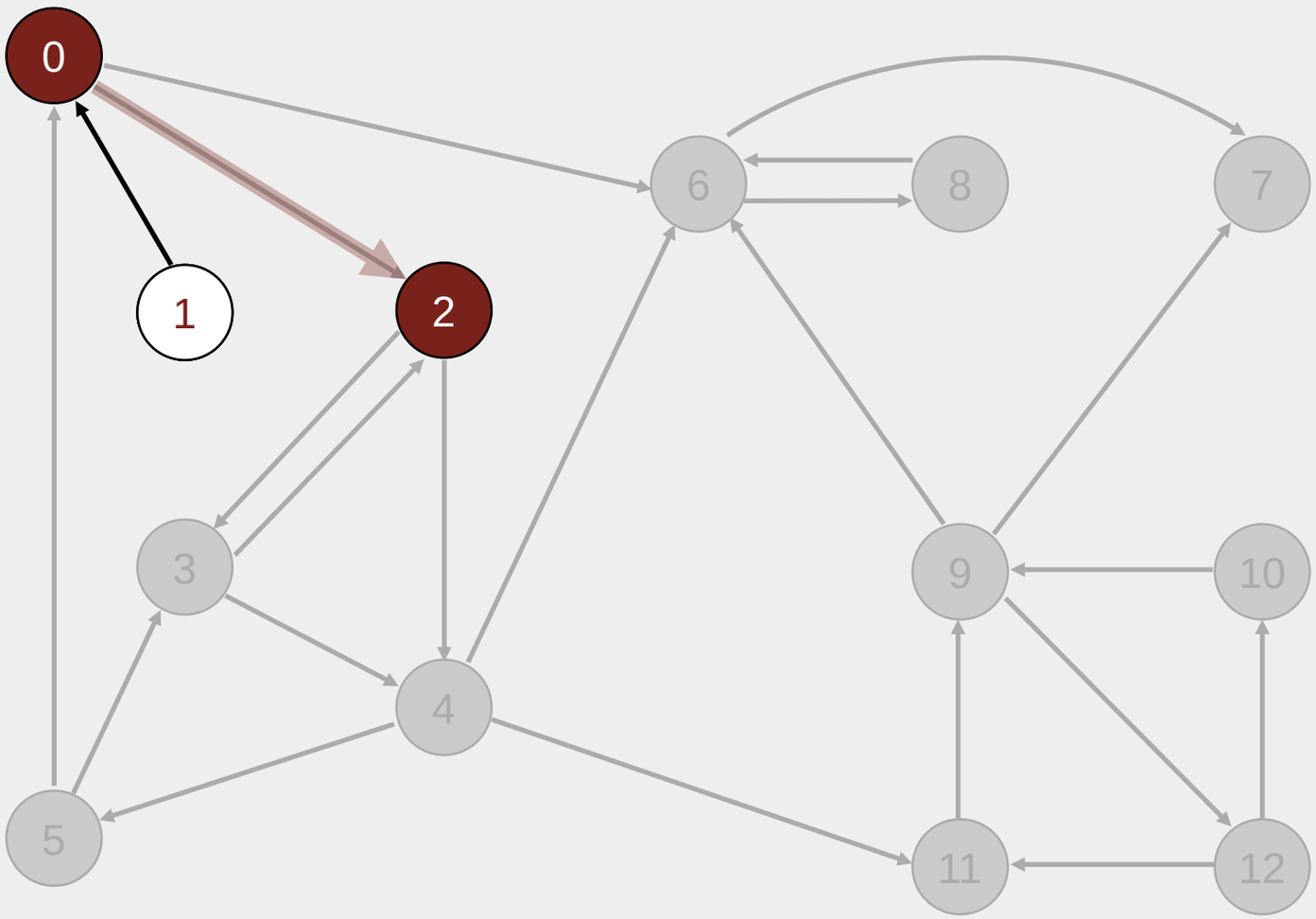


v	marked[v]
0	T
1	F
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

visit 2

Phase 1. Compute reverse postorder in G^R.

2 4 5 3 11 9 12 10 6 7 8

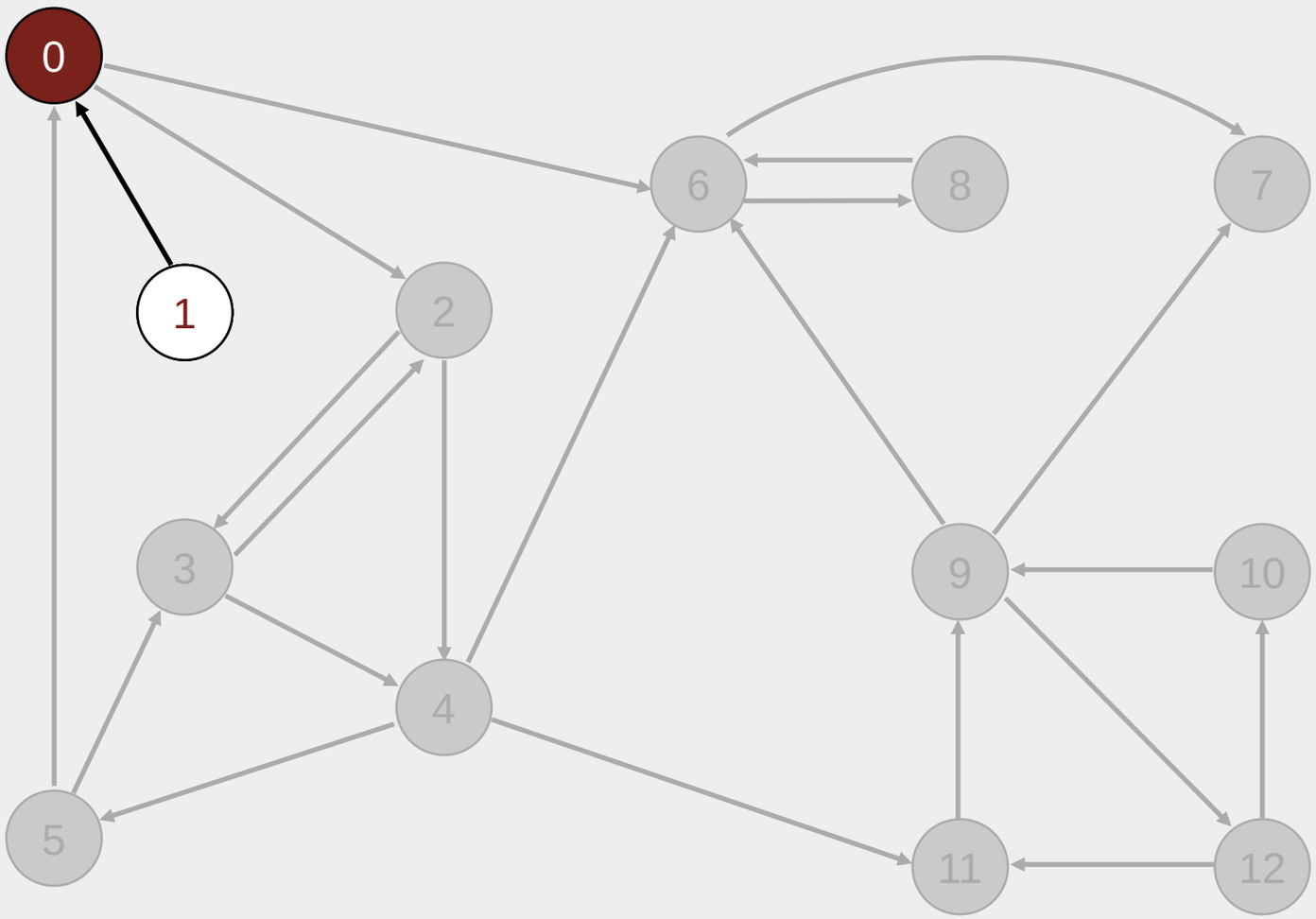


v	marked[v]
0	T
1	F
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

2 done

Phase 1. Compute reverse postorder in G^R.

0 2 4 5 3 11 9 12 10 6 7 8

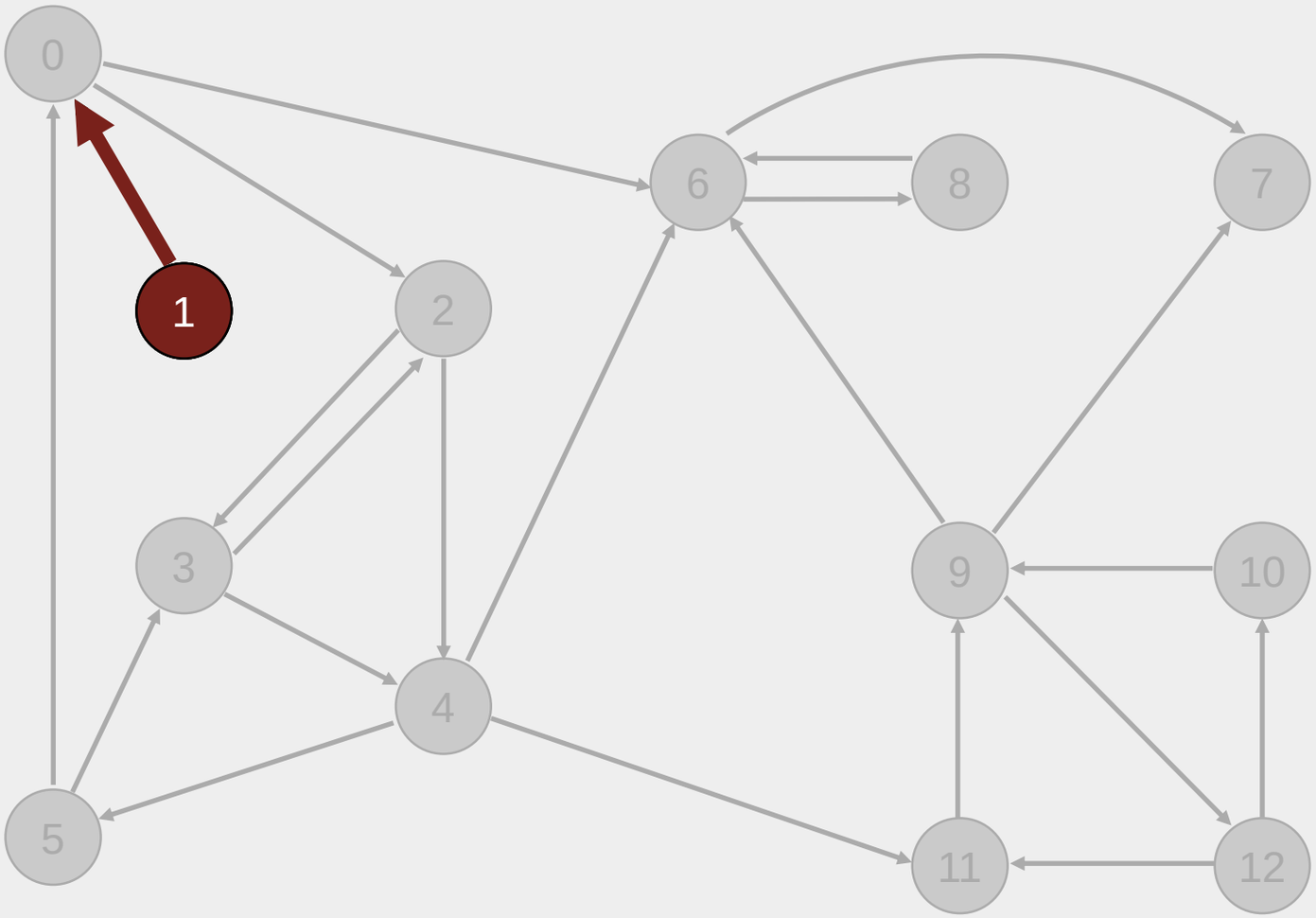


v	marked[v]
0	T
1	F
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

0 done

Phase 1. Compute reverse postorder in G^R.

0 2 4 5 3 11 9 12 10 6 7 8

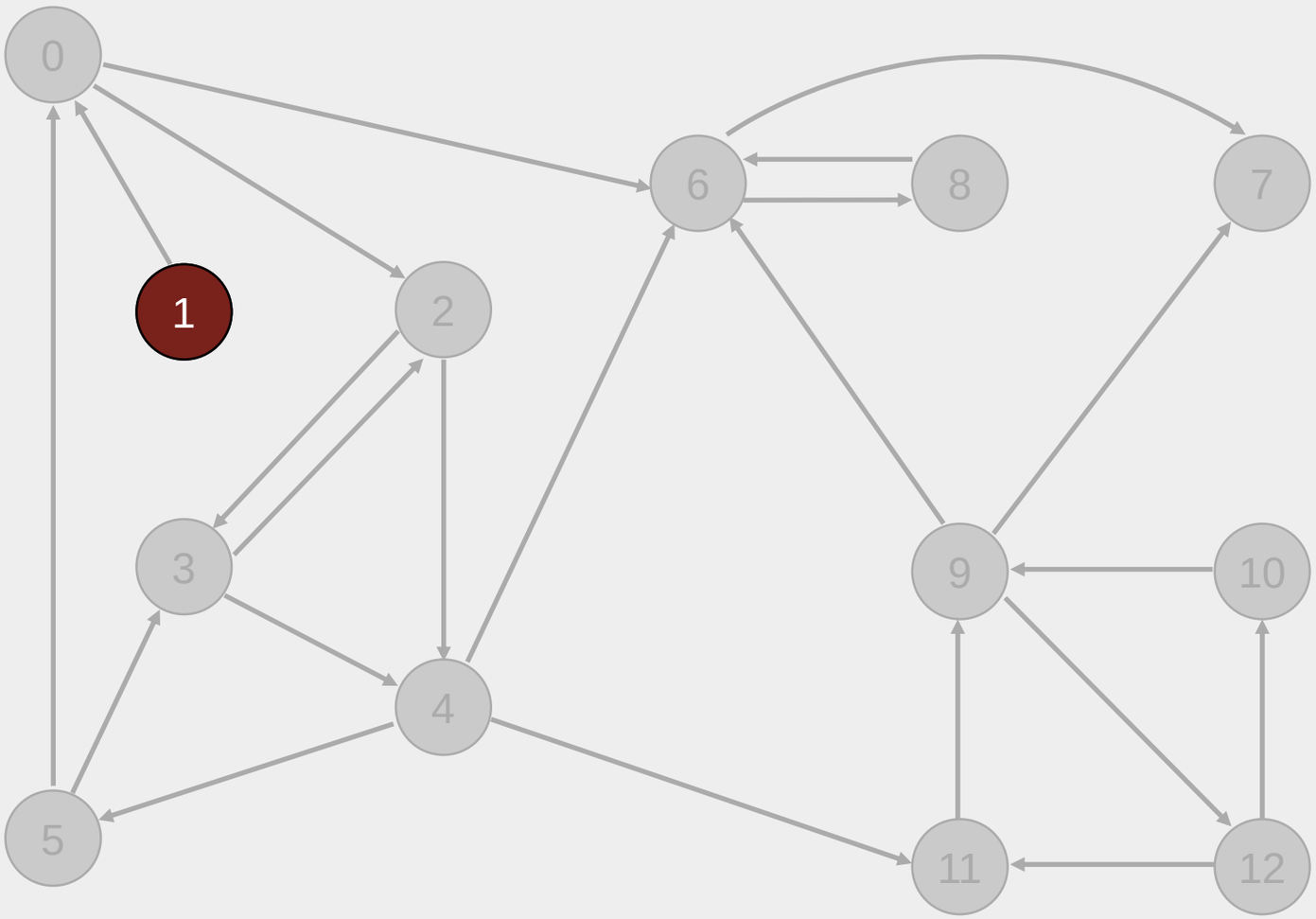


v	marked[v]
0	T
1	T
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

visit 1

Phase 1. Compute reverse postorder in G^R.

1 5 3 11 9 12 10 6 7 8

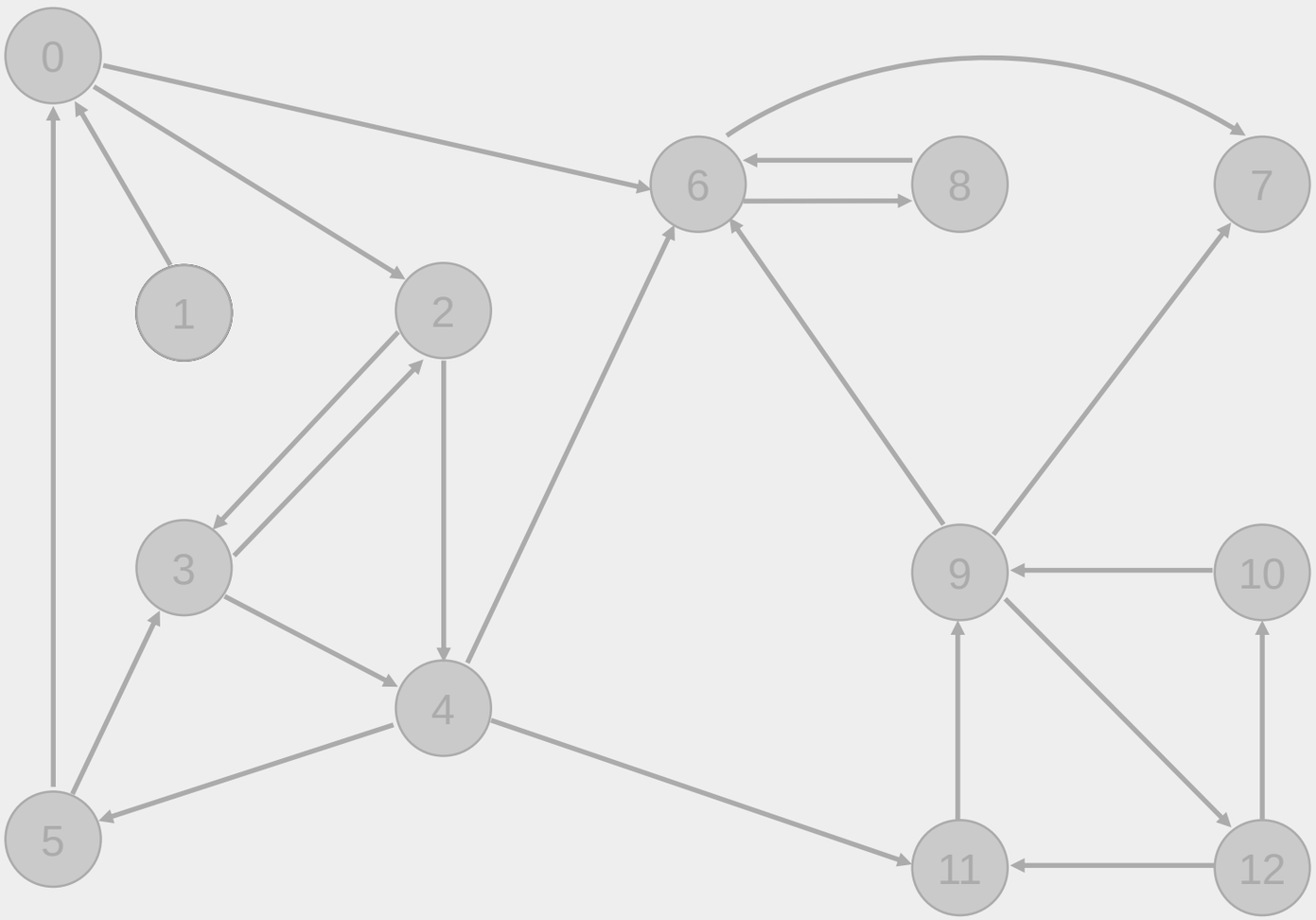


v	marked[v]
0	T
1	T
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

1 done

Phase 1. Compute reverse postorder in G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

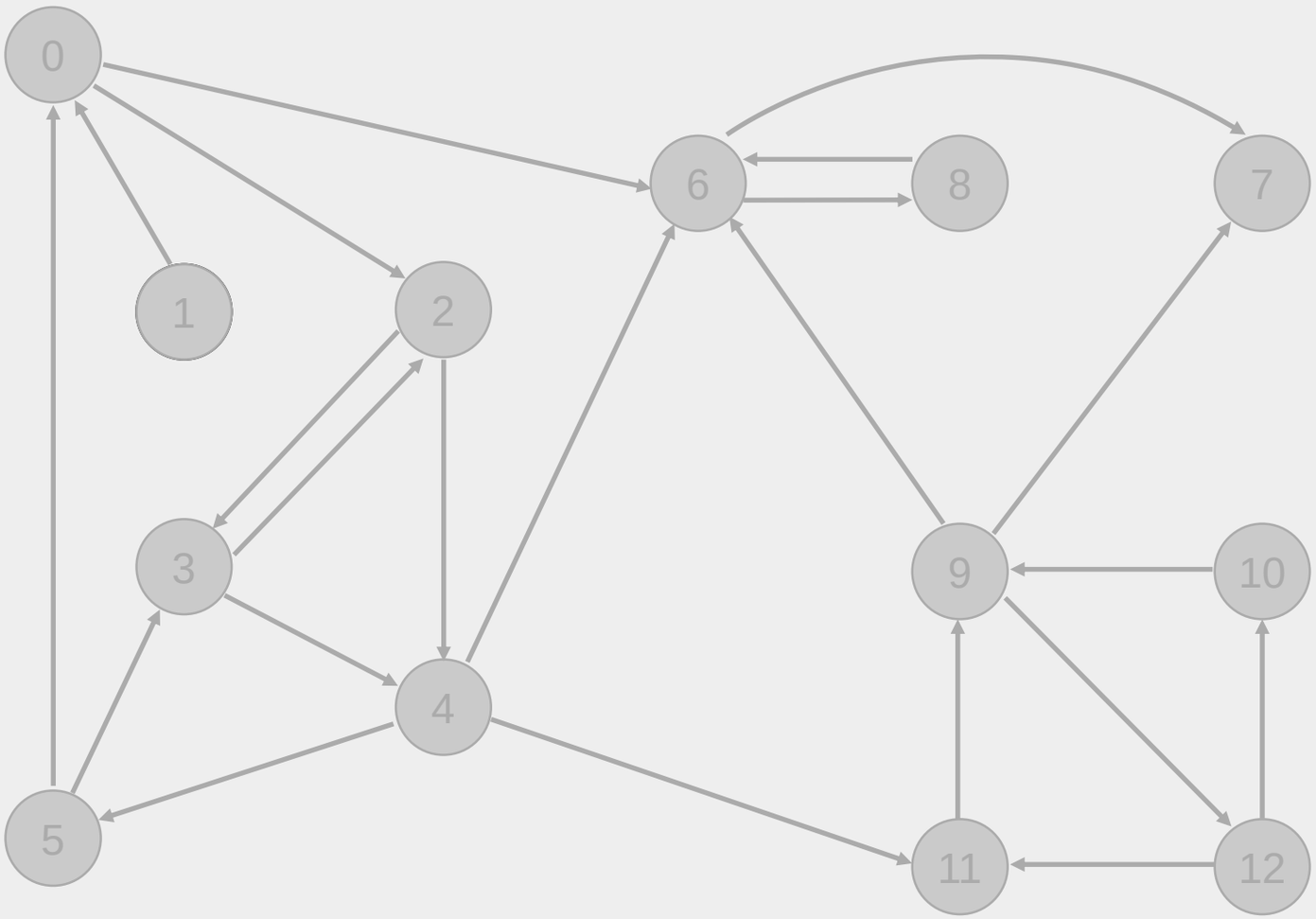


v	marked[v]
0	T
1	T
2	T
3	T
4	T
5	T
6	T
7	T
8	T
9	T
10	T
11	T
12	T

check 2 3 4 5 6 7 8 9 10 11 12

Phase 1. Compute reverse postorder in G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

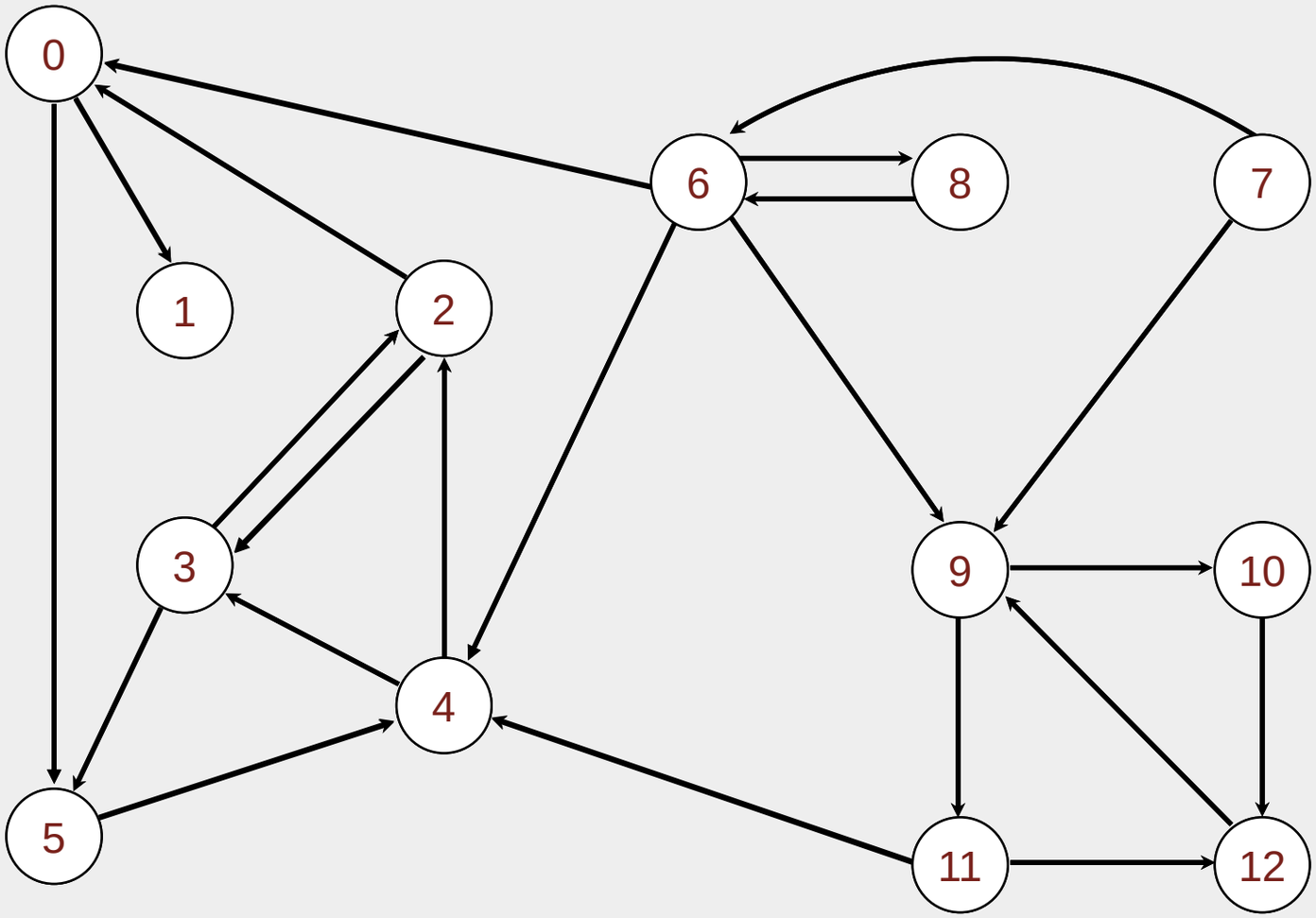


reverse digraph G^R

- DFS in reverse graph
- **DFS in original graph**

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

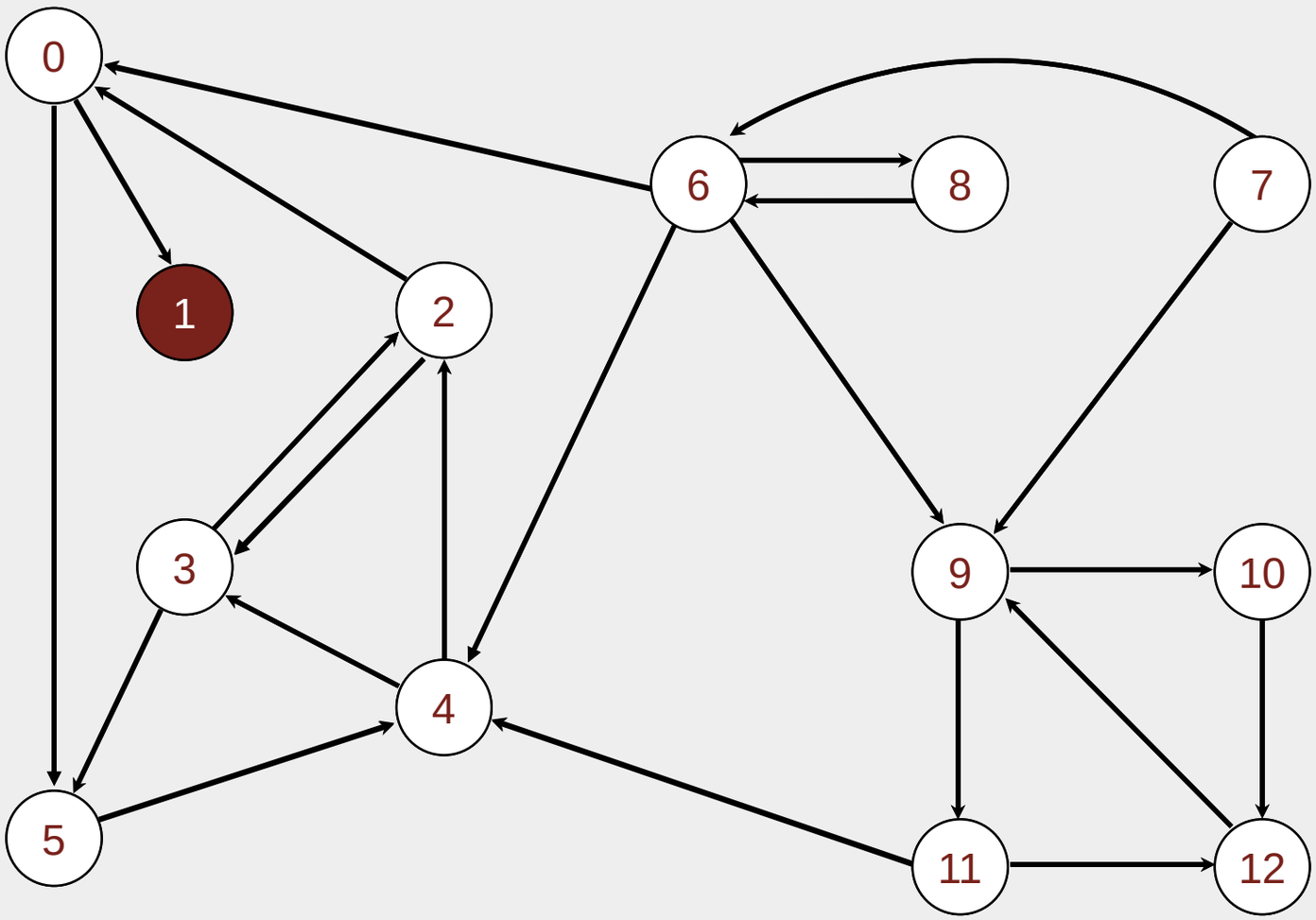


original digraph G

v	scc[v]
0	–
1	–
2	–
3	–
4	–
5	–
6	–
7	–
8	–
9	–
10	–
11	–
12	–

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

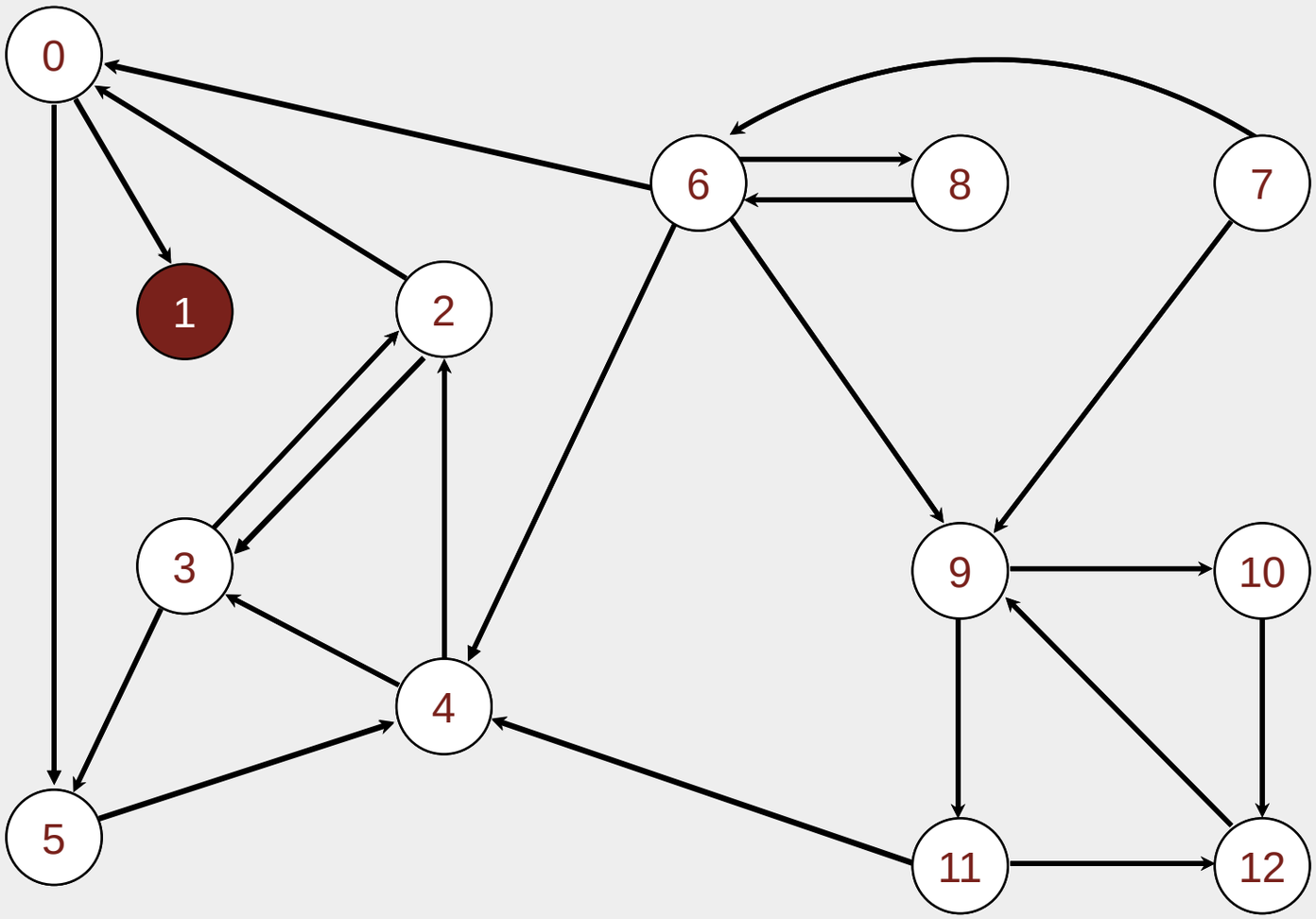


v	scc[v]
0	–
1	0
2	–
3	–
4	–
5	–
6	–
7	–
8	–
9	–
10	–
11	–
12	–

visit 1

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

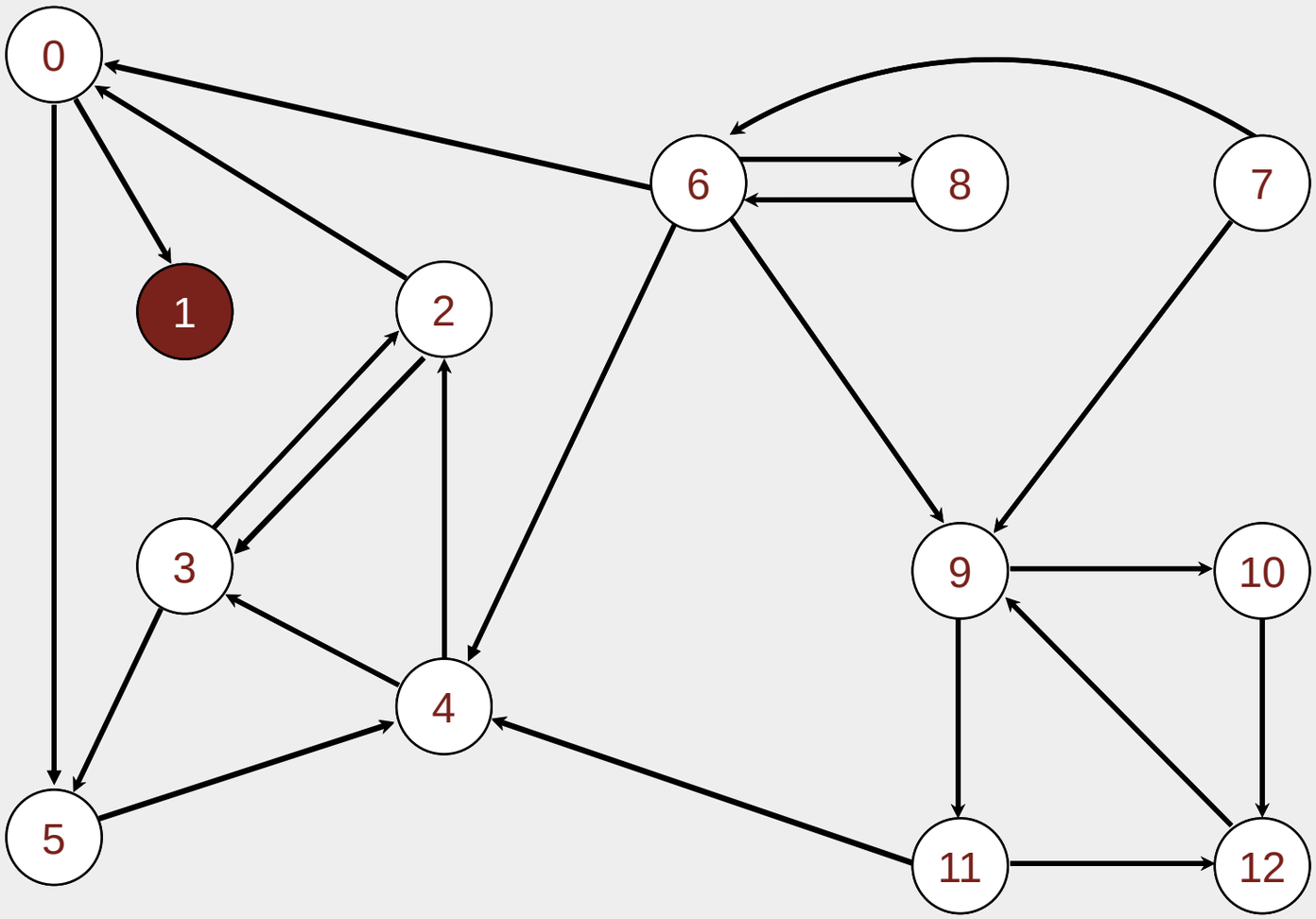


v	scc[v]
0	–
1	0
2	–
3	–
4	–
5	–
6	–
7	–
8	–
9	–
10	–
11	–
12	–

1 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

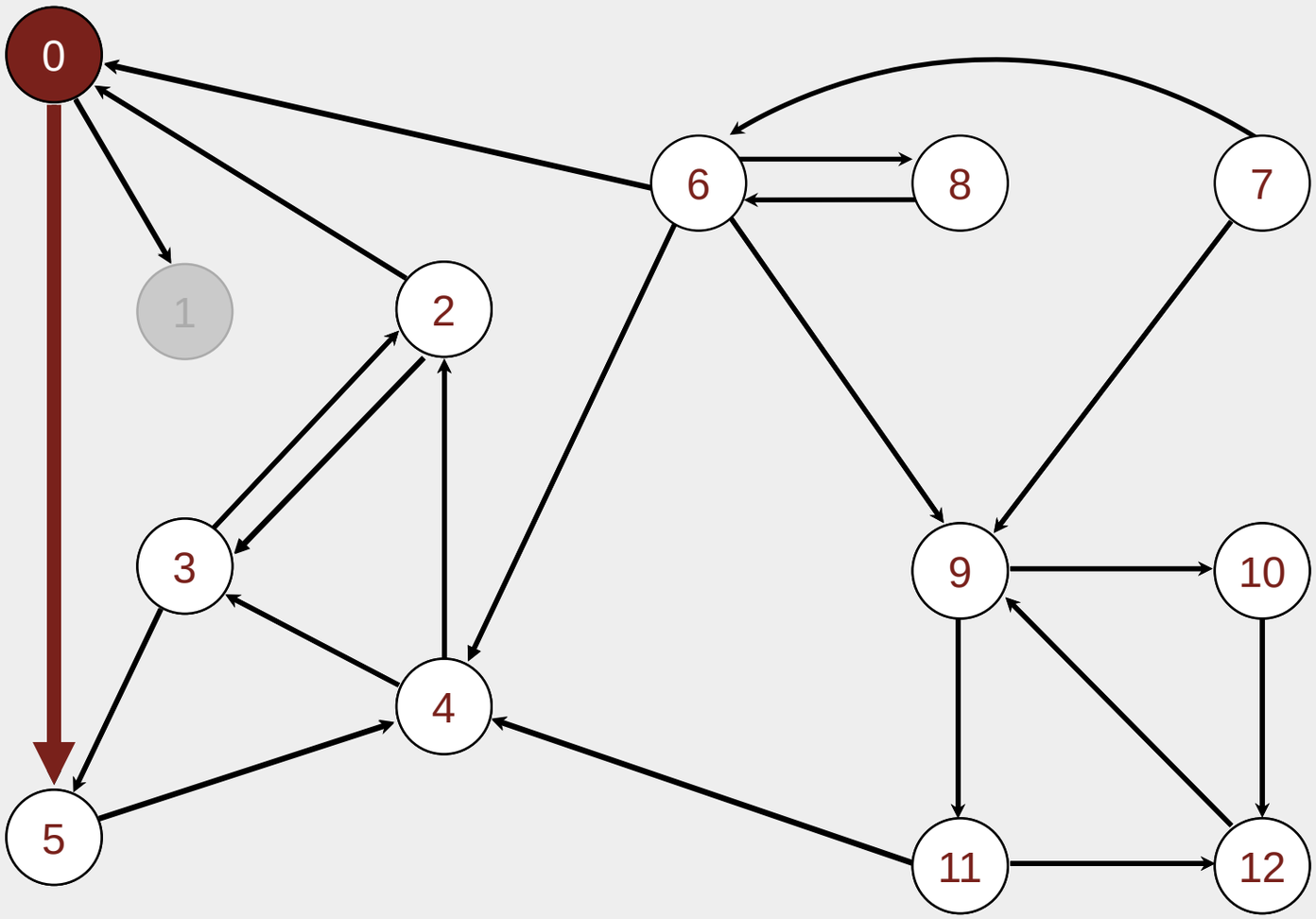


v	scc[v]
0	–
1	0
2	–
3	–
4	–
5	–
6	–
7	–
8	–
9	–
10	–
11	–
12	–

strong component: 1

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 **0** 2 **4** **5** **3** **11** **9** **12** **10** **6** **7** **8**

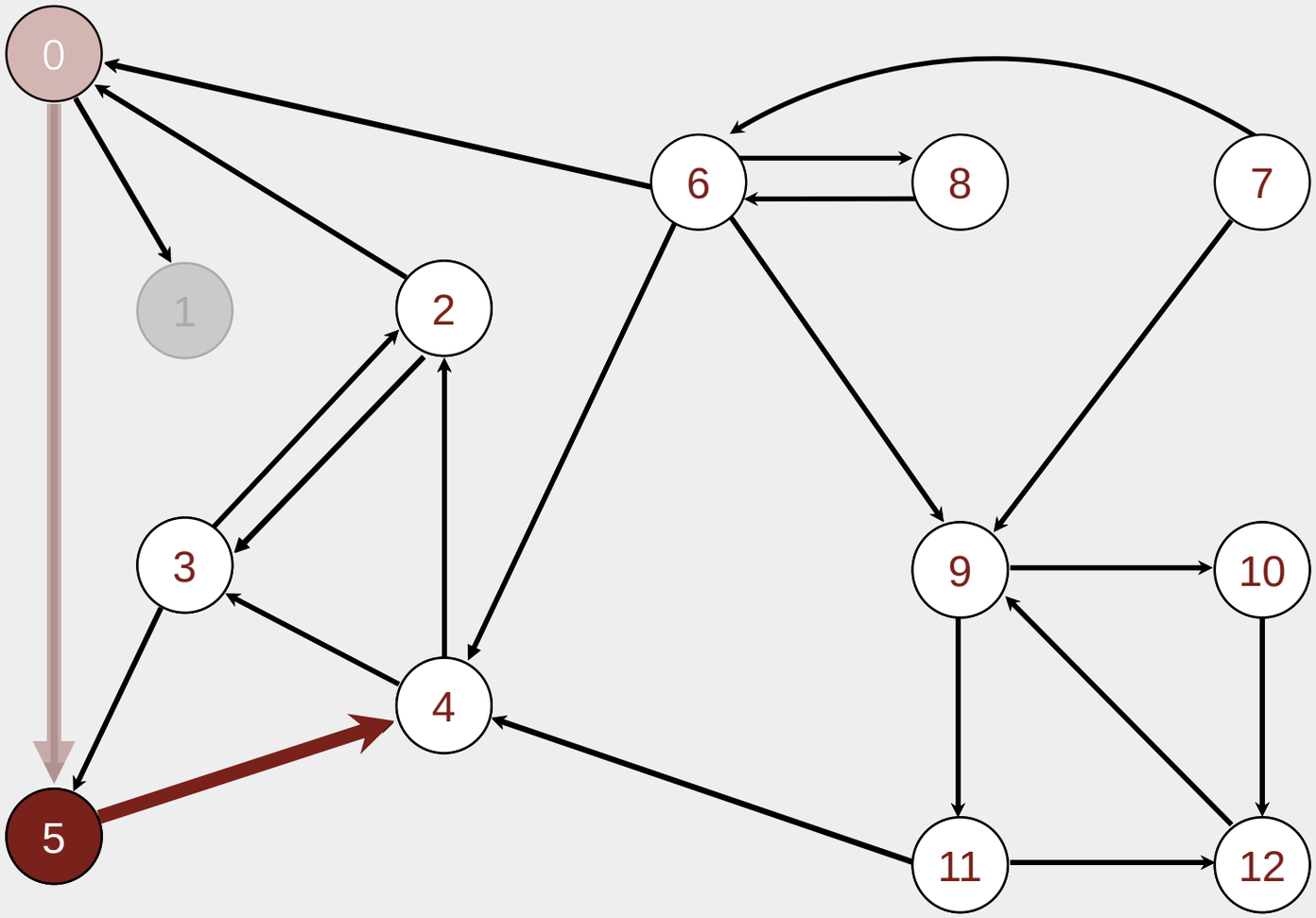


v	scc[v]
0	1
1	0
2	–
3	–
4	–
5	–
6	–
7	–
8	–
9	–
10	–
11	–
12	–

visit 0

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 **0** 2 **4** **5** **3** **11** **9** **12** **10** **6** **7** **8**

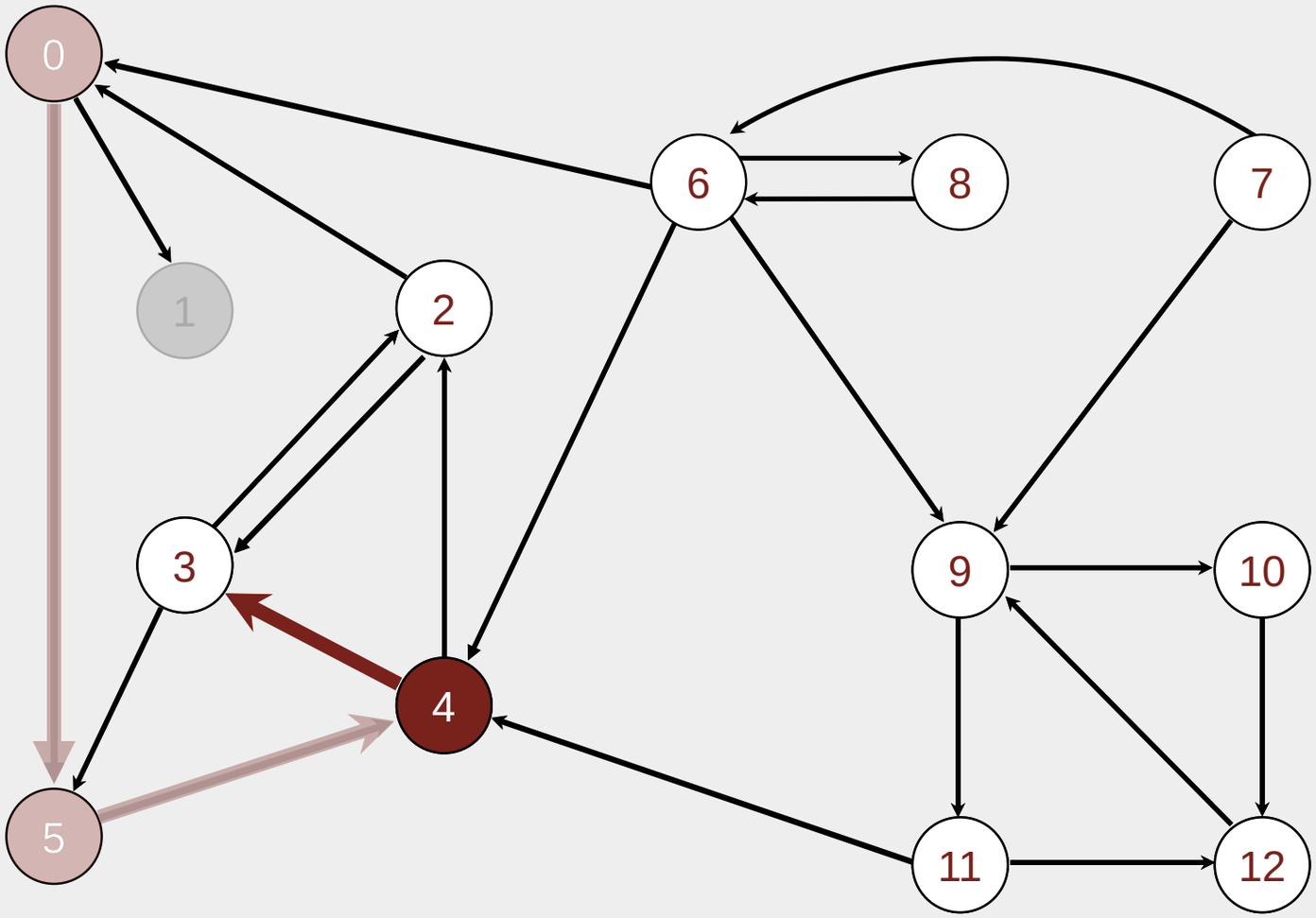


v	scc[v]
0	1
1	0
2	–
3	–
4	–
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

visit 5

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

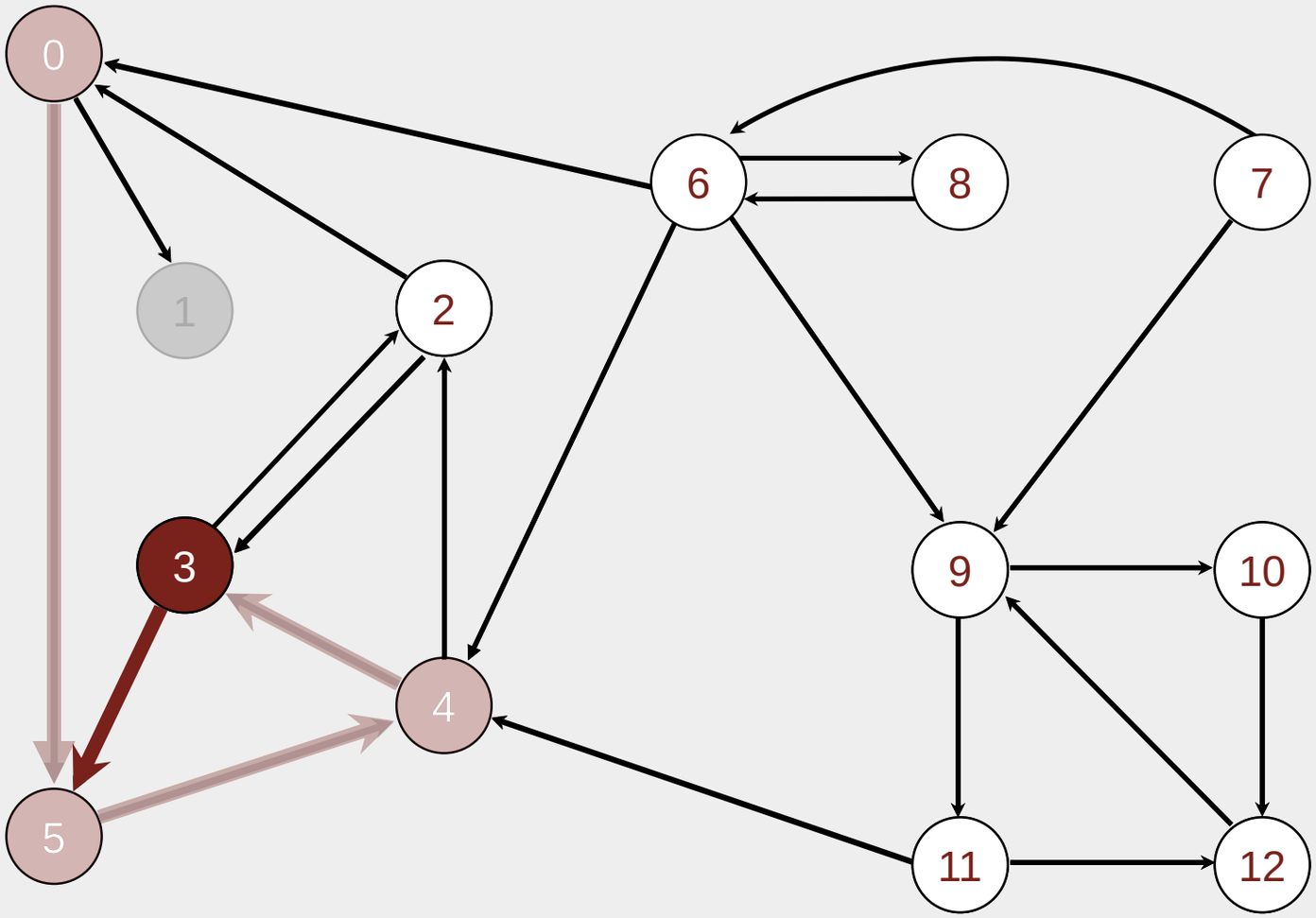


v	scc[v]
0	1
1	0
2	–
3	–
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

visit 4

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

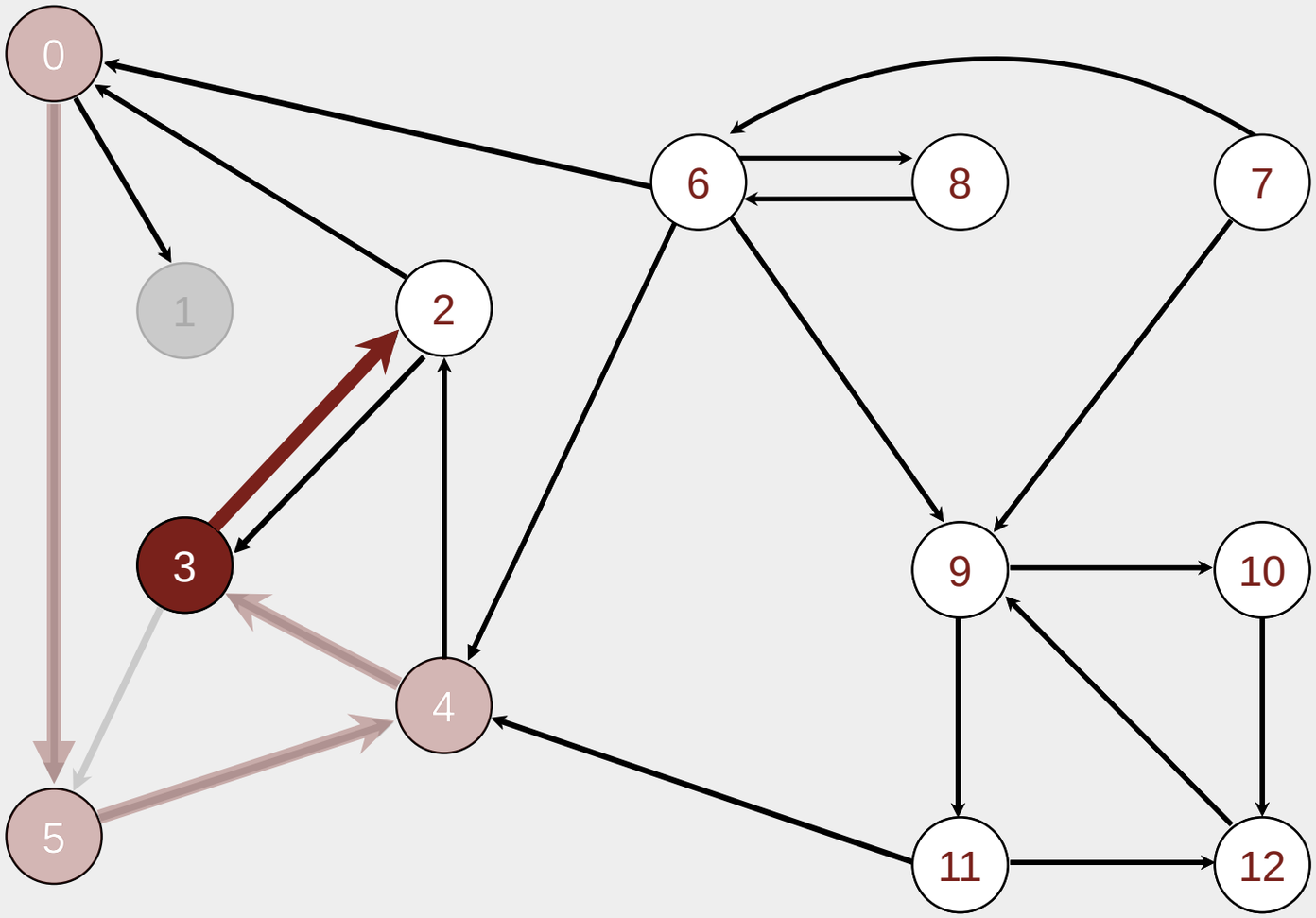


visit 3

v	scc[v]
0	1
1	0
2	–
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 **0** 2 **4** **5** **3** **11** **9** **12** **10** **6** **7** **8**

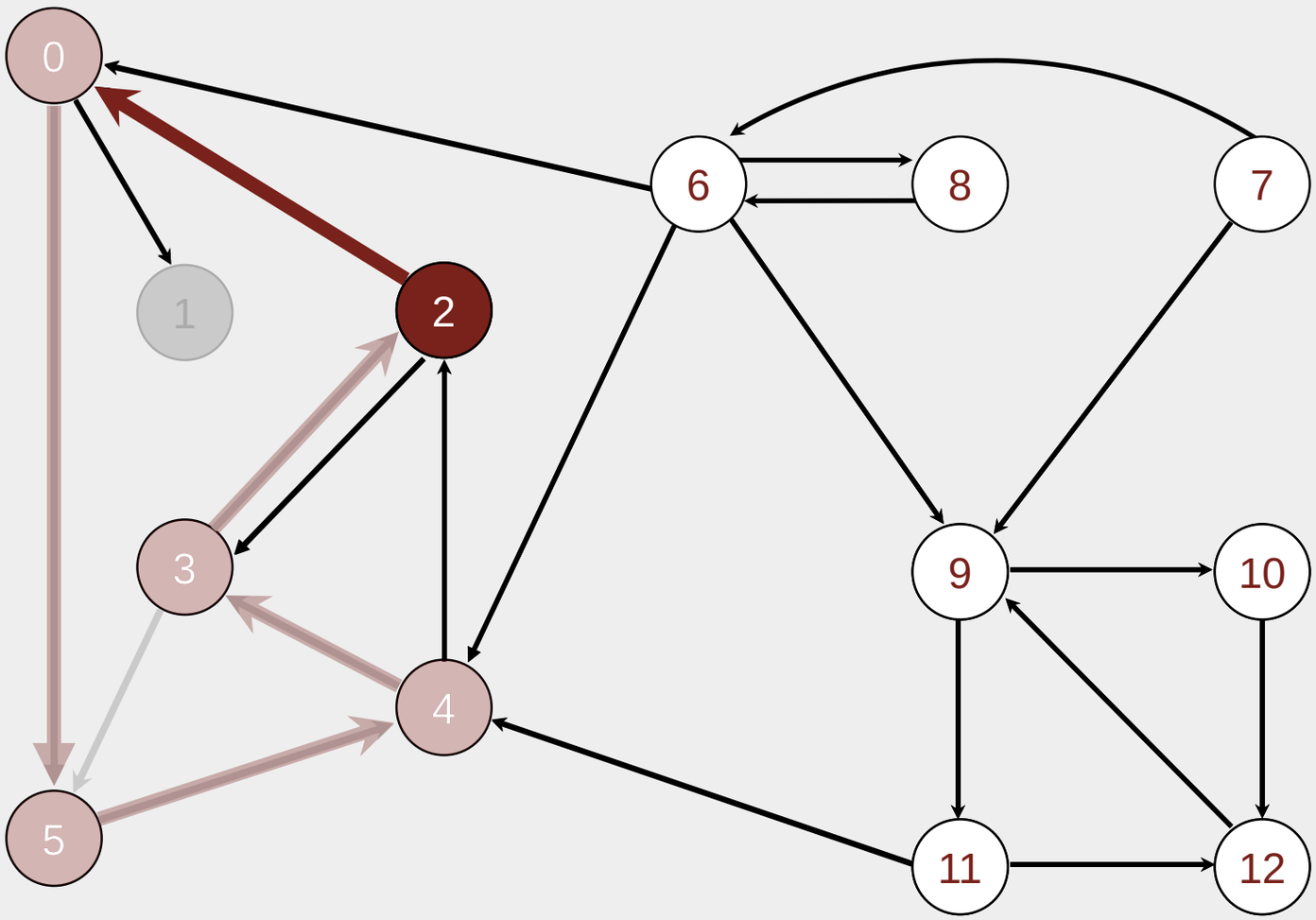


v	scc[v]
0	1
1	0
2	–
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

visit 3

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

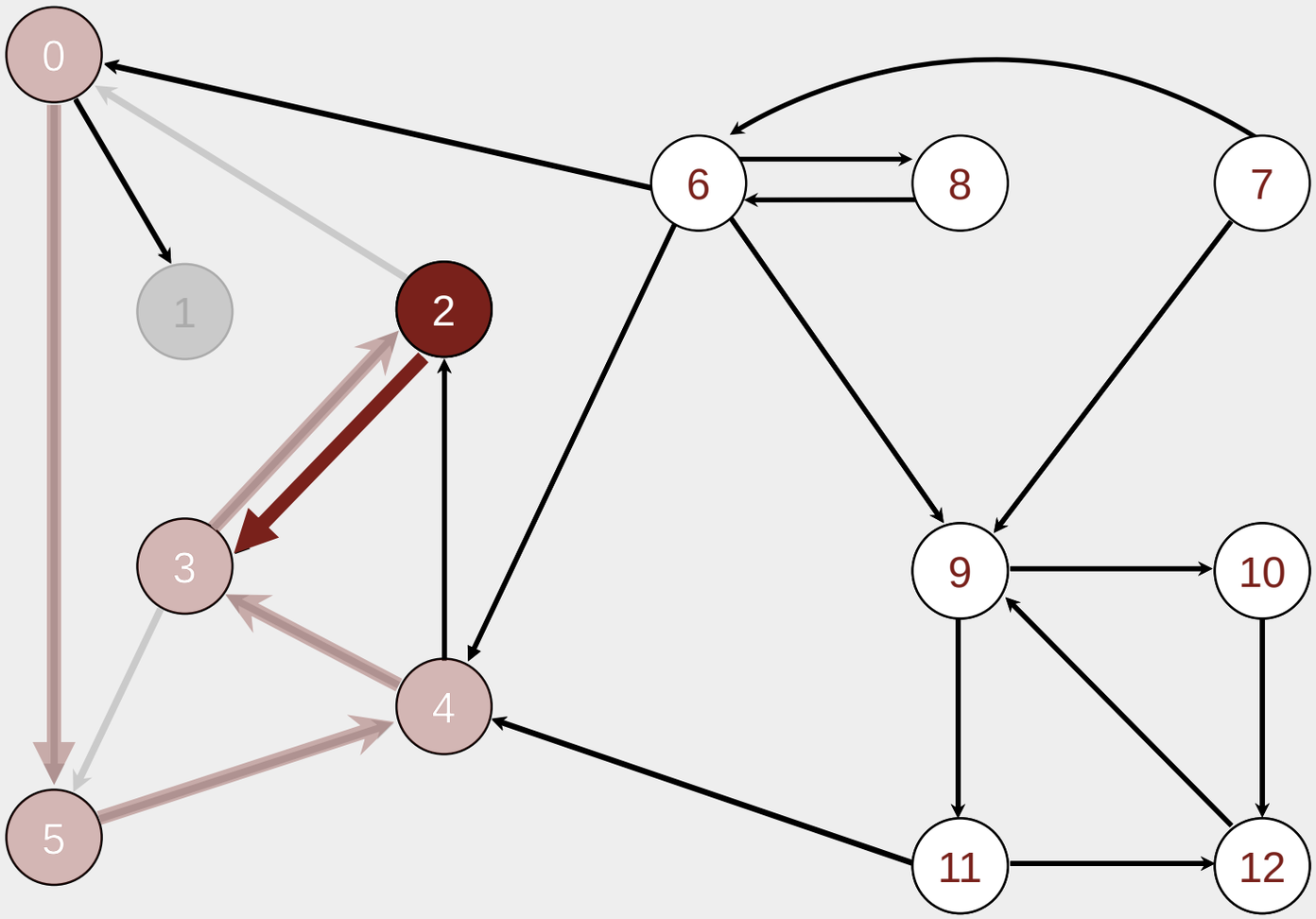


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

visit 2

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 **0** ~~**2**~~ **4** **5** **3** **11** **9** **12** **10** **6** **7** **8**

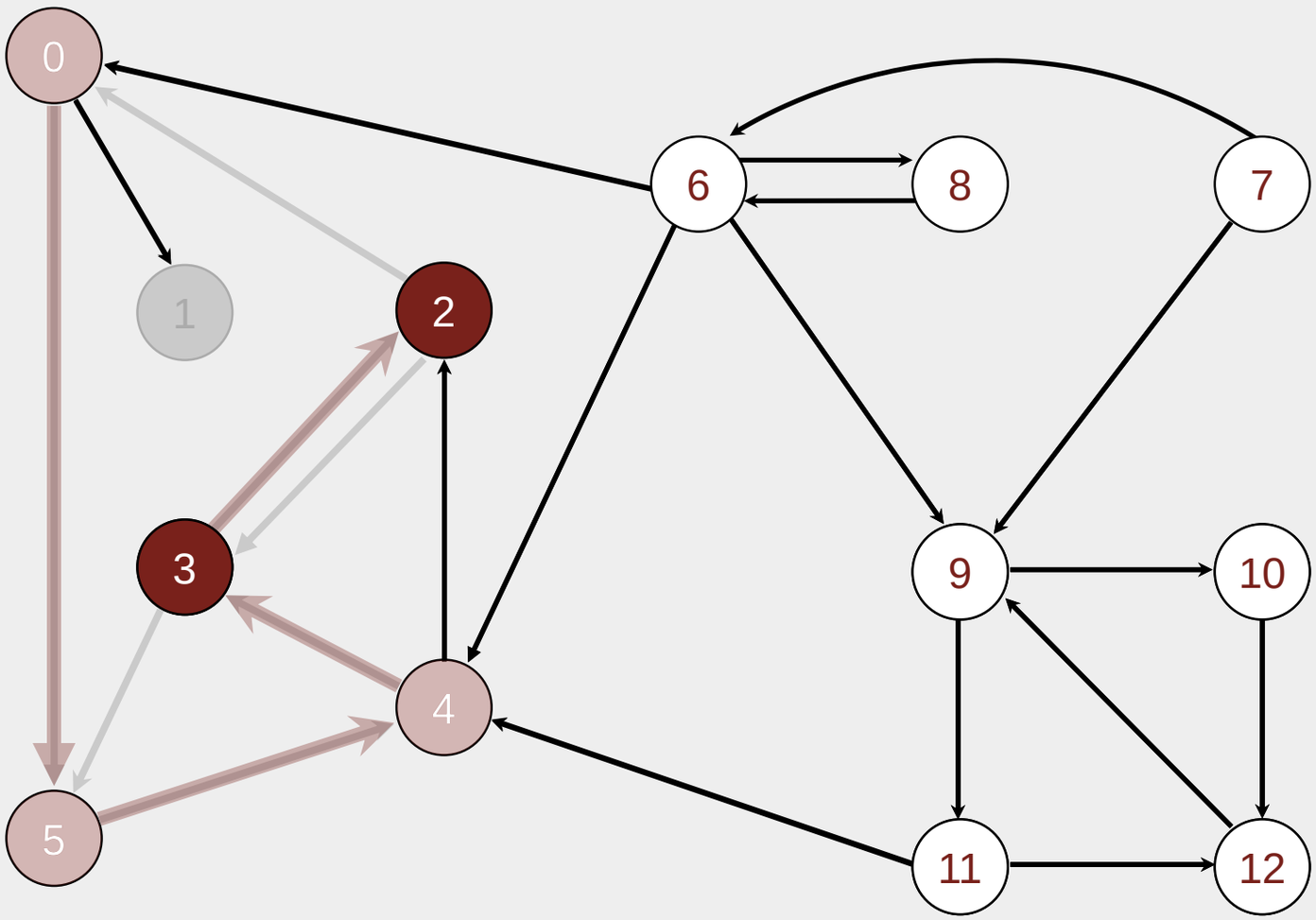


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

visit 2

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 **0** **2** **4** **5** **3** **11** **9** **12** **10** **6** **7** **8**

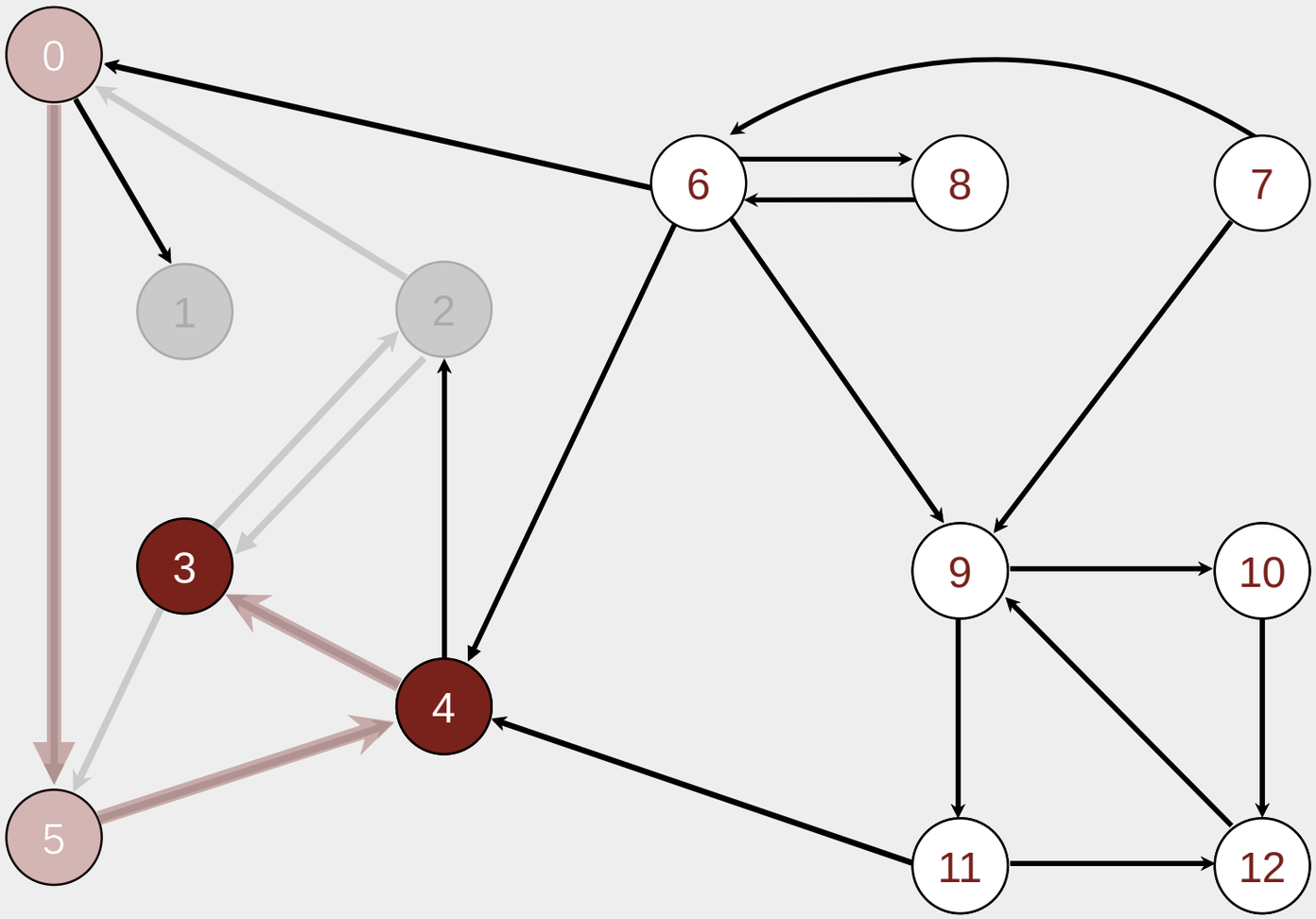


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

2 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 **0** 2 **4** **5** **3** **11** **9** **12** **10** **6** **7** **8**

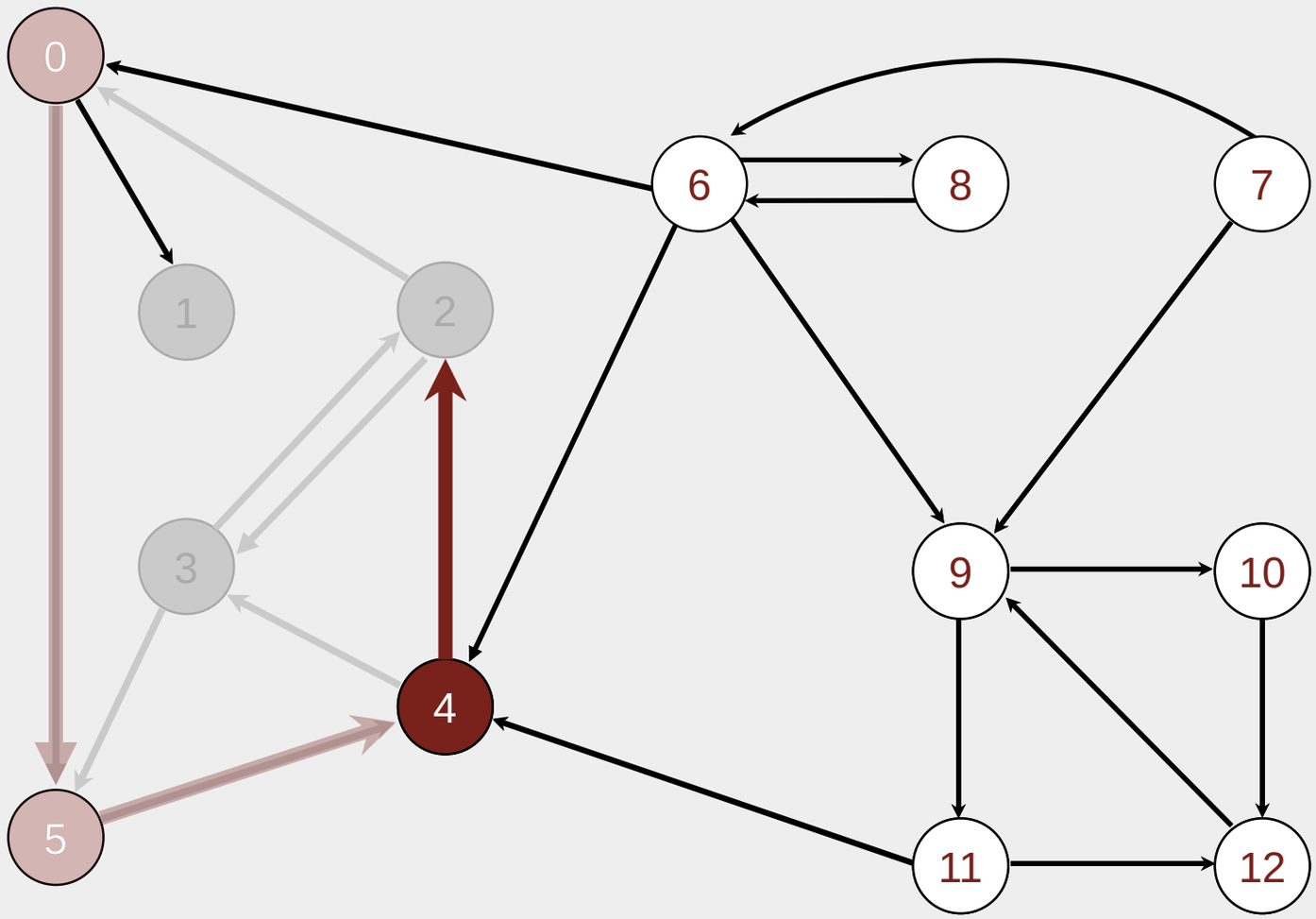


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

3 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

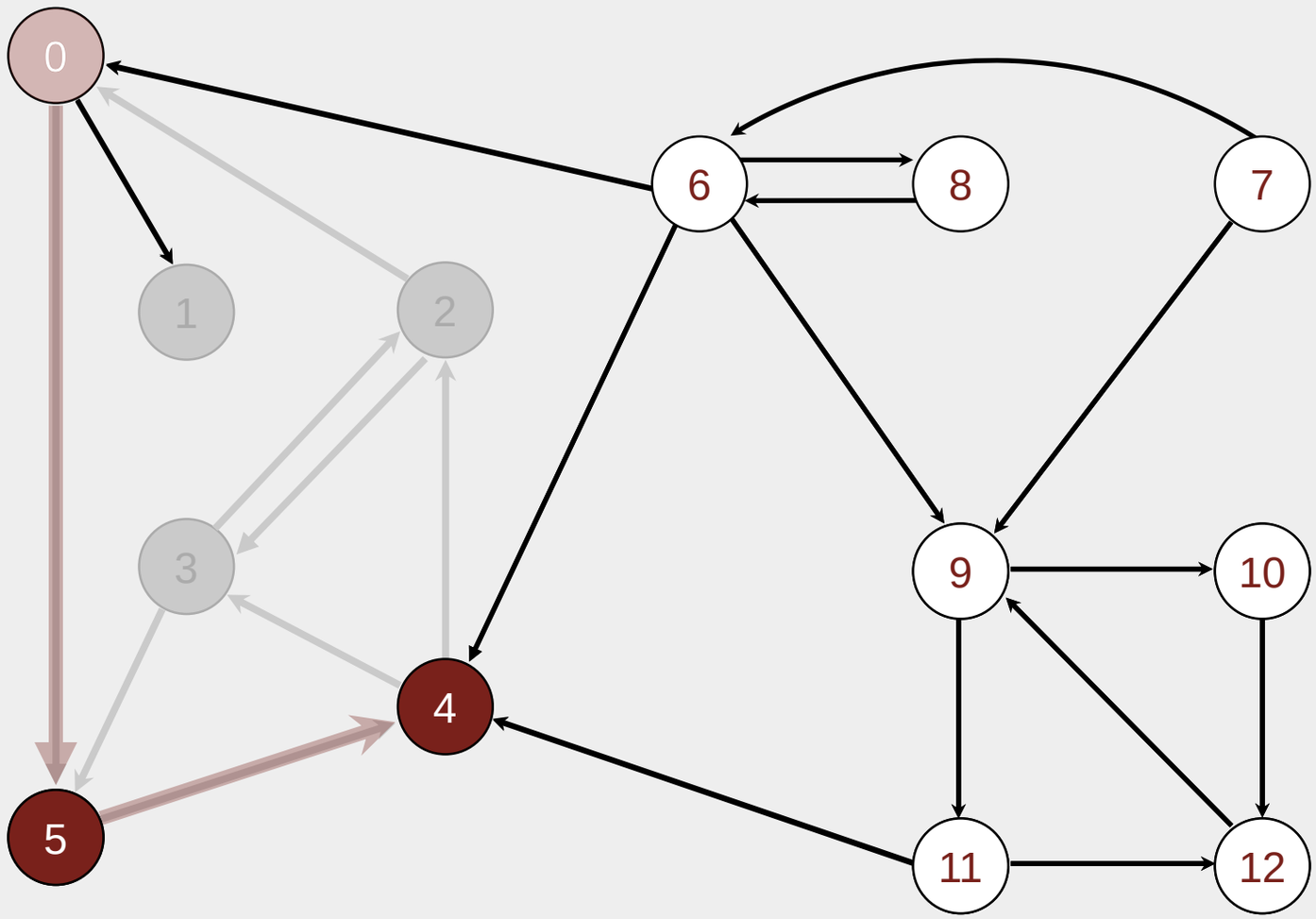


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

visit 4

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 **0** 2 **4** **5** **3** **11** **9** **12** **10** **6** **7** **8**

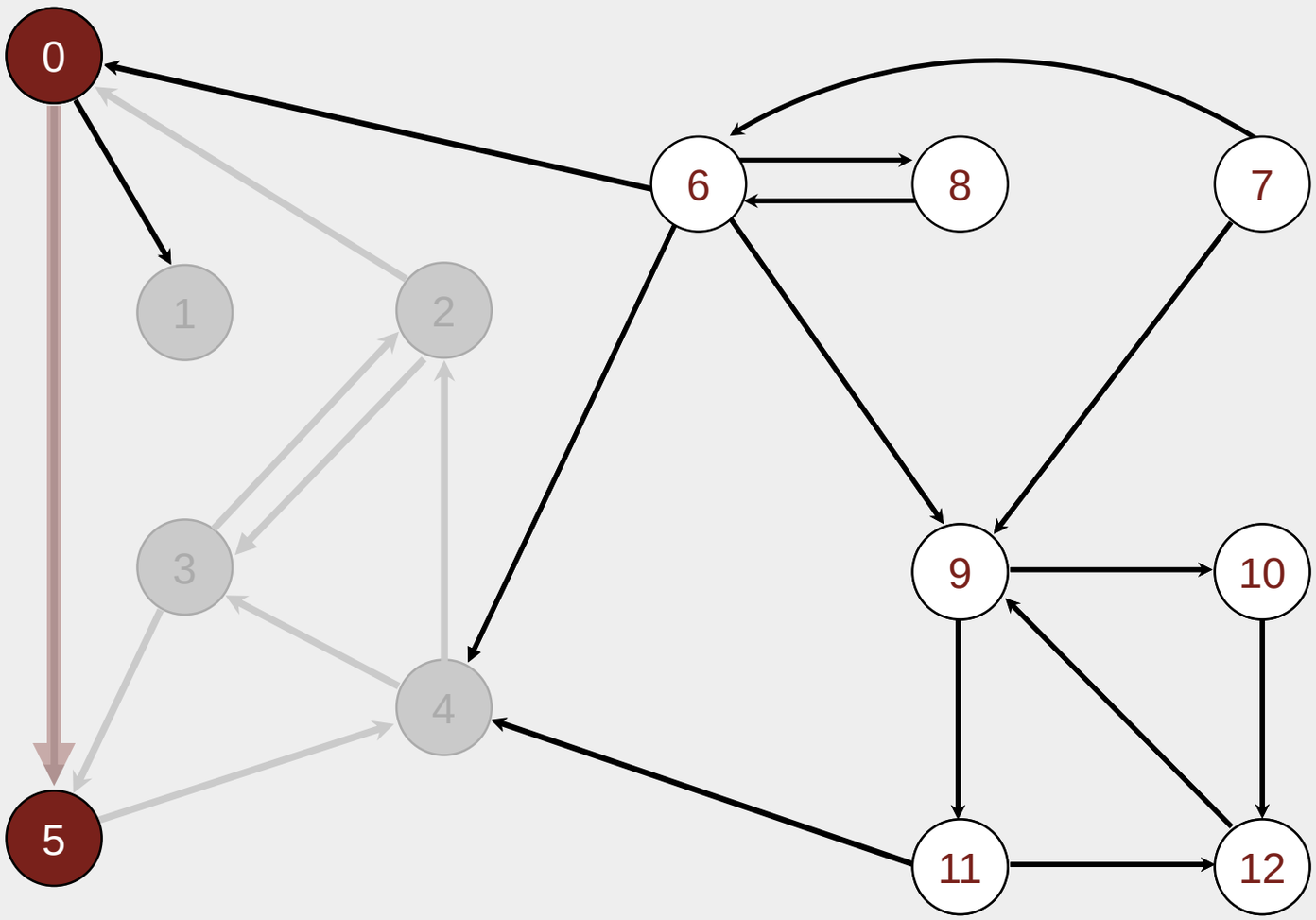


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

4 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 **0** 2 **4** **5** **3** **11** **9** **12** **10** **6** **7** **8**

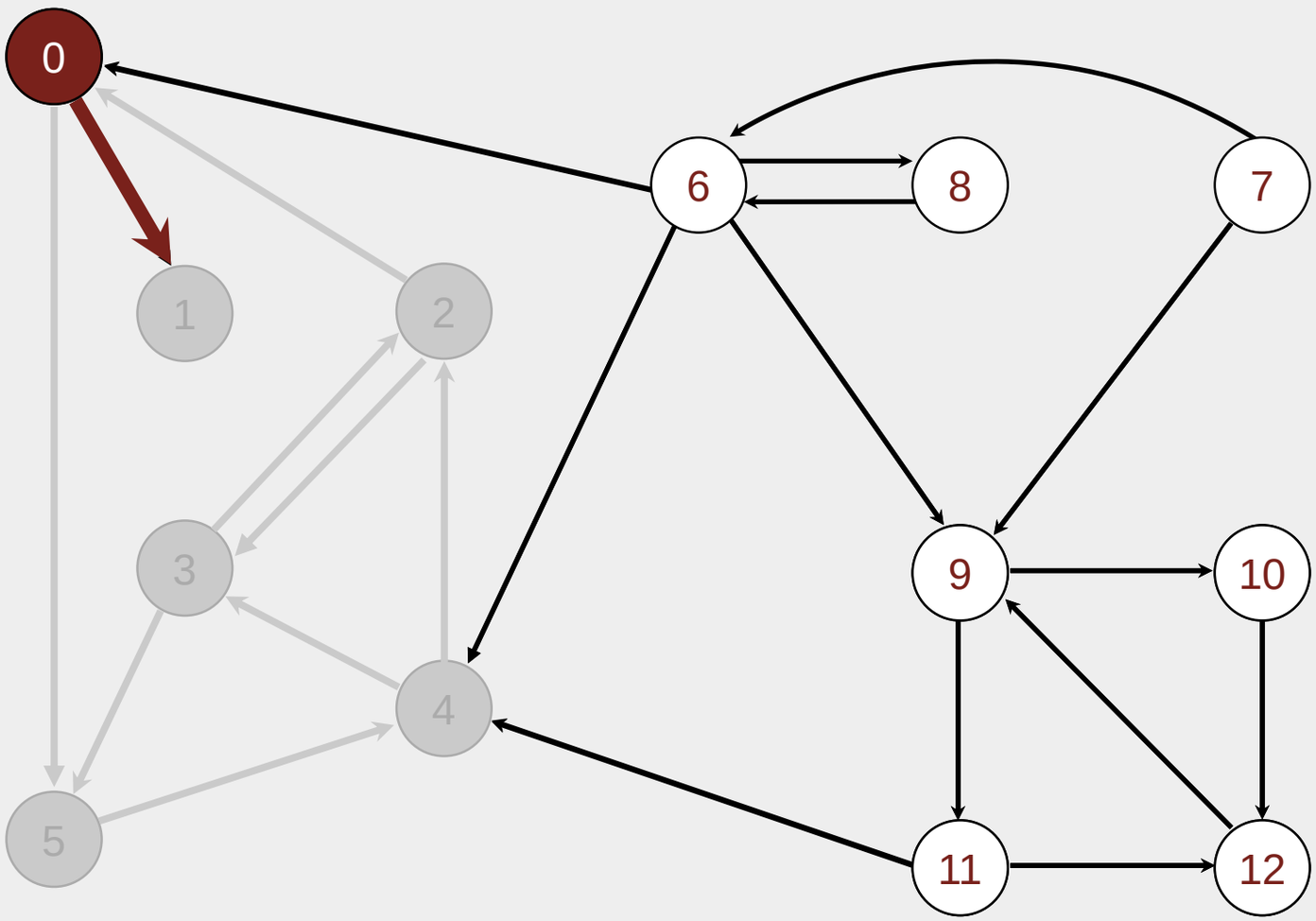


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

5 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

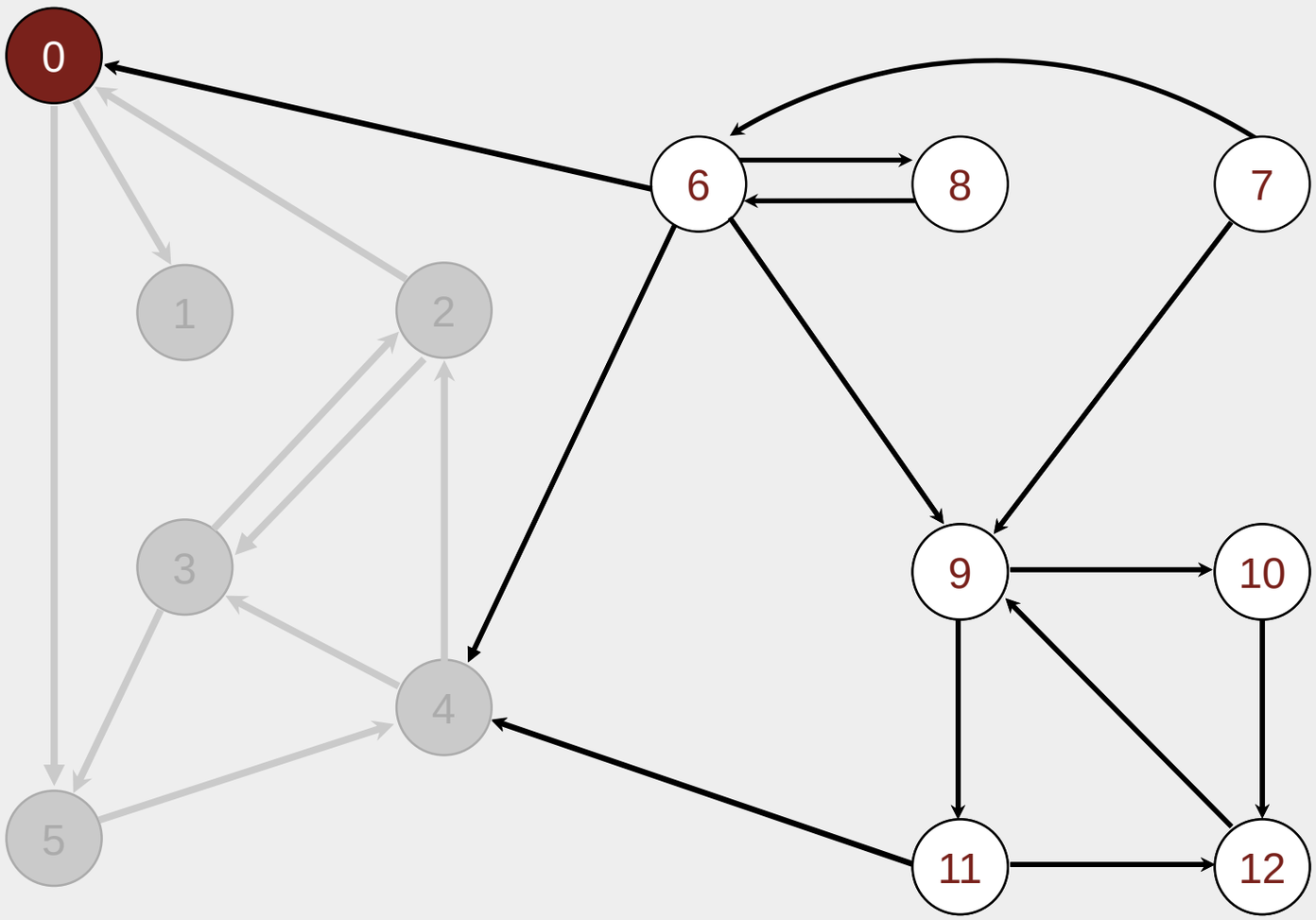


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

visit 0

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

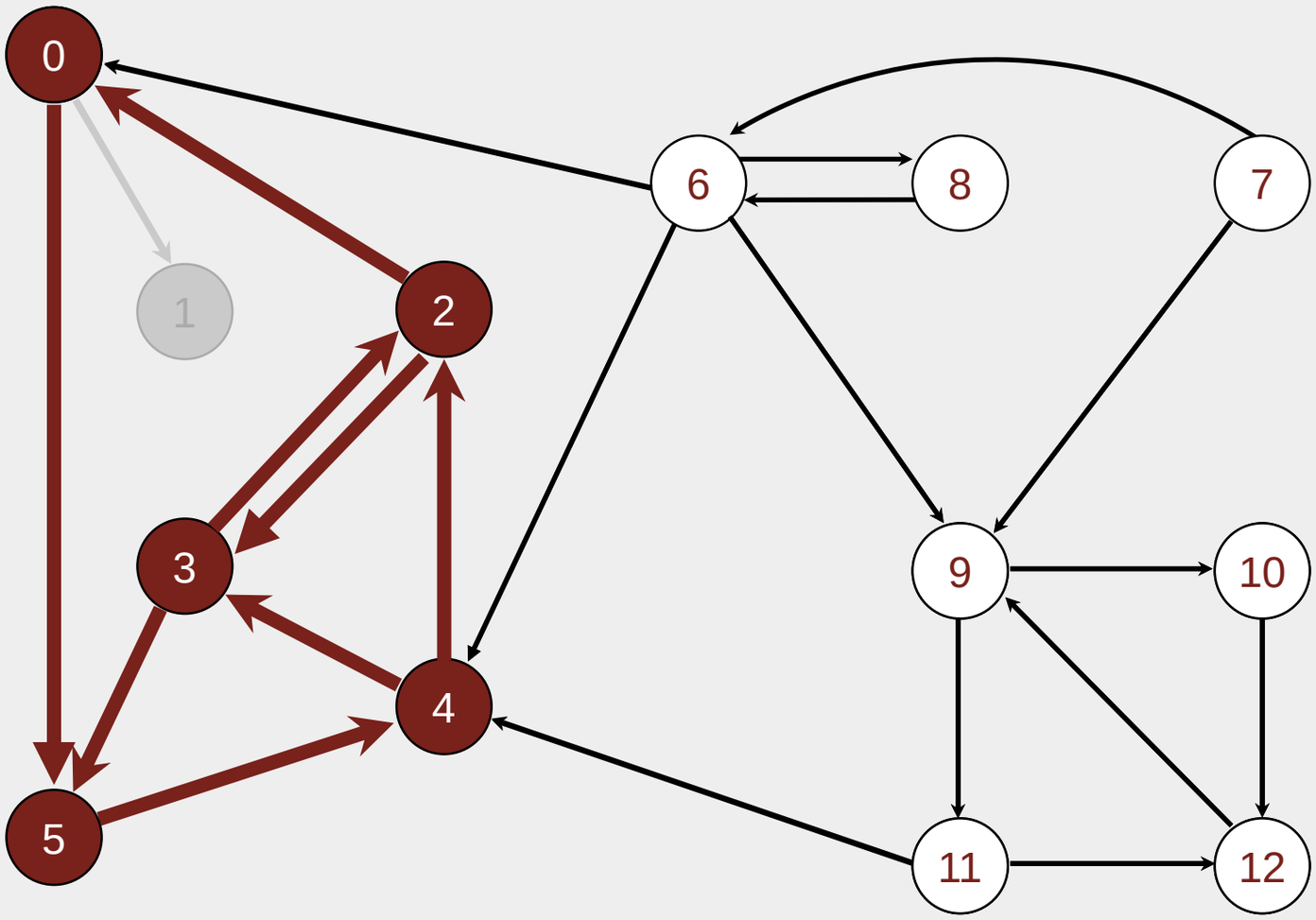


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

0 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

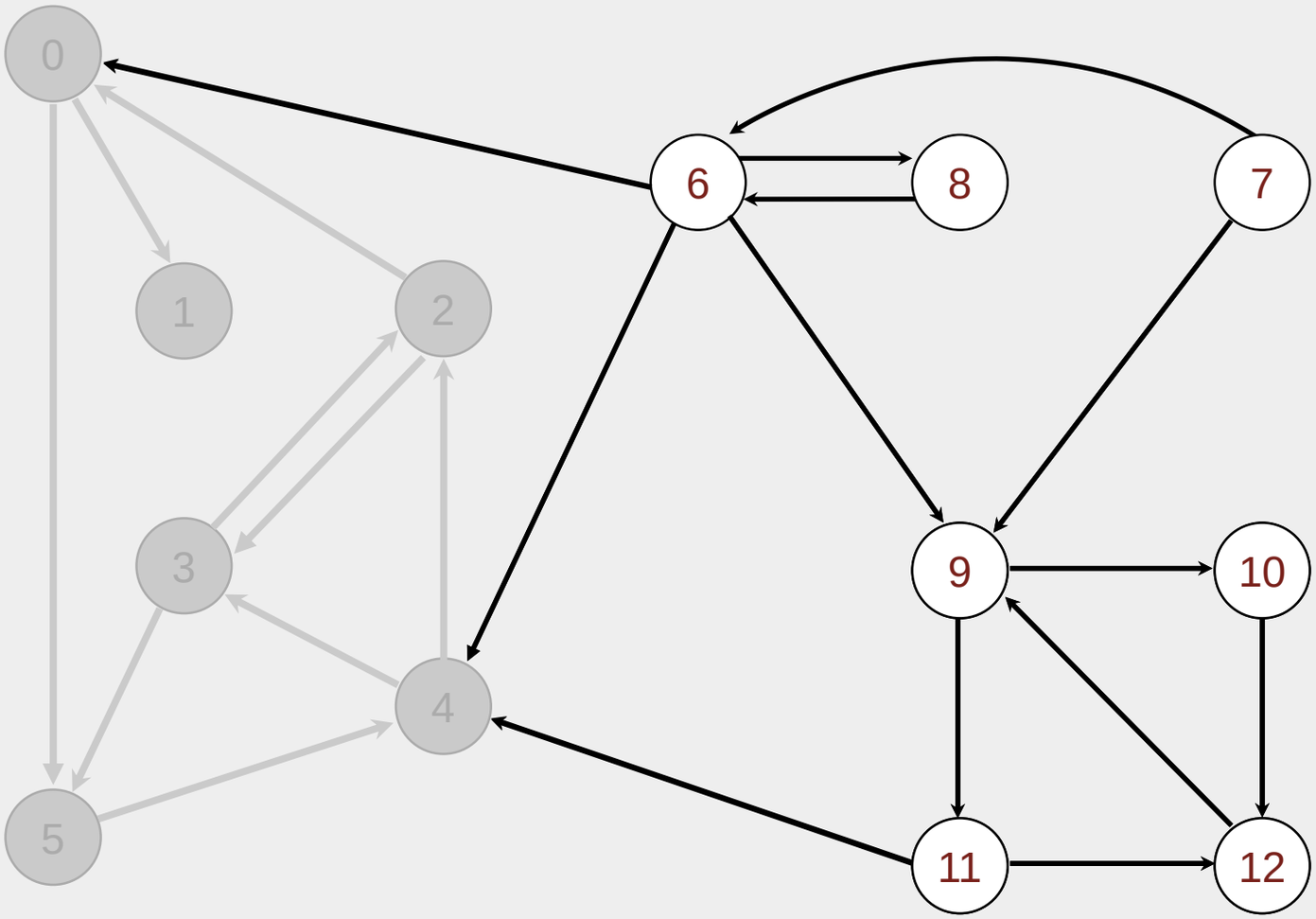


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

strong component: 0 2 3 4 5

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

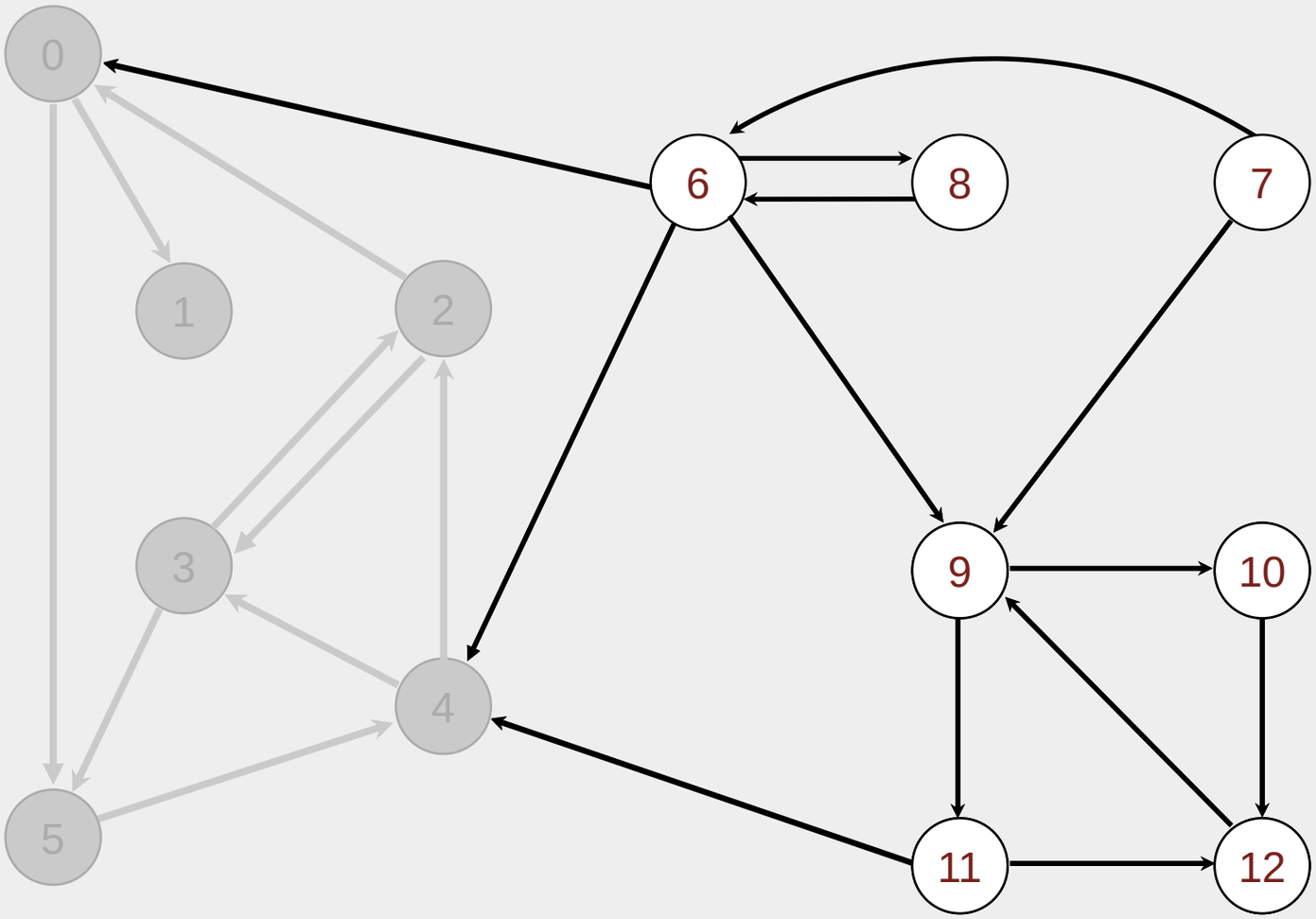


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

check 2

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

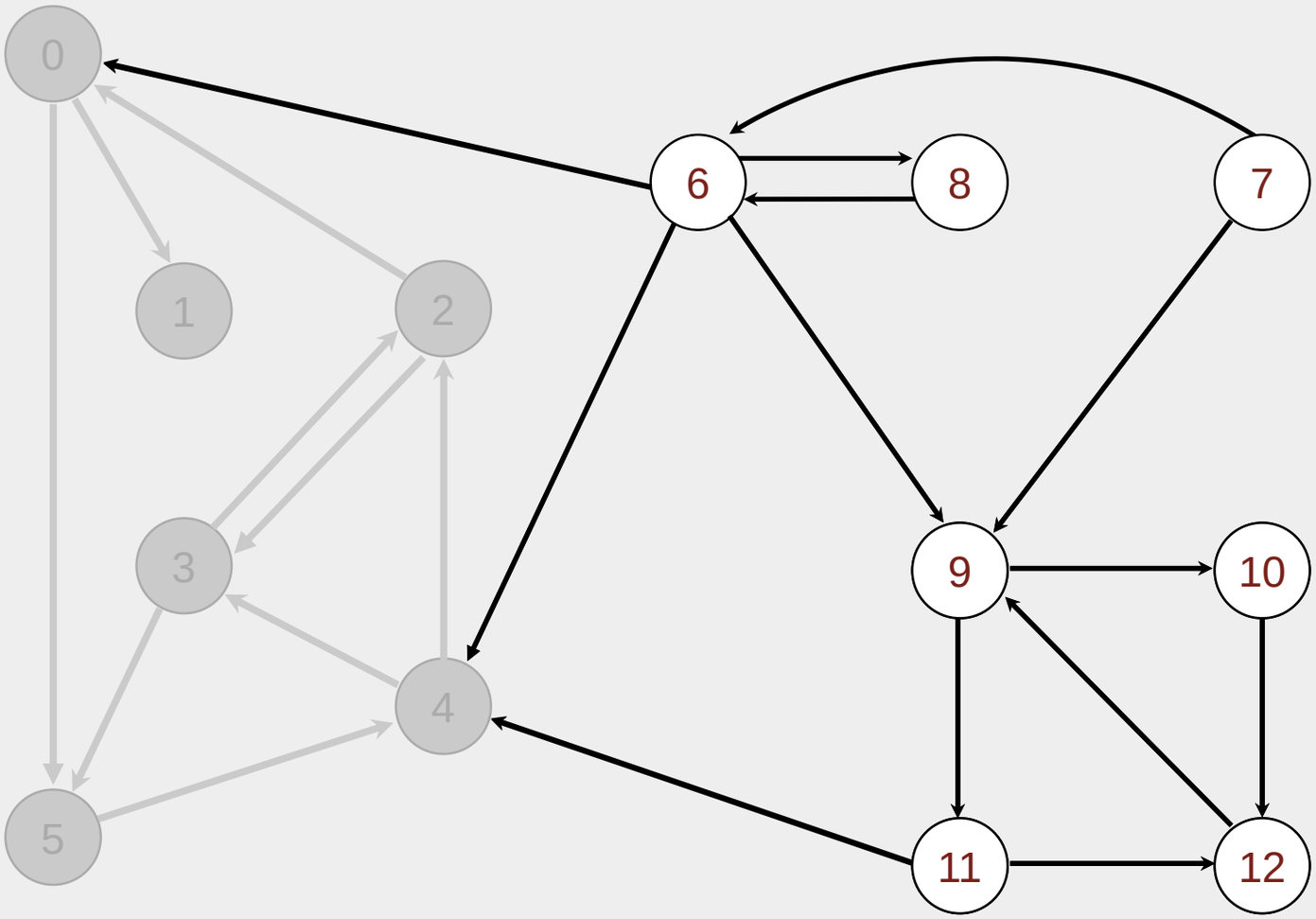


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

check 4

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

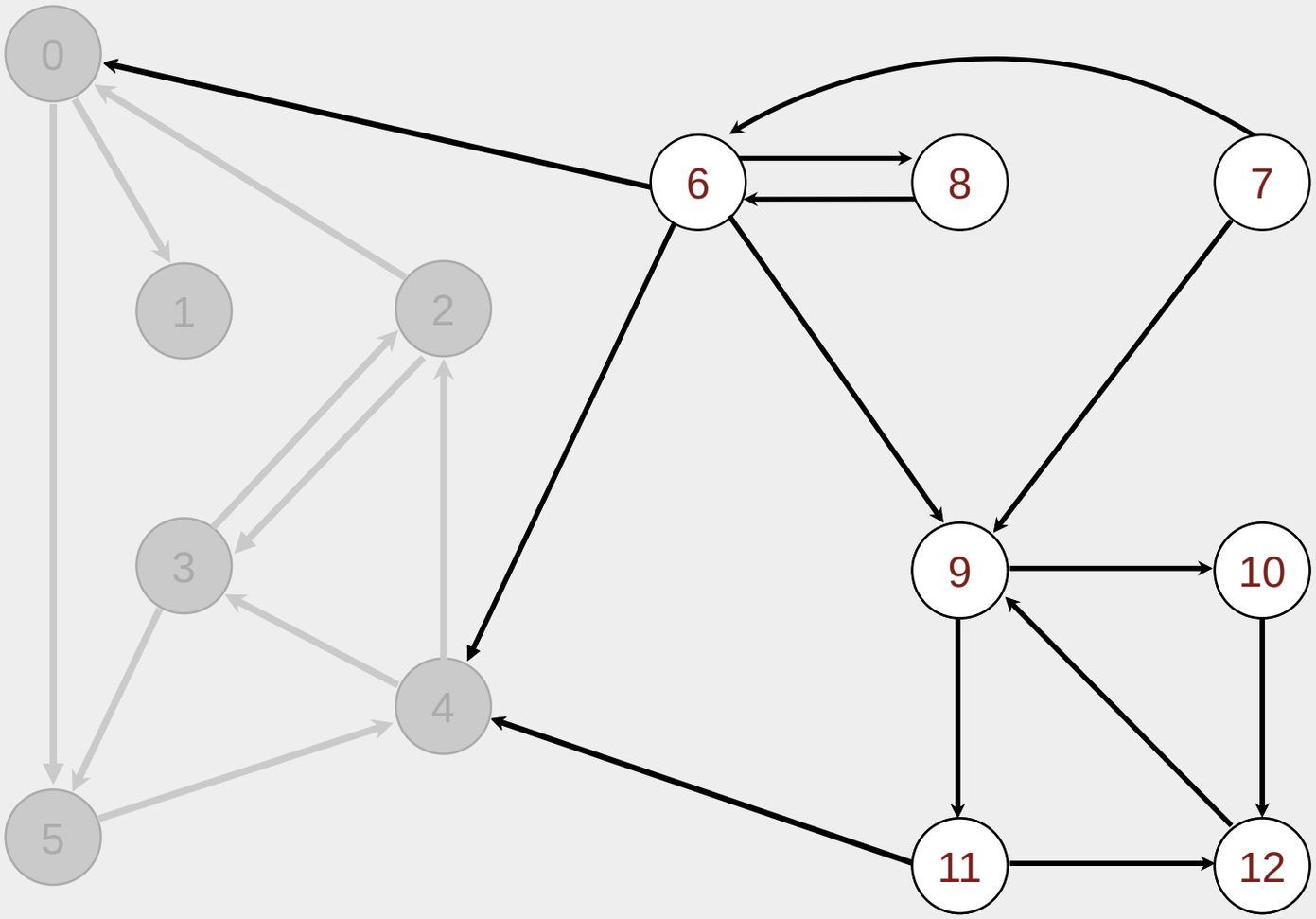


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

check 5

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 **3** **11** **9** **12** **10** **6** **7** **8**

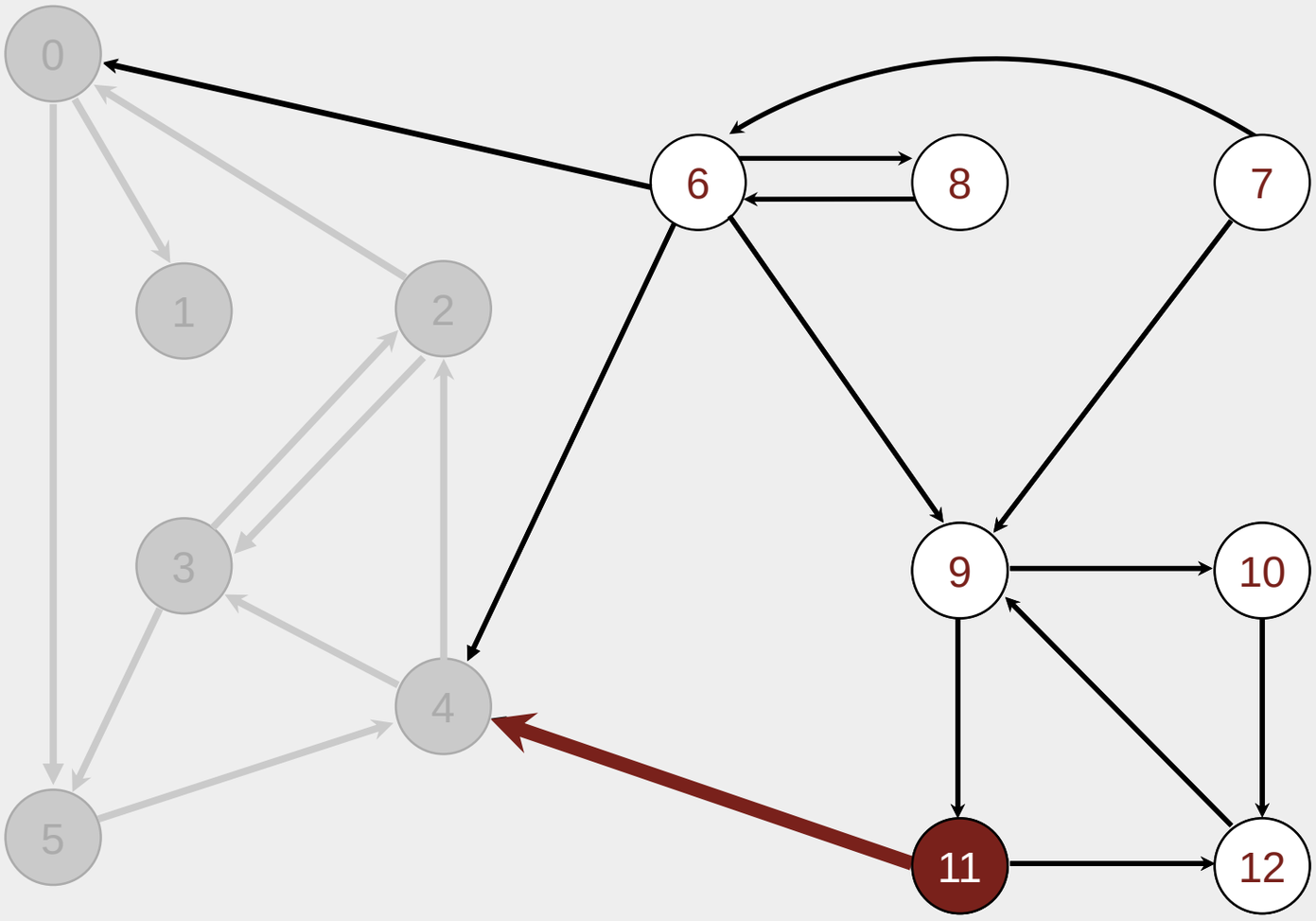


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	–
12	–

check 3

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 **11** **9** **12** **10** **6** **7** **8**

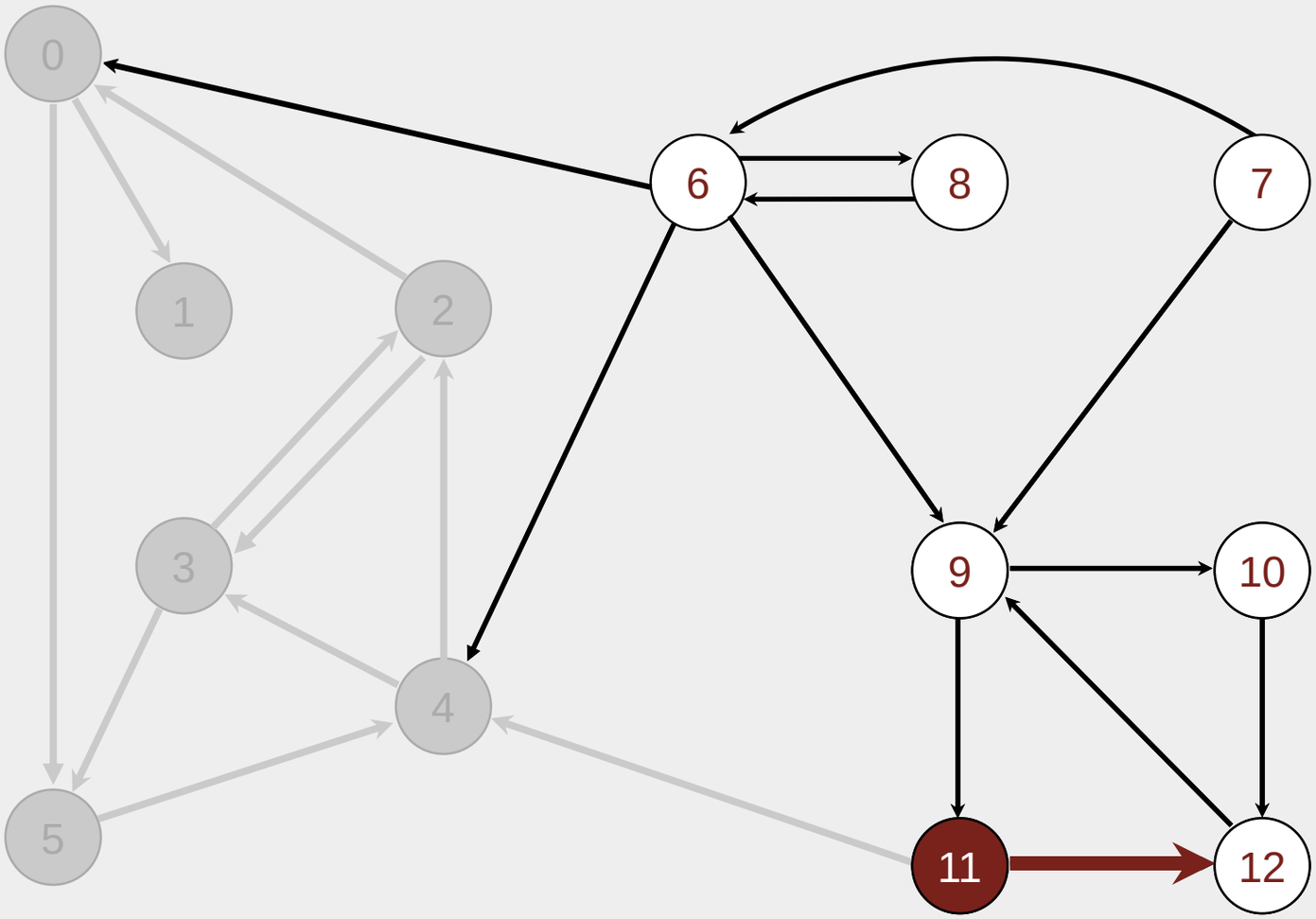


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	2
12	–

visit 11

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 **11 9 12 10 6 7 8**

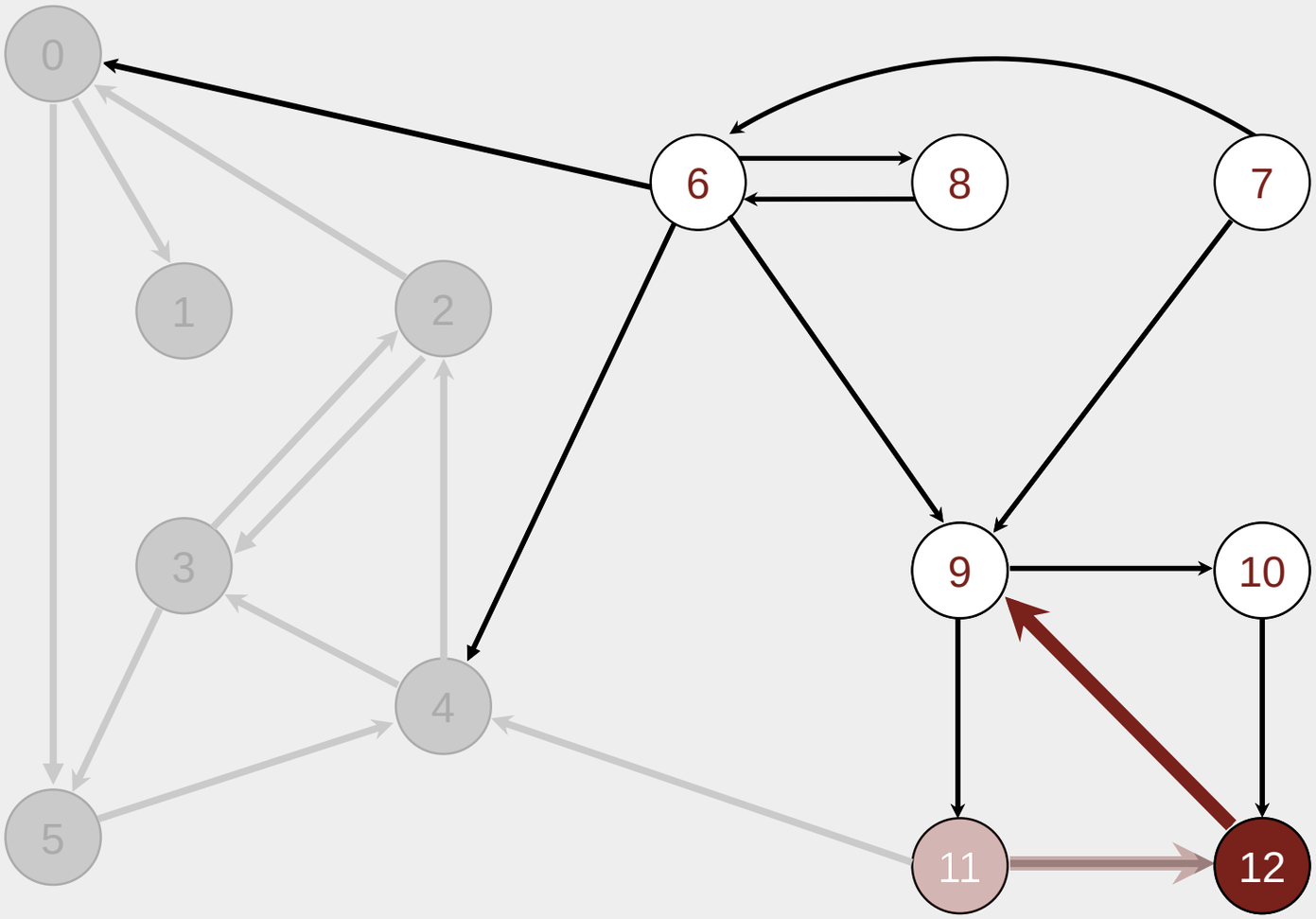


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	2
12	–

visit 11

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 **11** **9** **12** **10** **6** **7** **8**

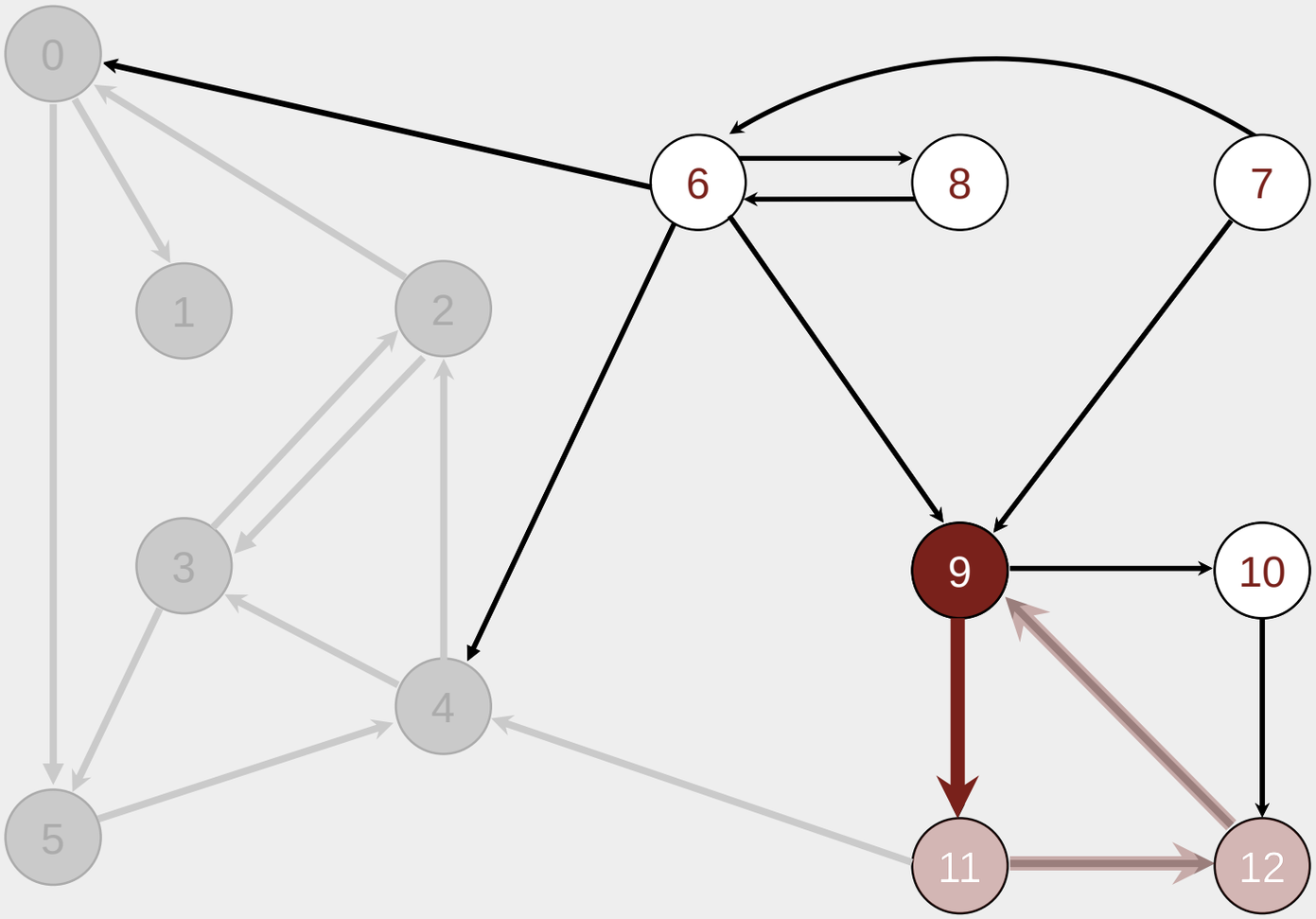


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	–
10	–
11	2
12	2

visit 12

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 **11** **9** **12** **10** **6** **7** **8**

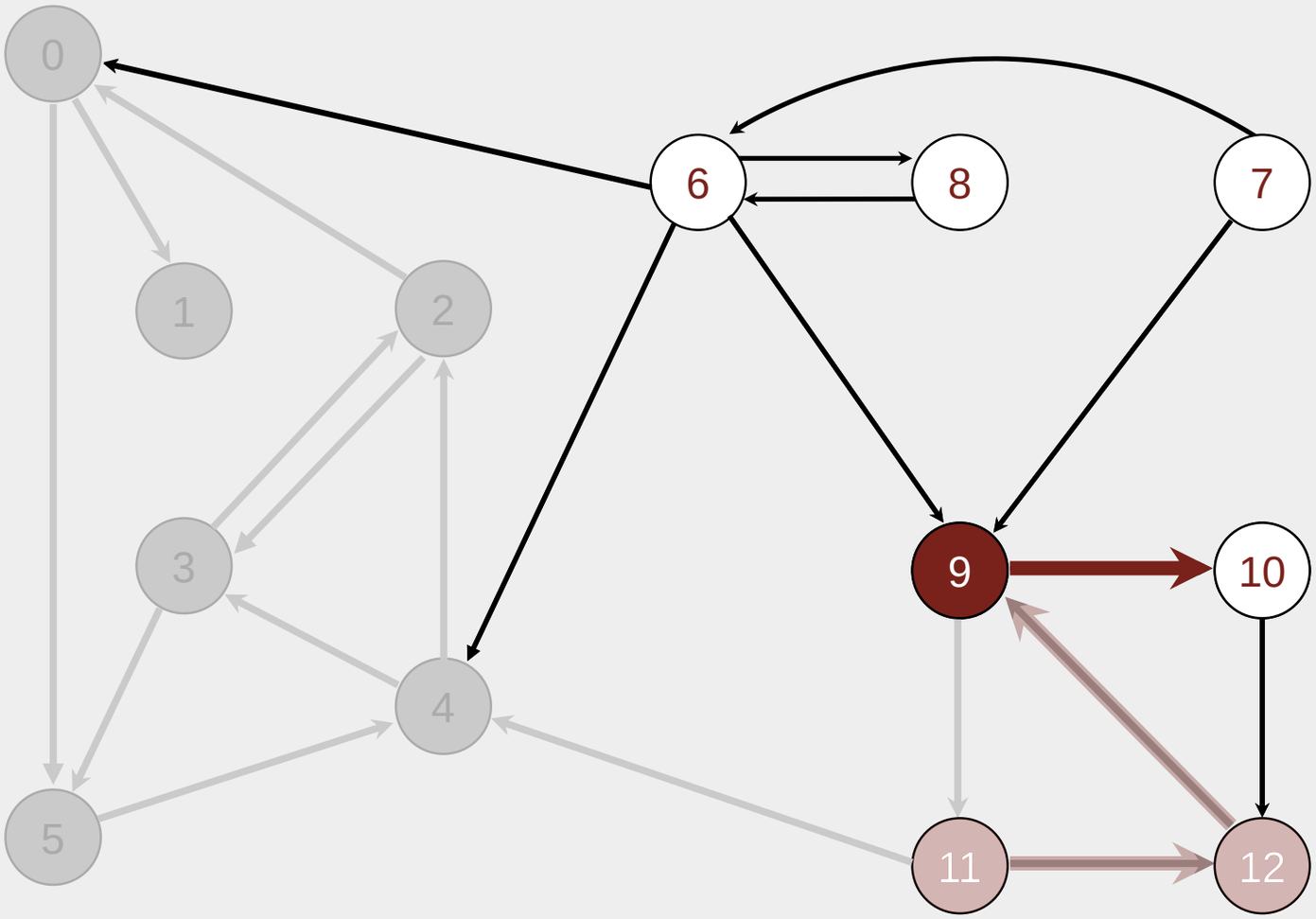


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	2
10	–
11	2
12	2

visit 9

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 **11** **9** **12** **10** **6** **7** **8**

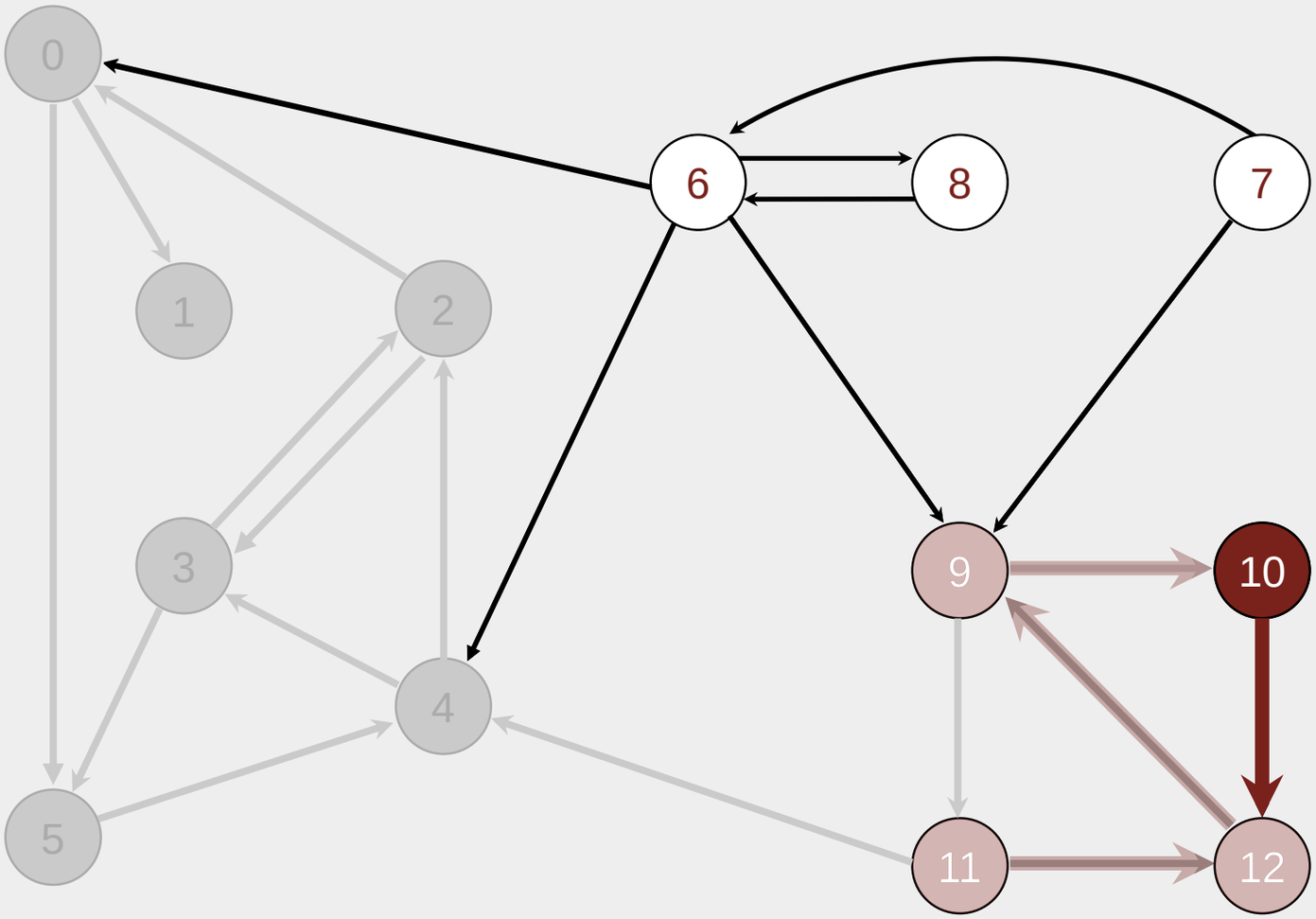


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	2
10	–
11	2
12	2

visit 9

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 **11** **9** **12** **10** **6** **7** **8**

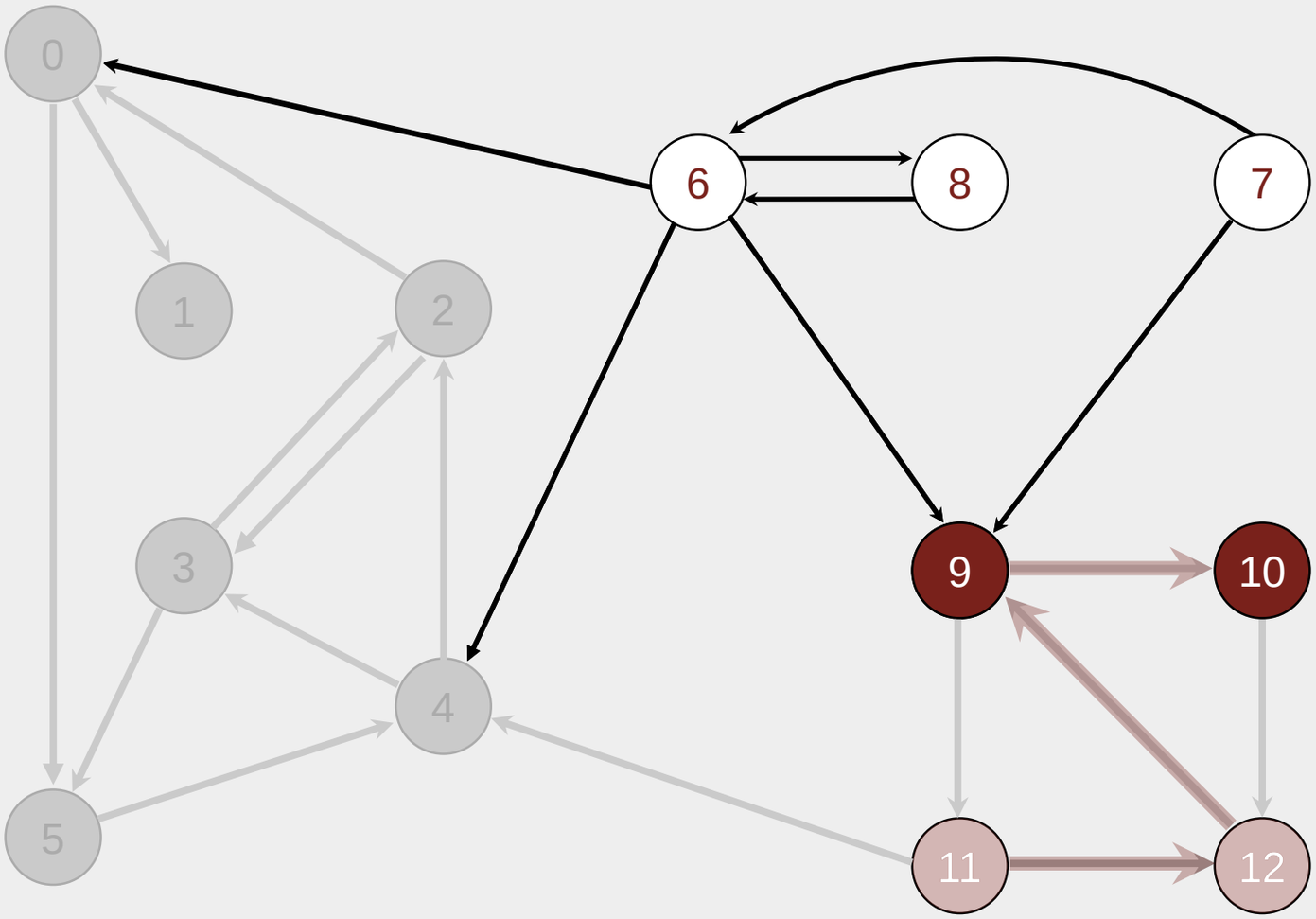


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	2
10	2
11	2
12	2

visit 10

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 **11 9 12 10 6 7 8**

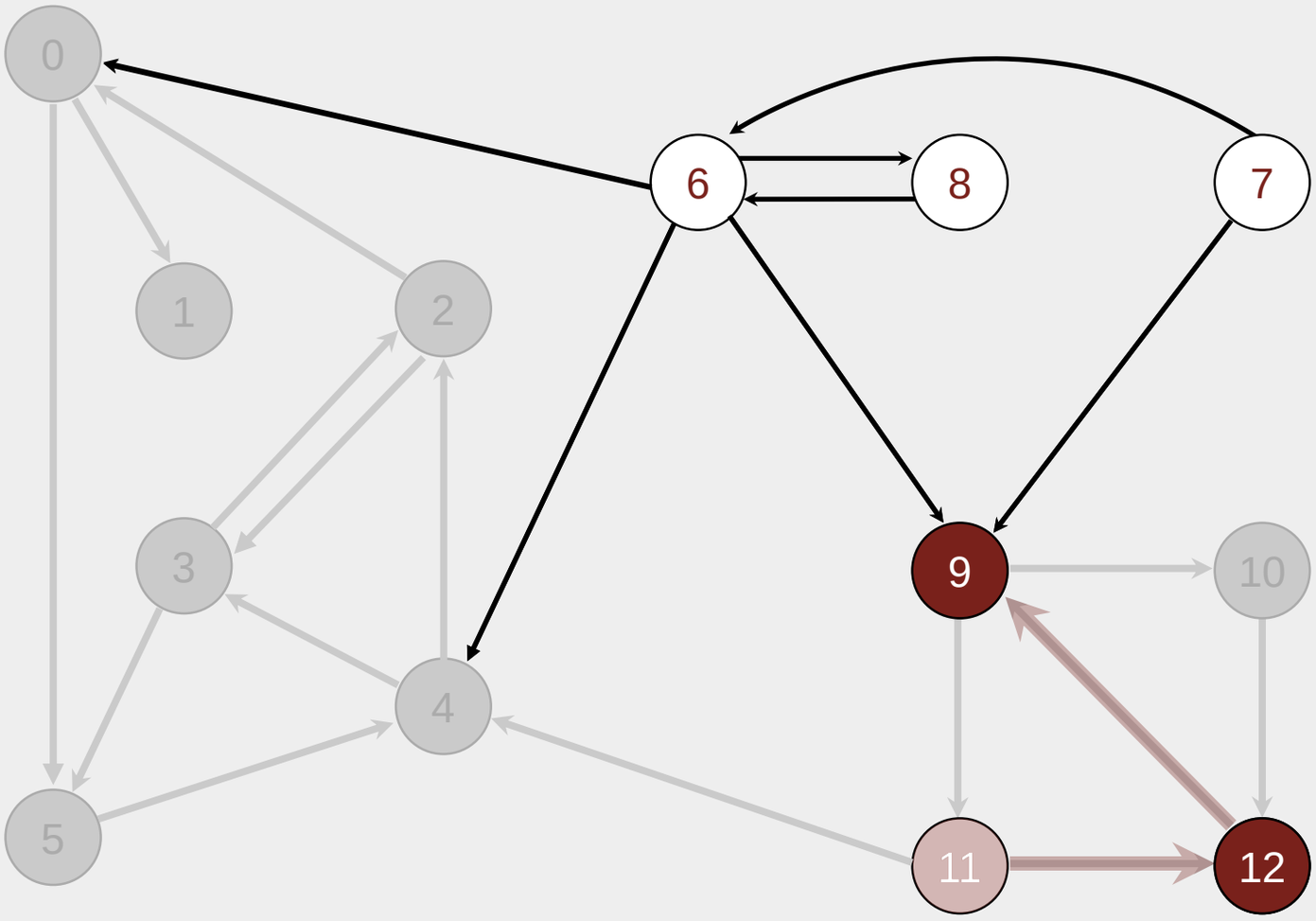


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	2
10	2
11	2
12	2

10 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 **11** **9** **12** **10** **6** **7** **8**

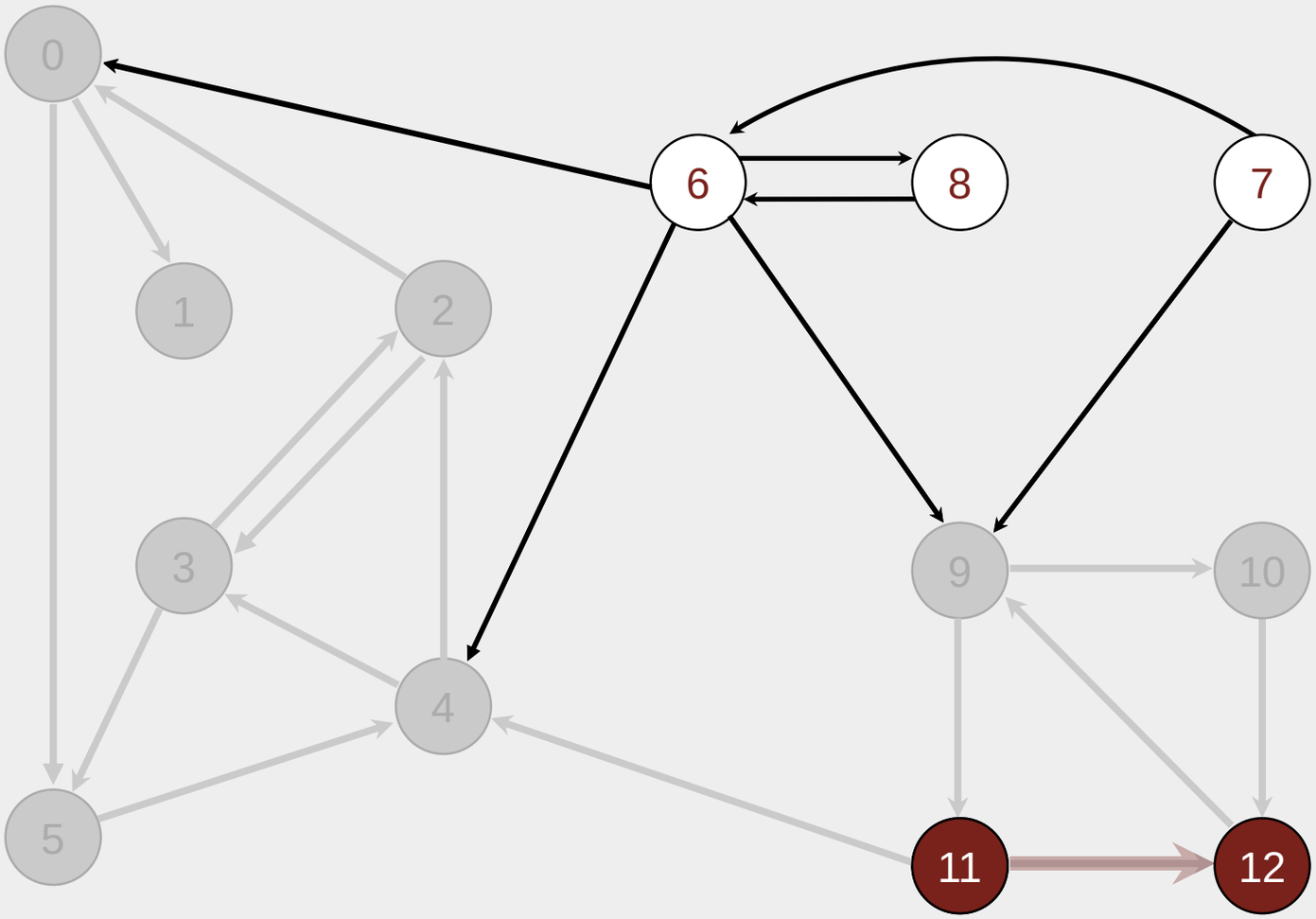


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	2
10	2
11	2
12	2

9 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 **11** **9** **12** **10** **6** **7** **8**

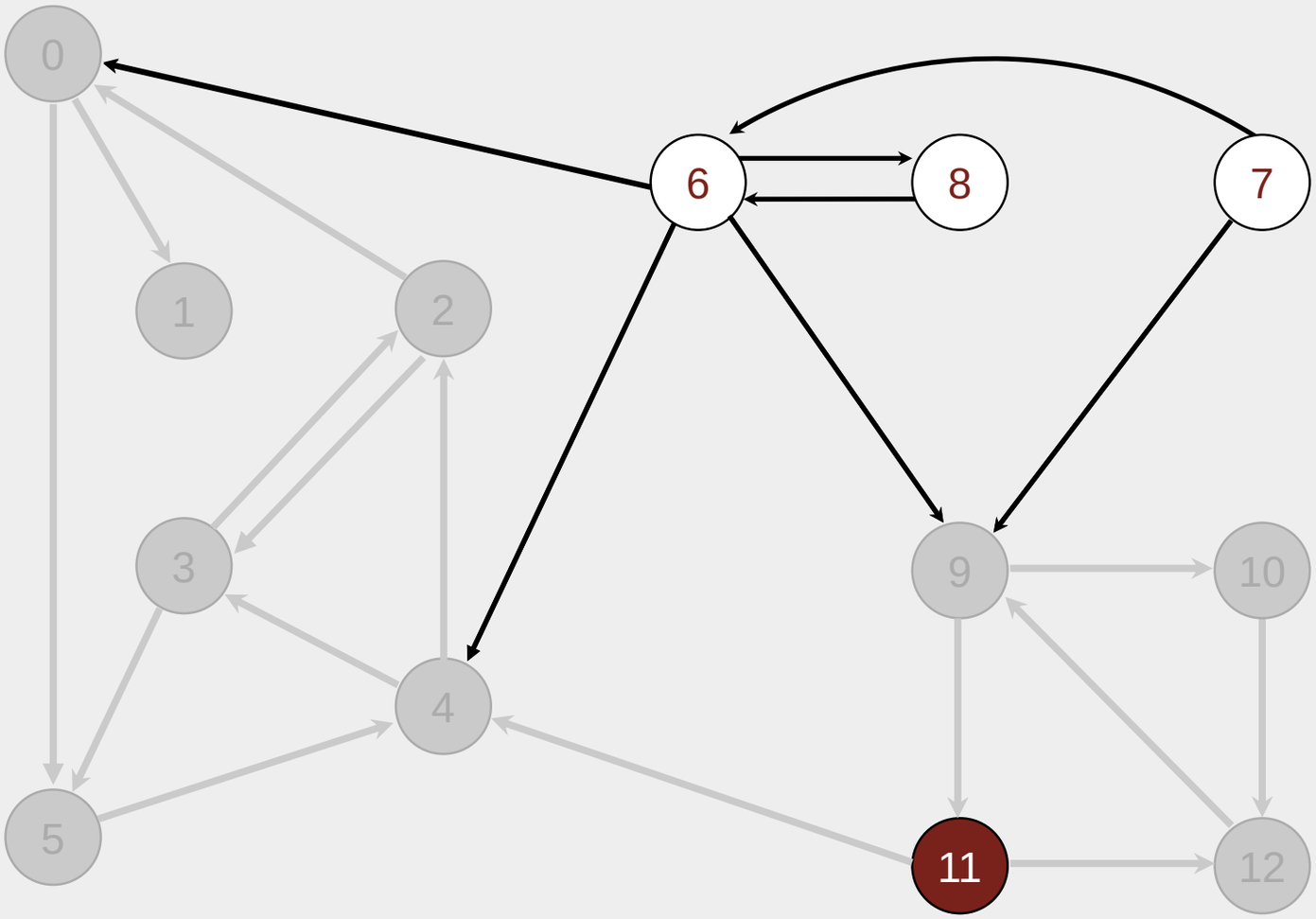


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	2
10	2
11	2
12	2

12 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 **11** **9** **12** **10** **6** **7** **8**

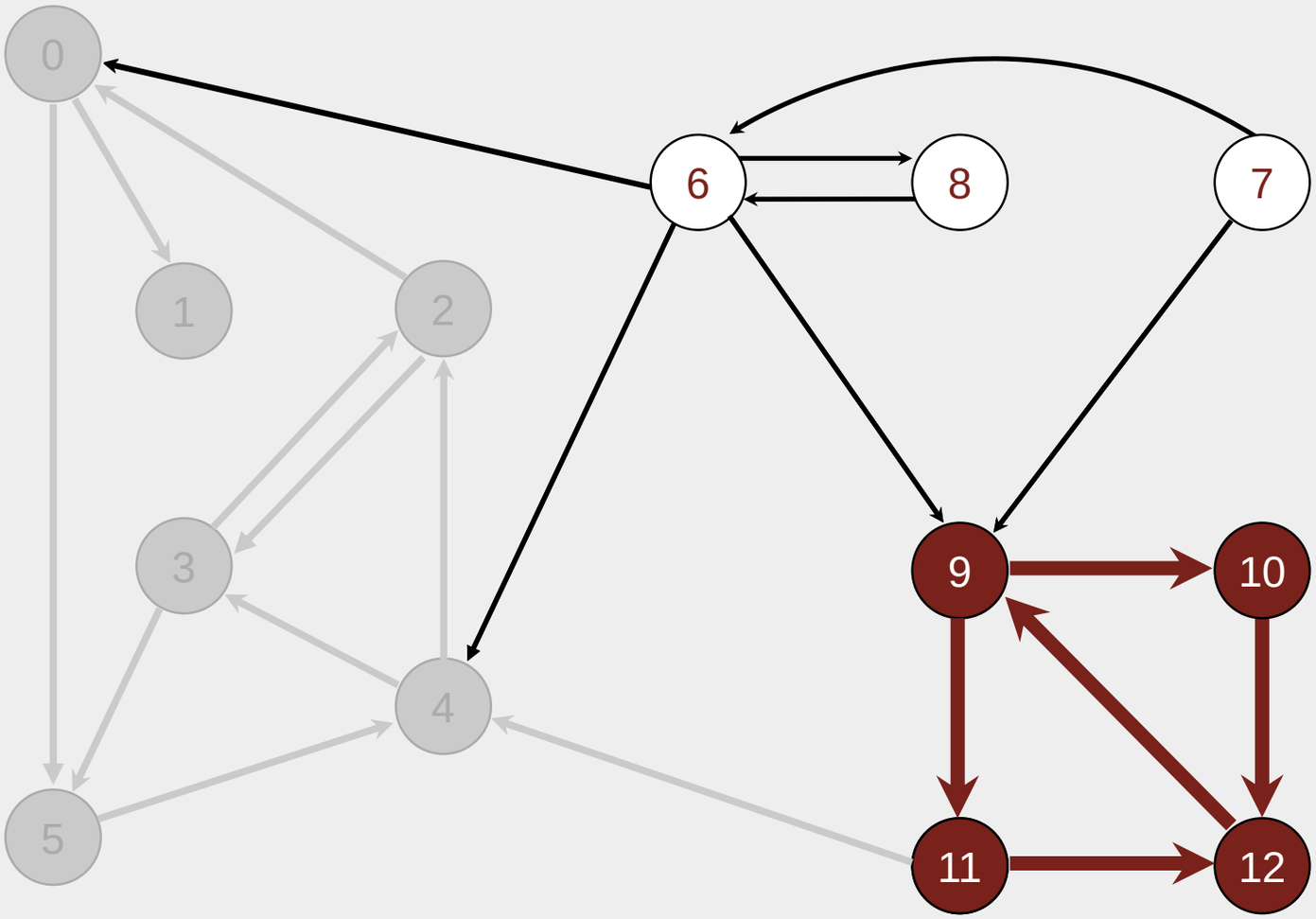


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	2
10	2
11	2
12	2

11 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 **11 9 12 10 6 7 8**

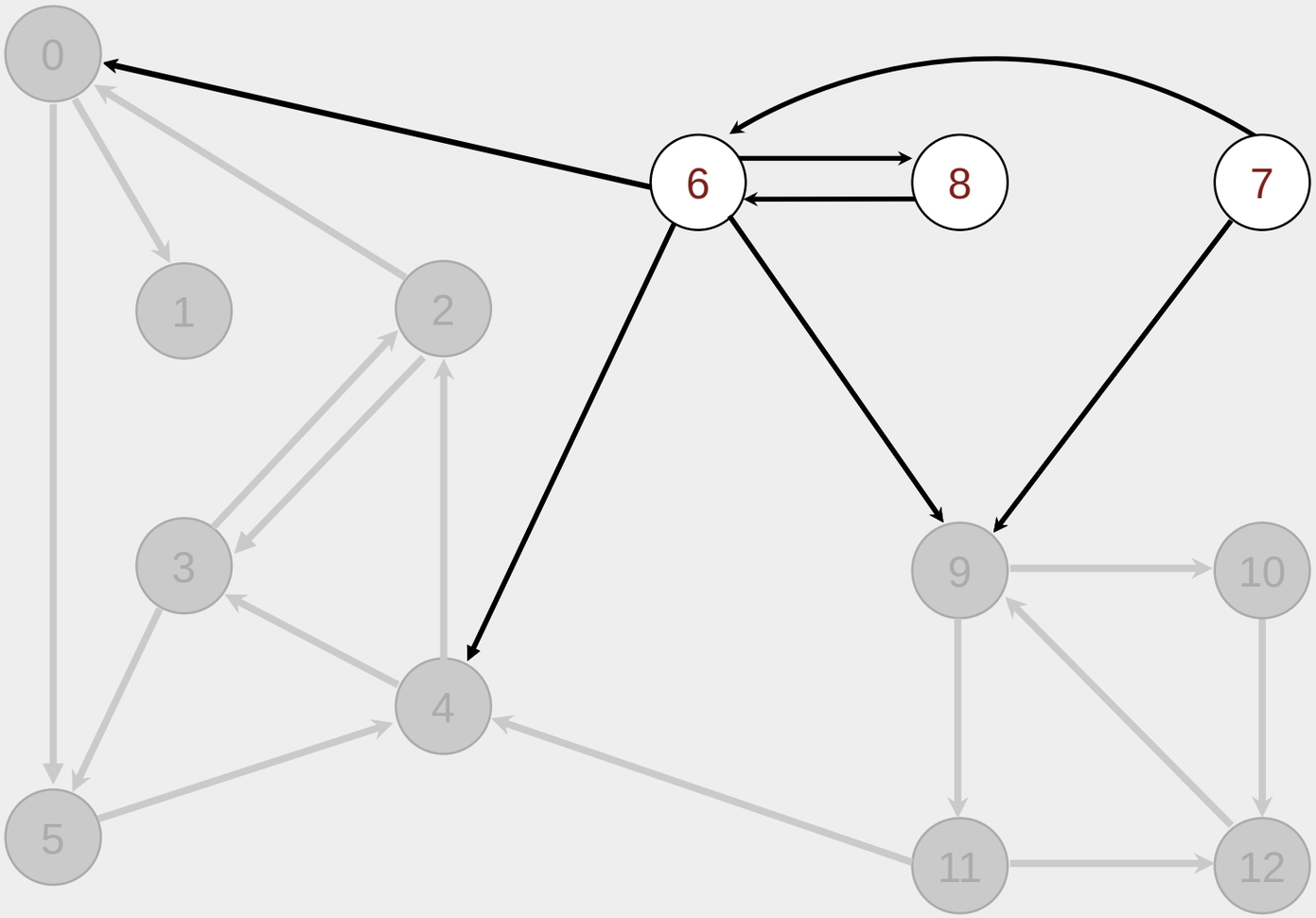


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	2
10	2
11	2
12	2

strong component: 9 10 11 12

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

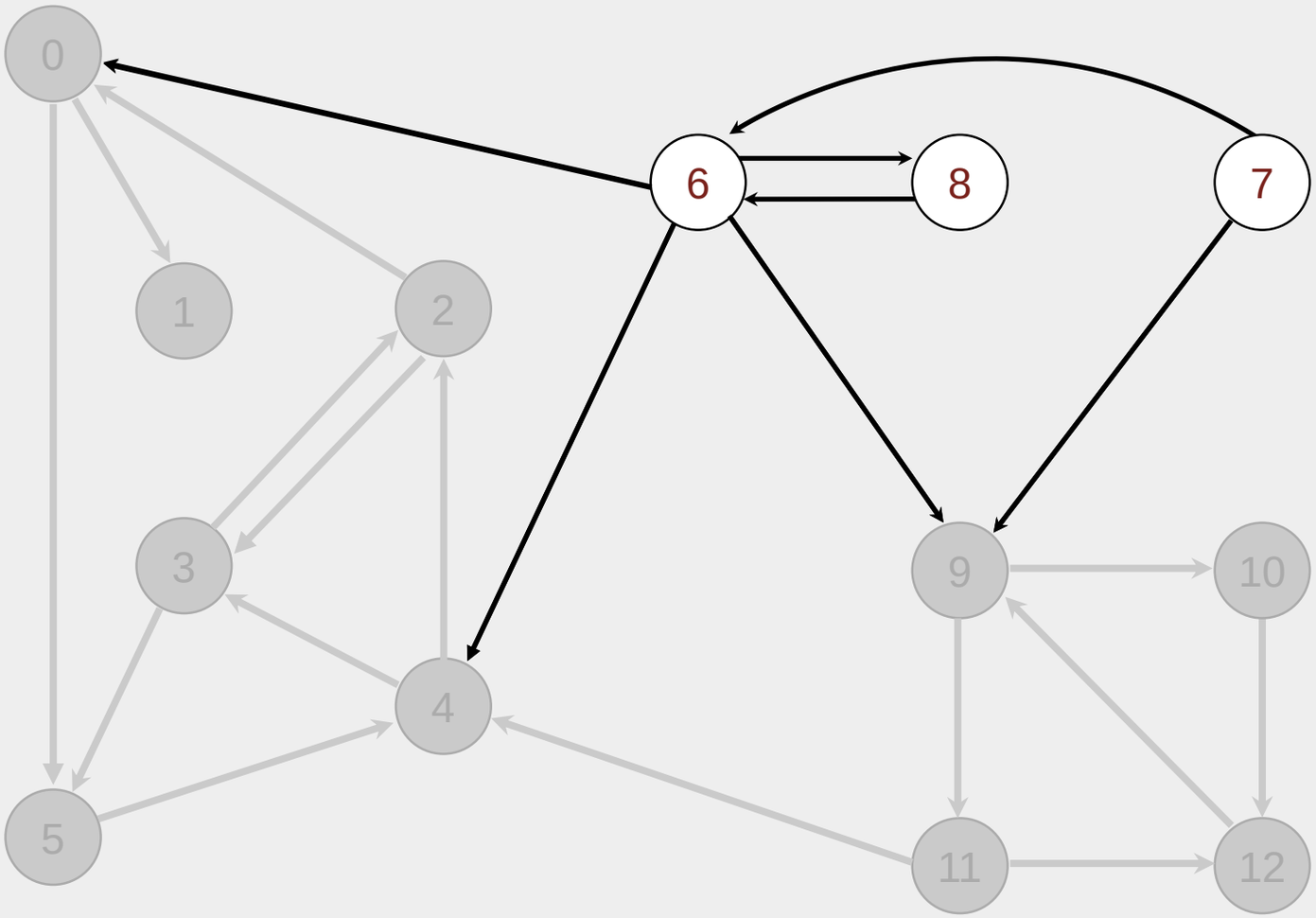


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	2
10	2
11	2
12	2

check 9

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8

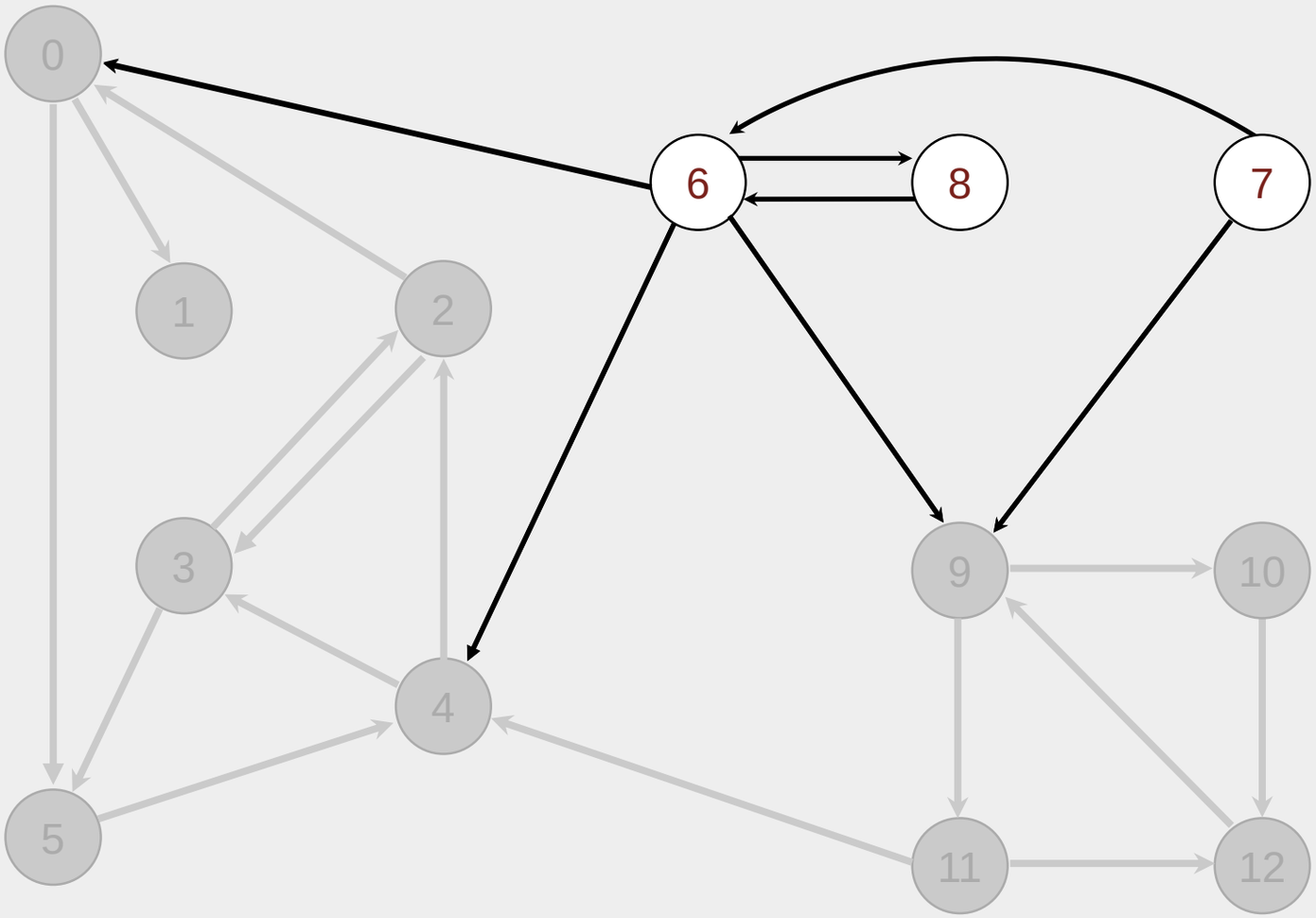


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	2
10	2
11	2
12	2

check 12

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 **10** **6** **7** **8**

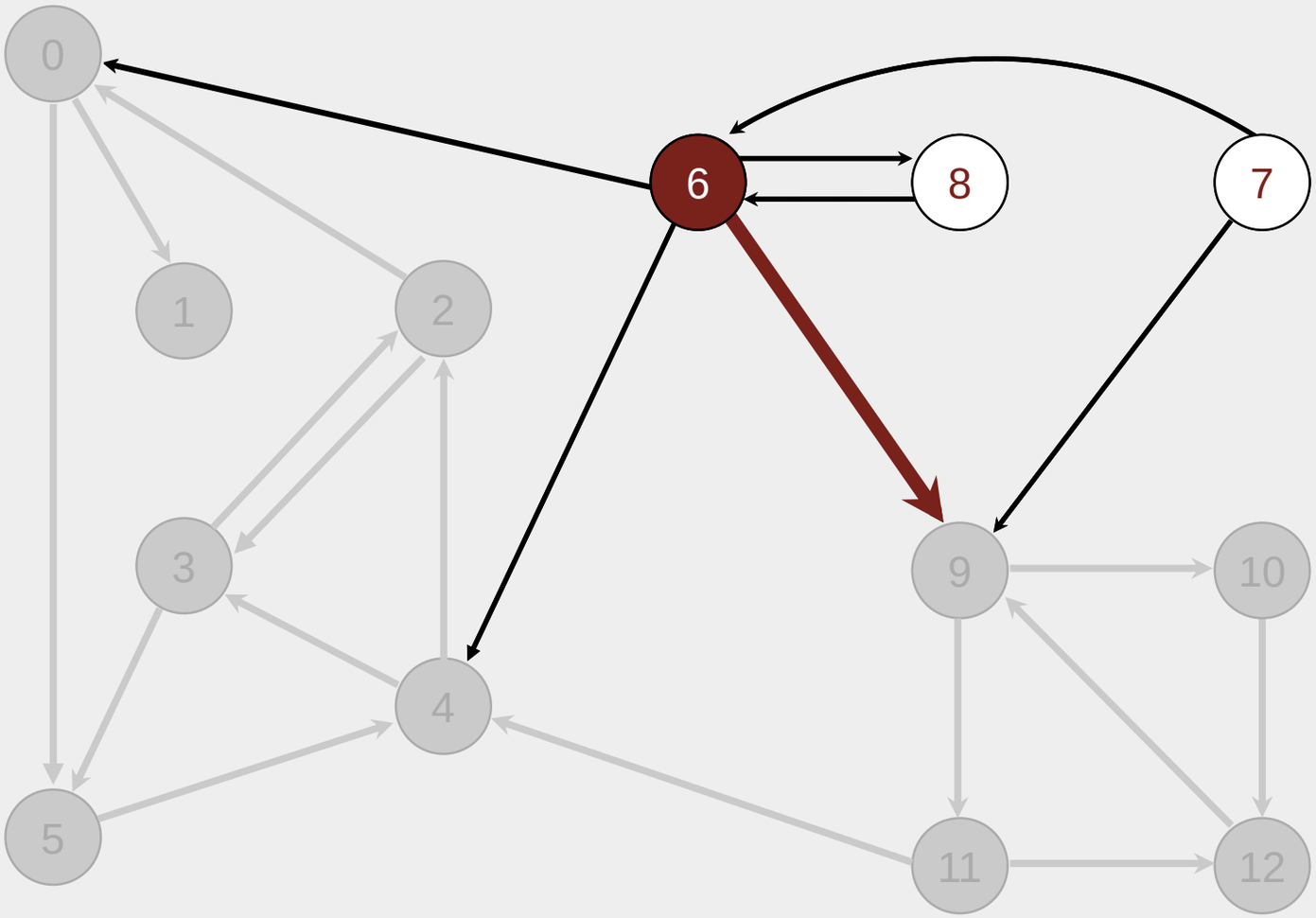


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	–
7	–
8	–
9	2
10	2
11	2
12	2

check 10

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 **6** **7** **8**

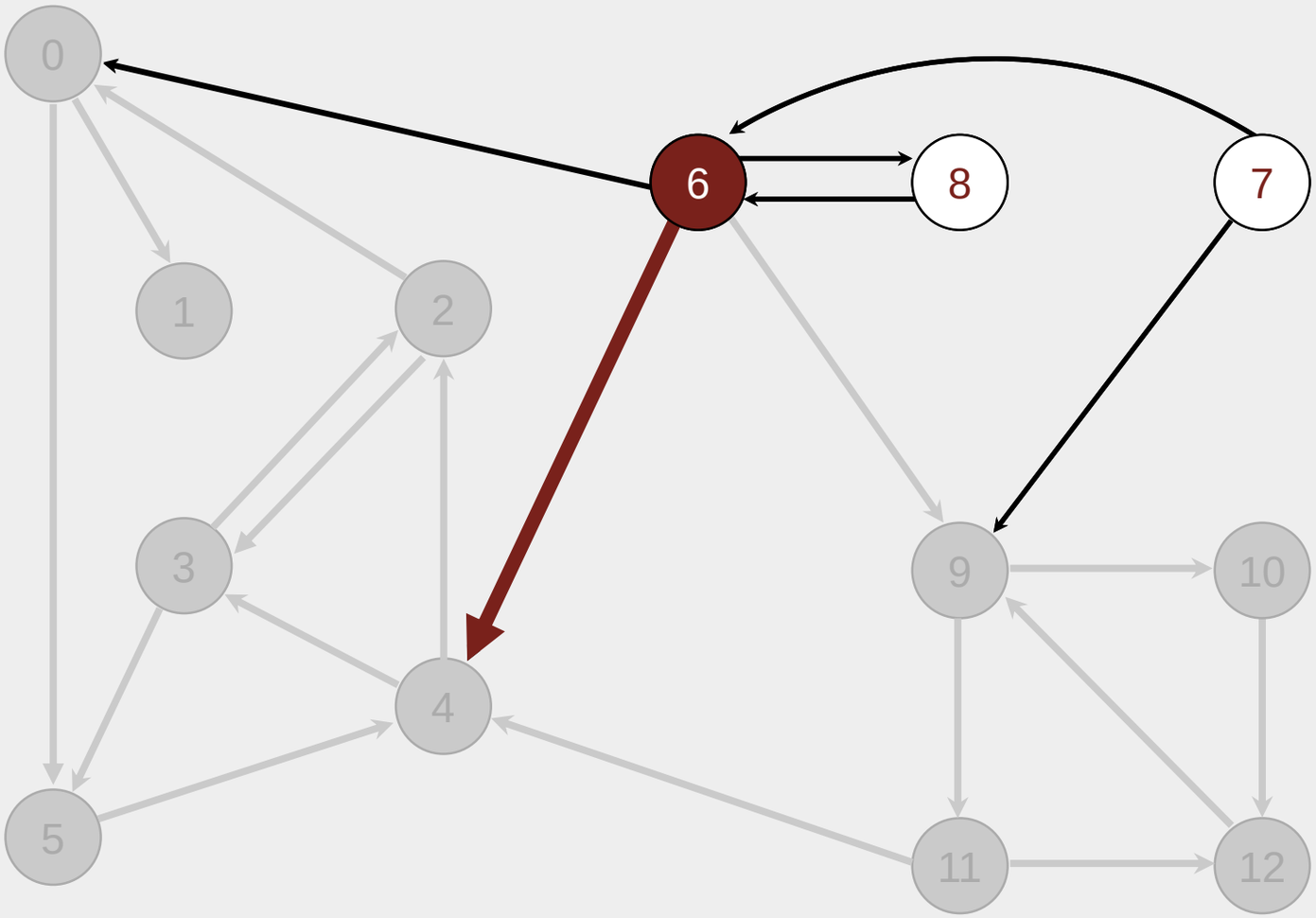


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	–
8	–
9	2
10	2
11	2
12	2

visit 6

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 **6** **7** **8**

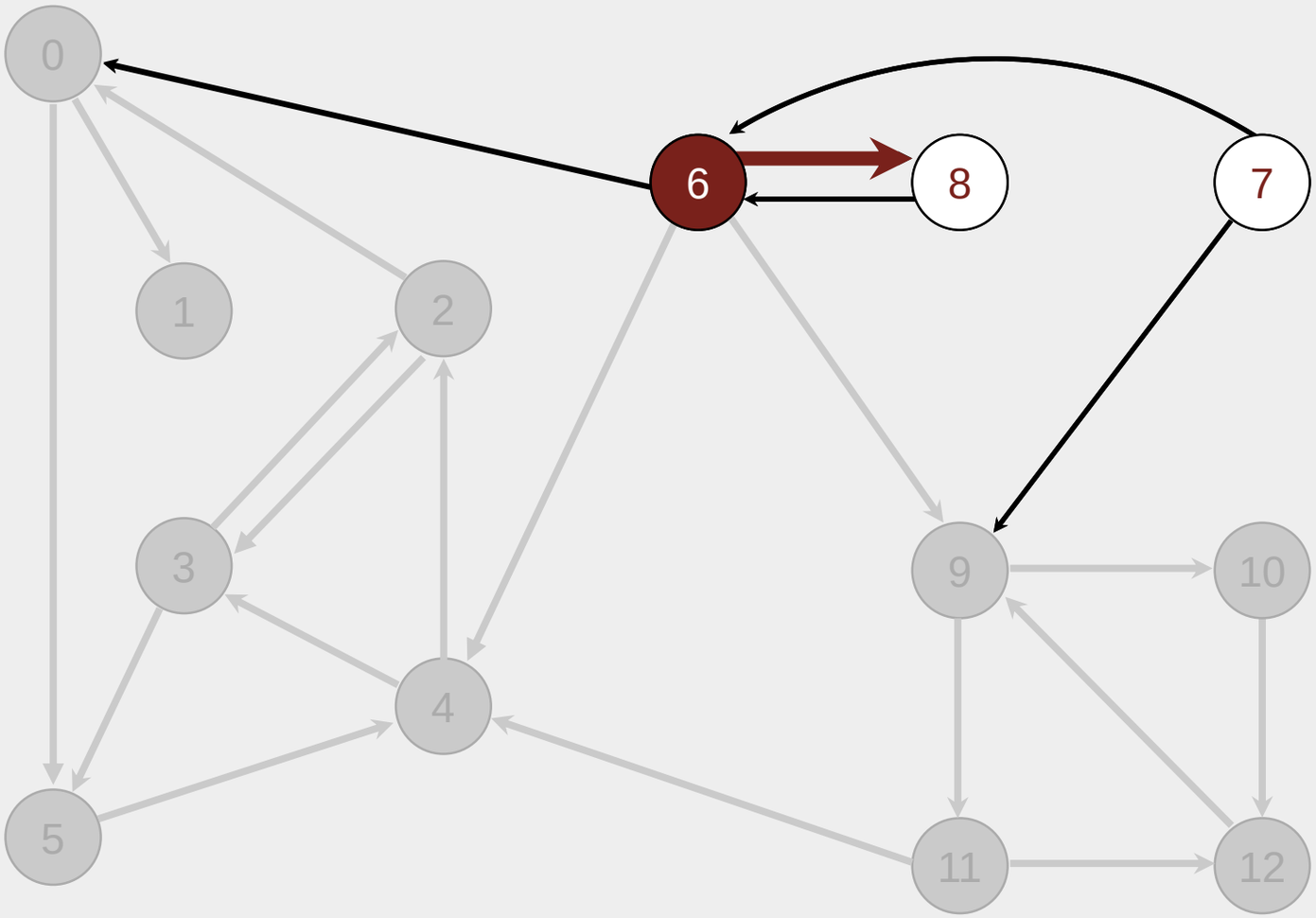


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	–
8	–
9	2
10	2
11	2
12	2

visit 6

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 **6** **7** **8**

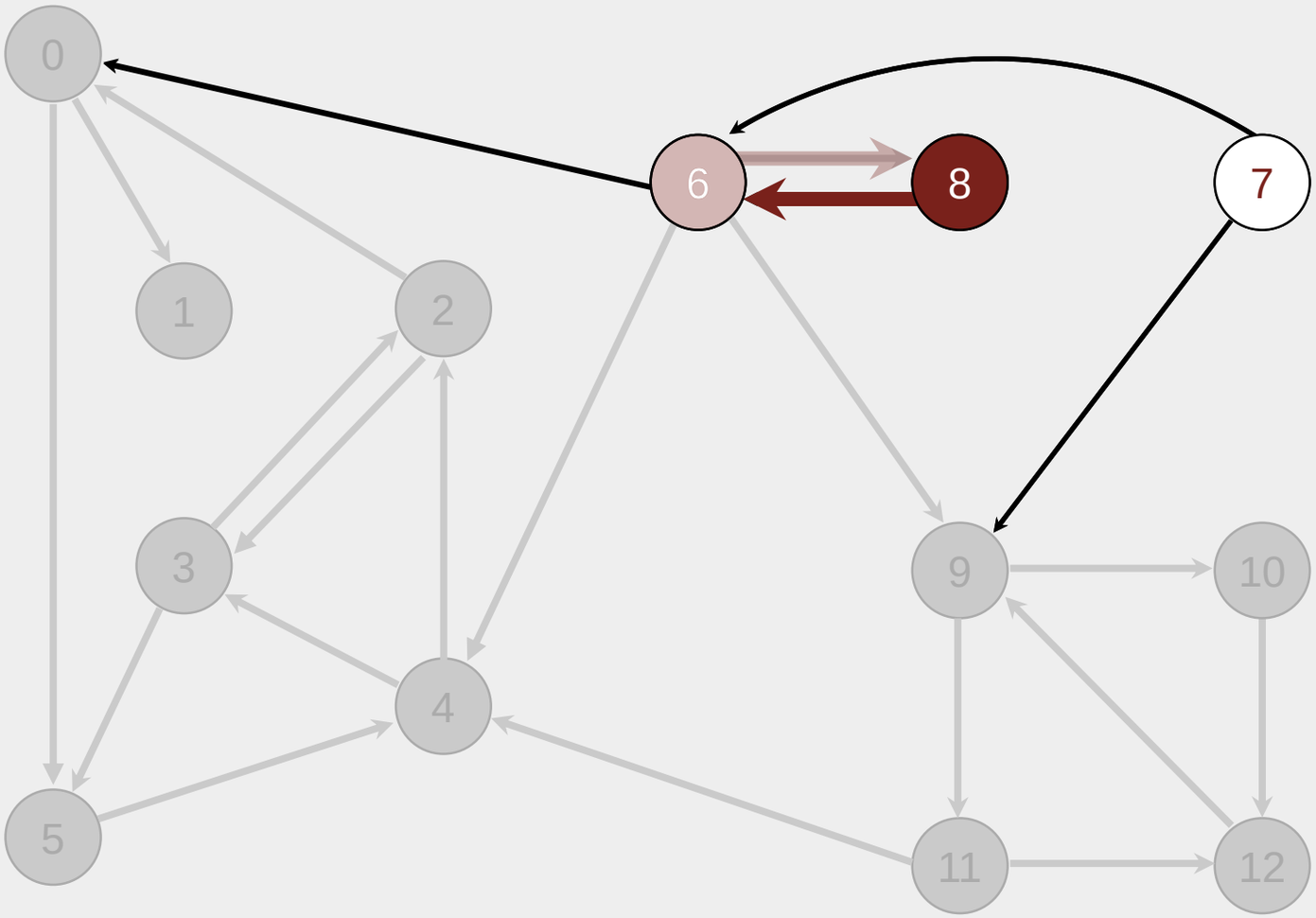


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	–
8	–
9	2
10	2
11	2
12	2

visit 6

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 **6** **7** **8**

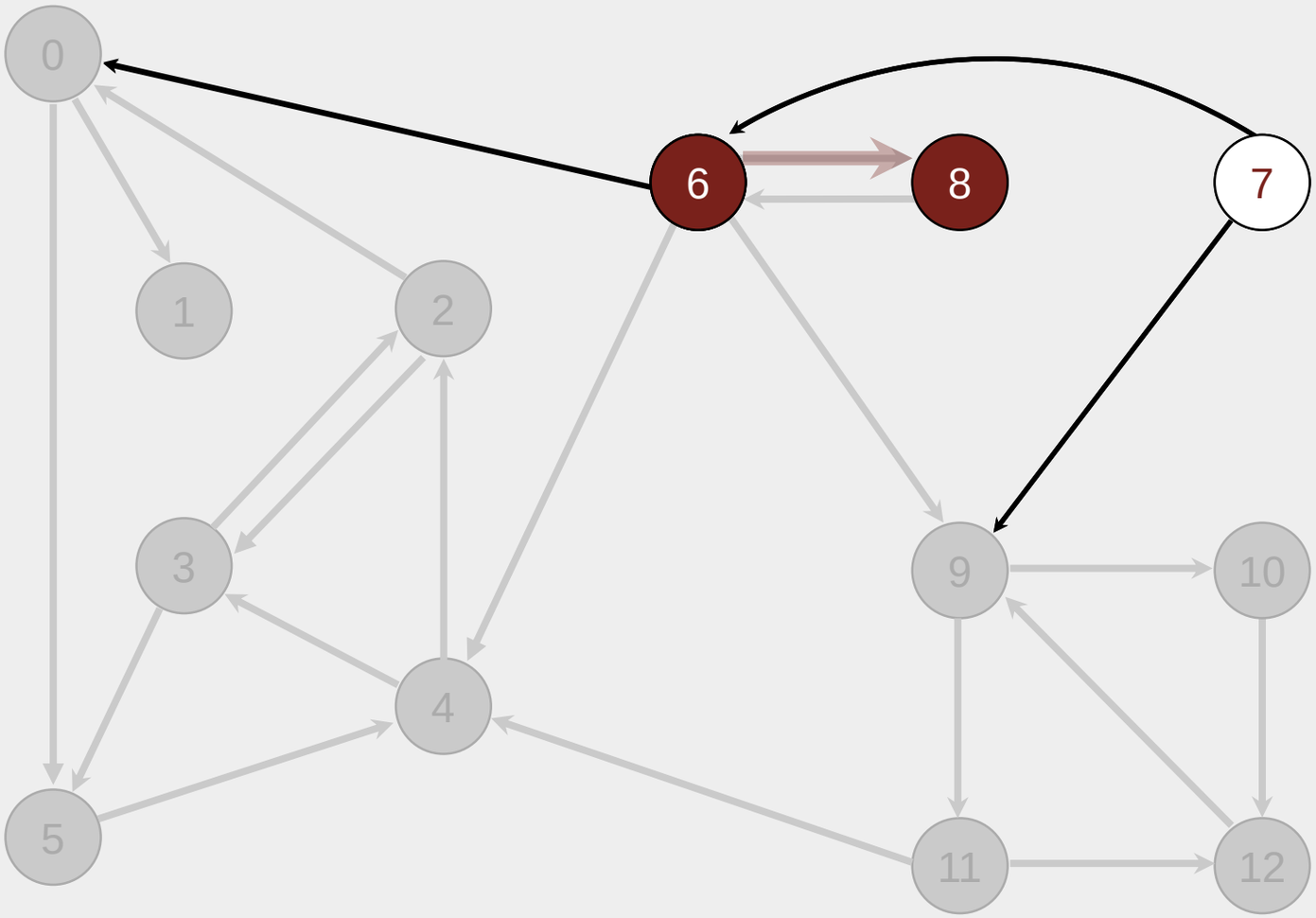


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	–
8	3
9	2
10	2
11	2
12	2

visit 8

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 **6** **7** **8**

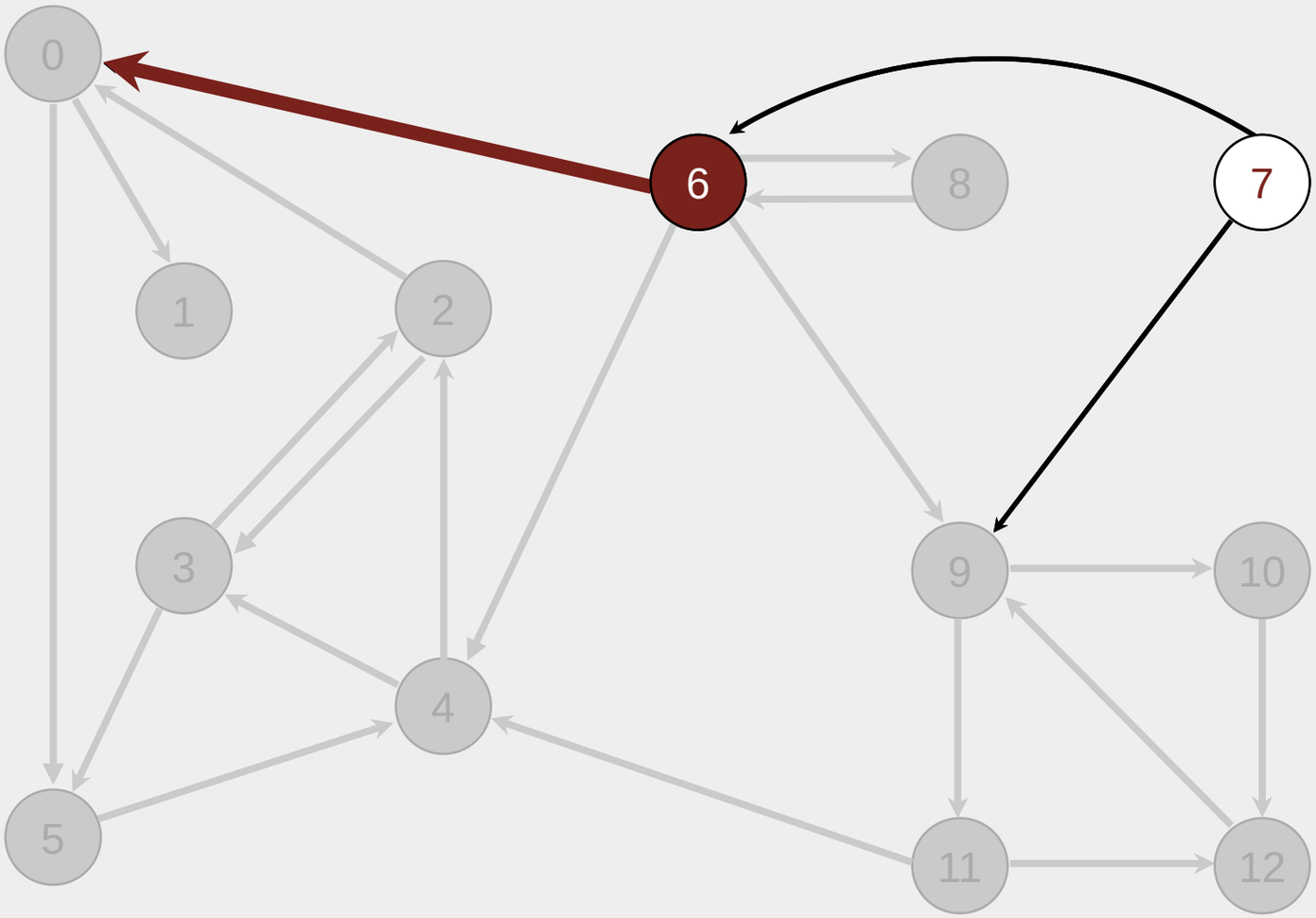


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	–
8	3
9	2
10	2
11	2
12	2

8 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 **6** **7** **8**

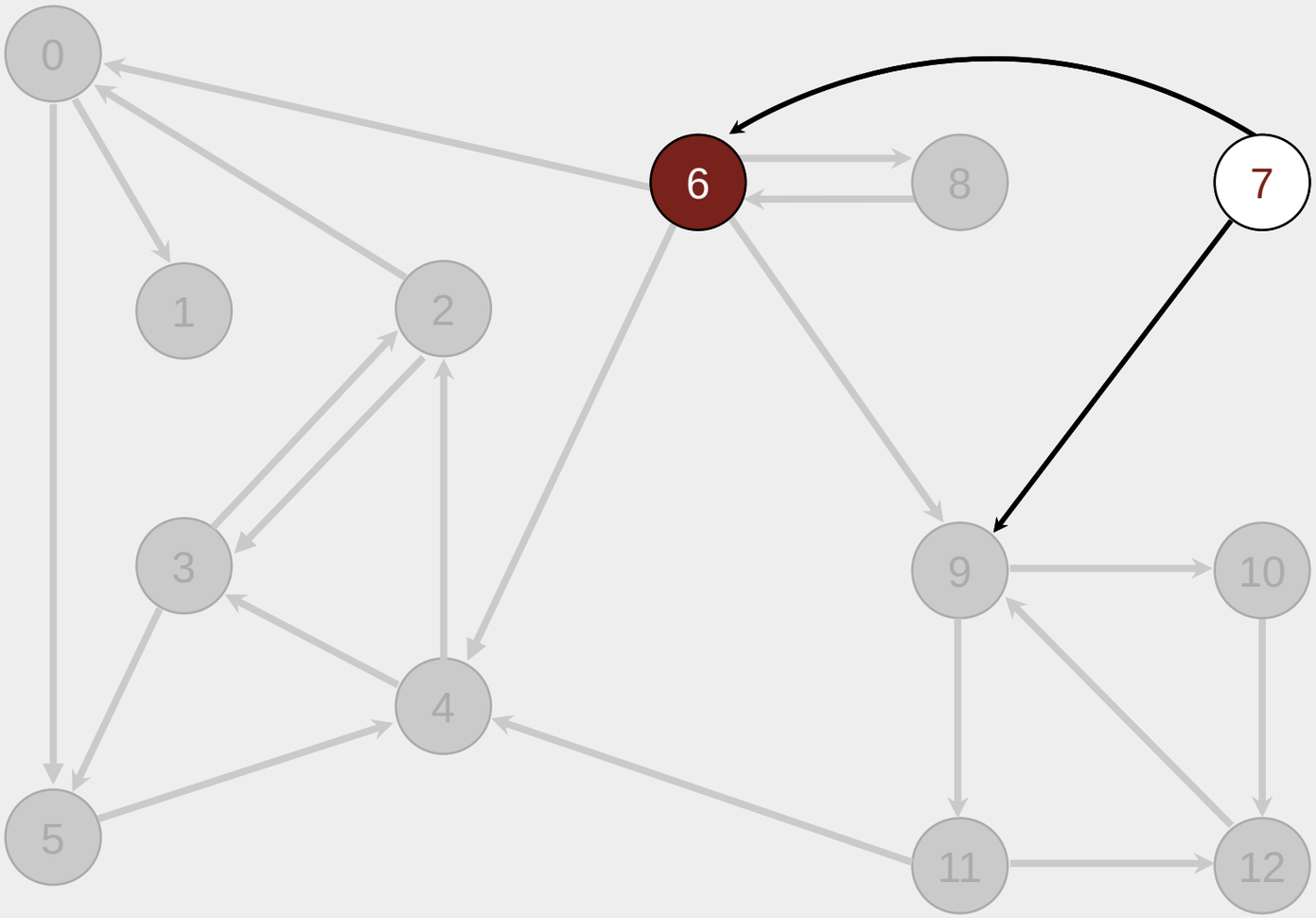


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	–
8	3
9	2
10	2
11	2
12	2

visit 6

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 **6** **7** **8**

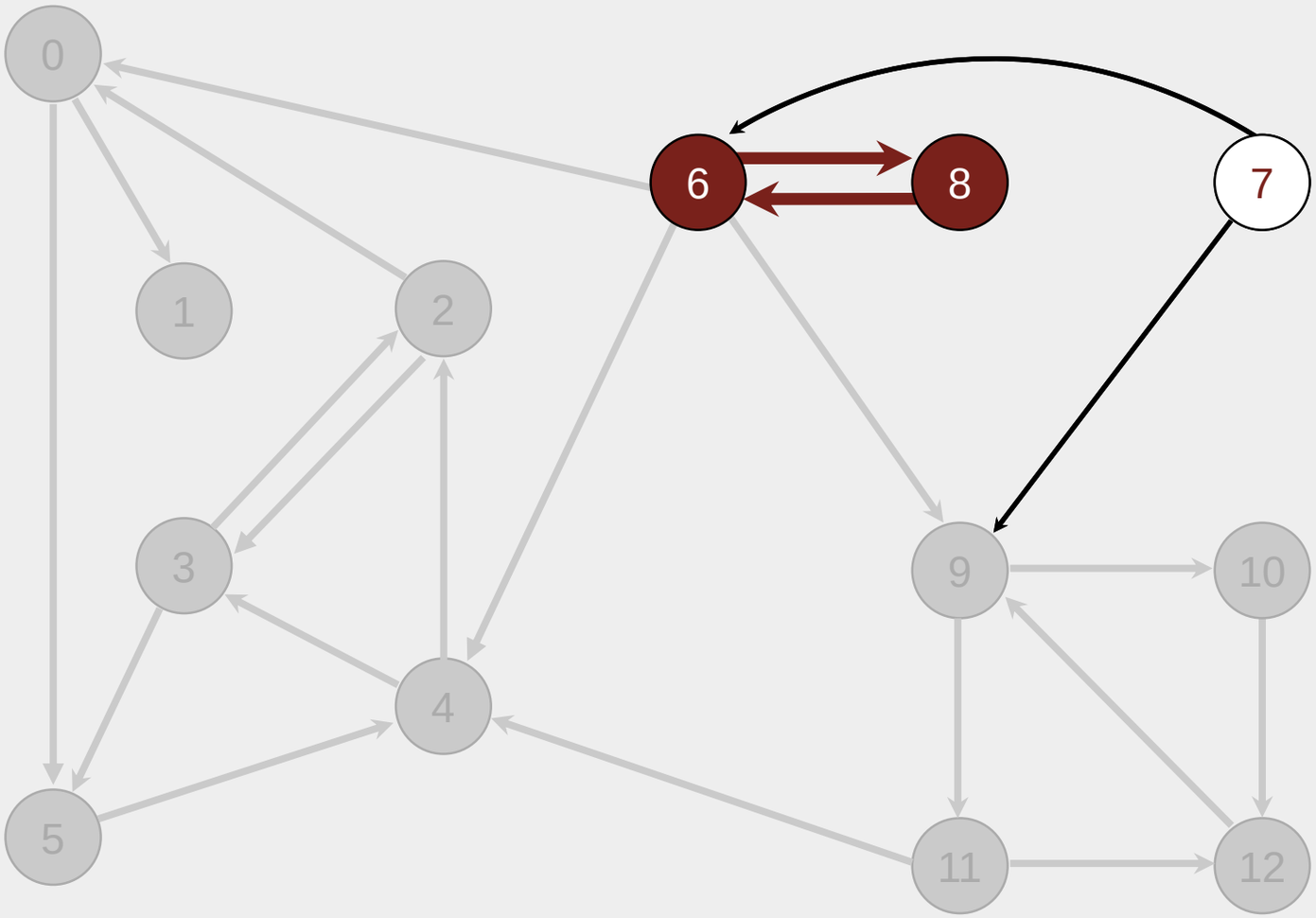


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	–
8	3
9	2
10	2
11	2
12	2

6 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 **6** **7** **8**

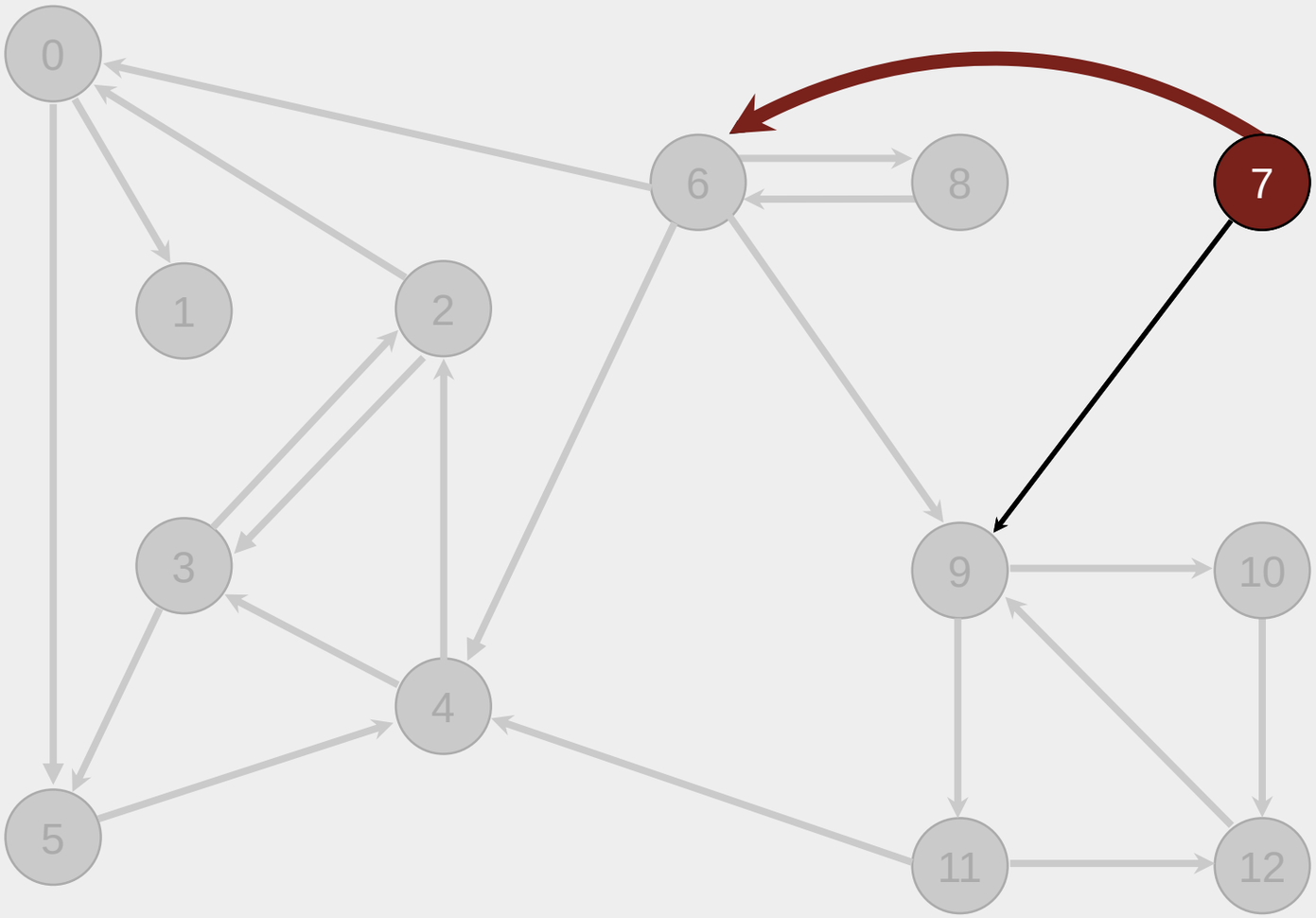


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	–
8	3
9	2
10	2
11	2
12	2

strong component: 6 8

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 **7** **8**

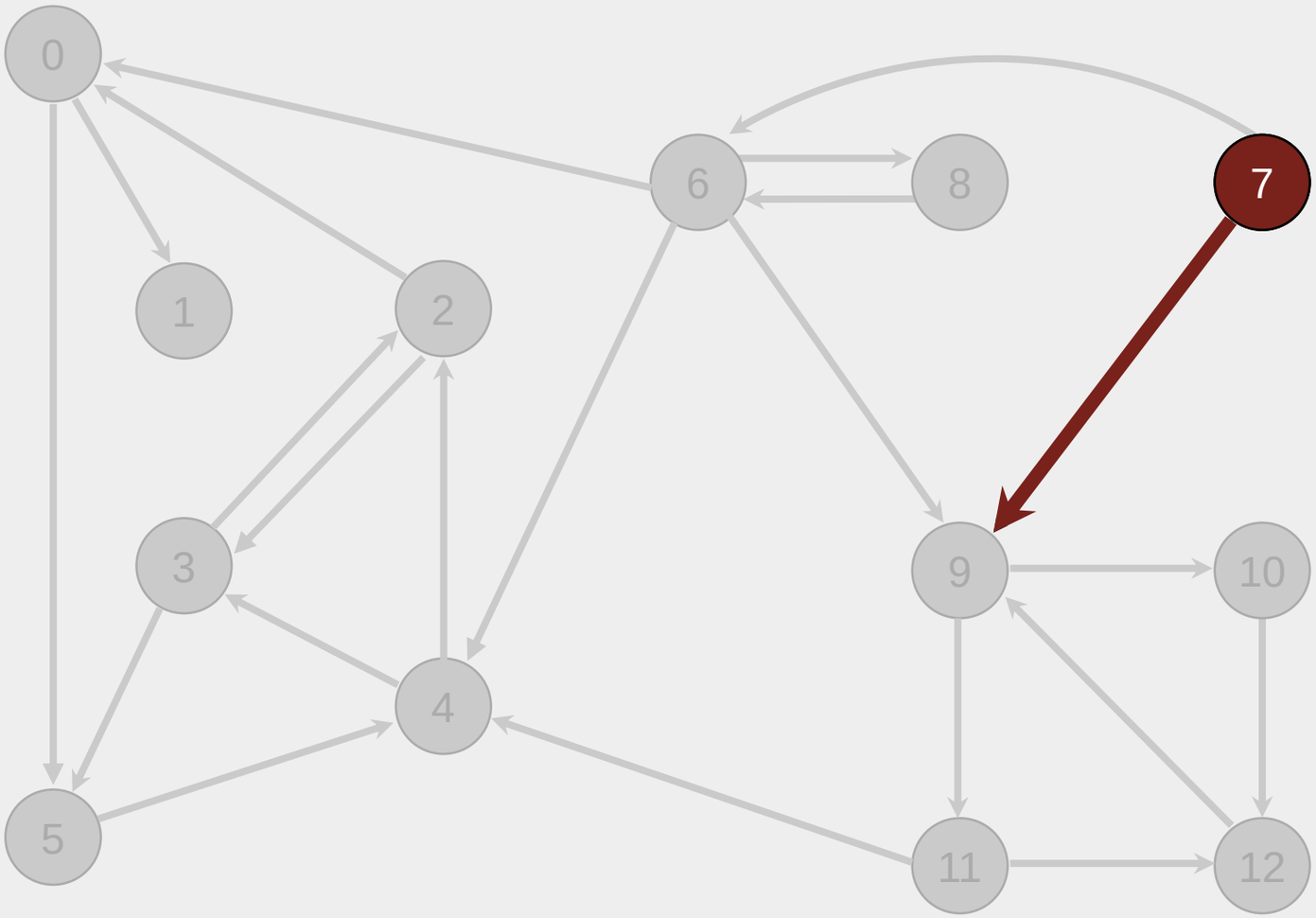


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	4
8	3
9	2
10	2
11	2
12	2

visit 7

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 **7** **8**

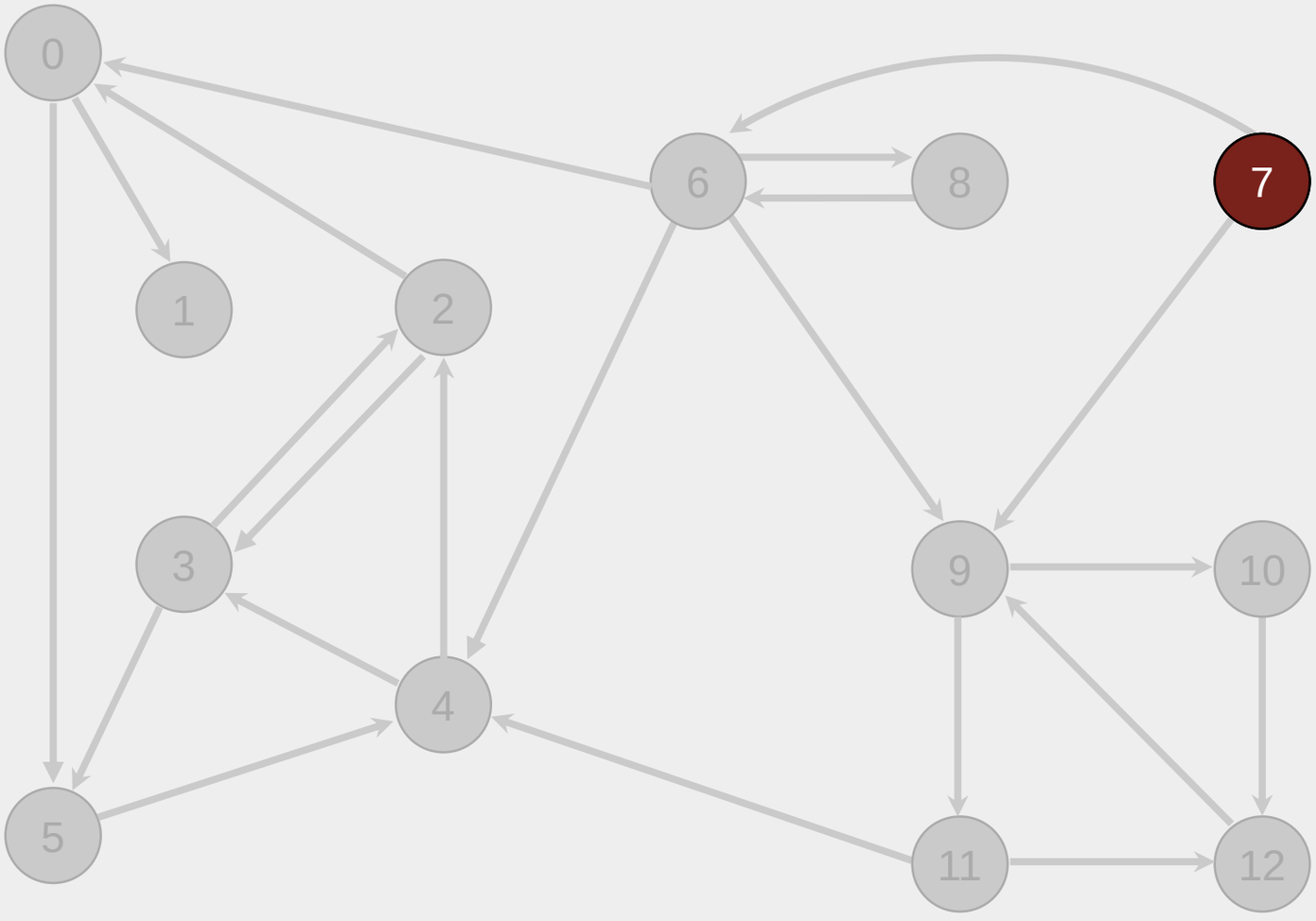


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	4
8	3
9	2
10	2
11	2
12	2

visit 7

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 **7** **8**

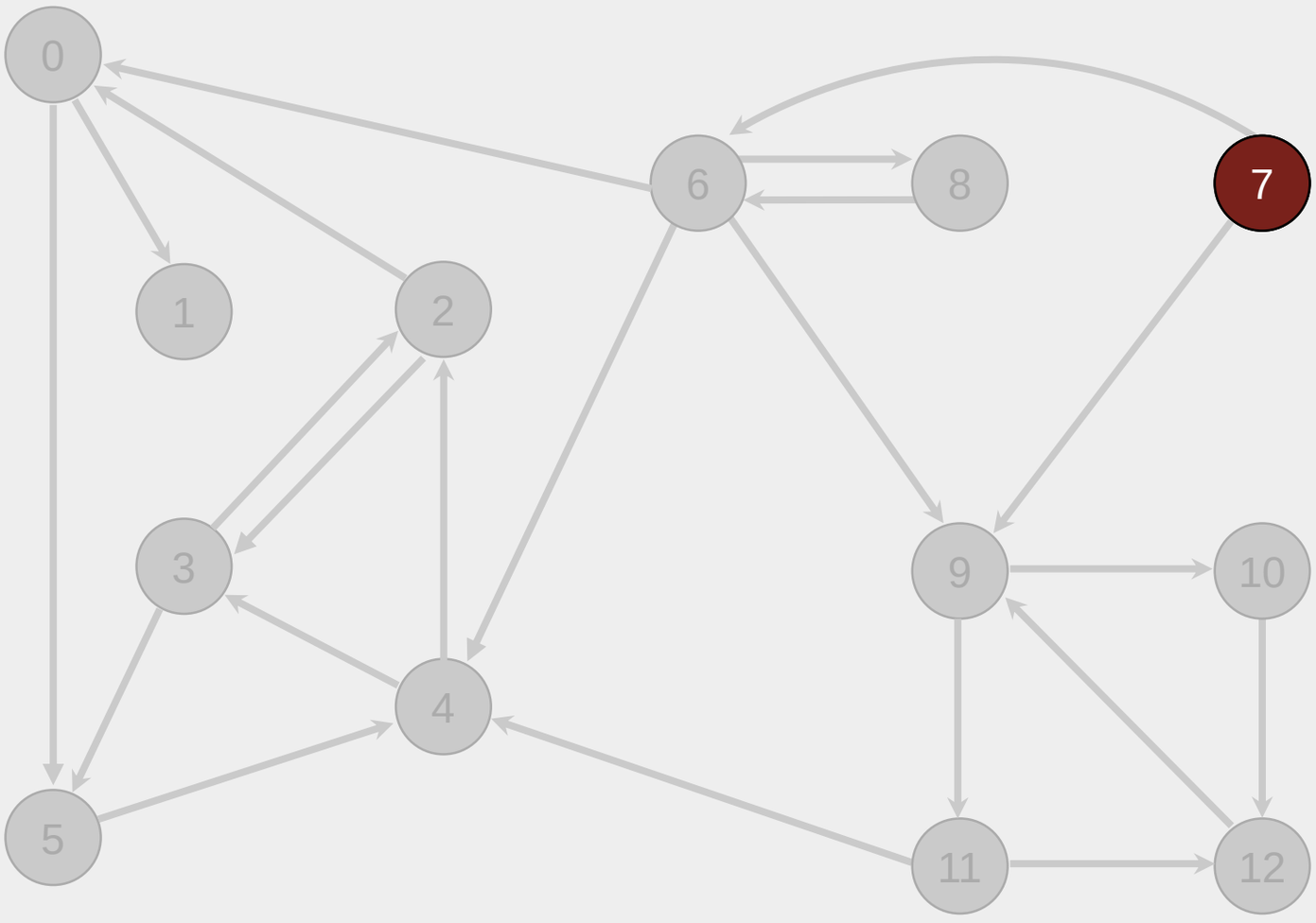


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	4
8	3
9	2
10	2
11	2
12	2

7 done

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 **7** **8**

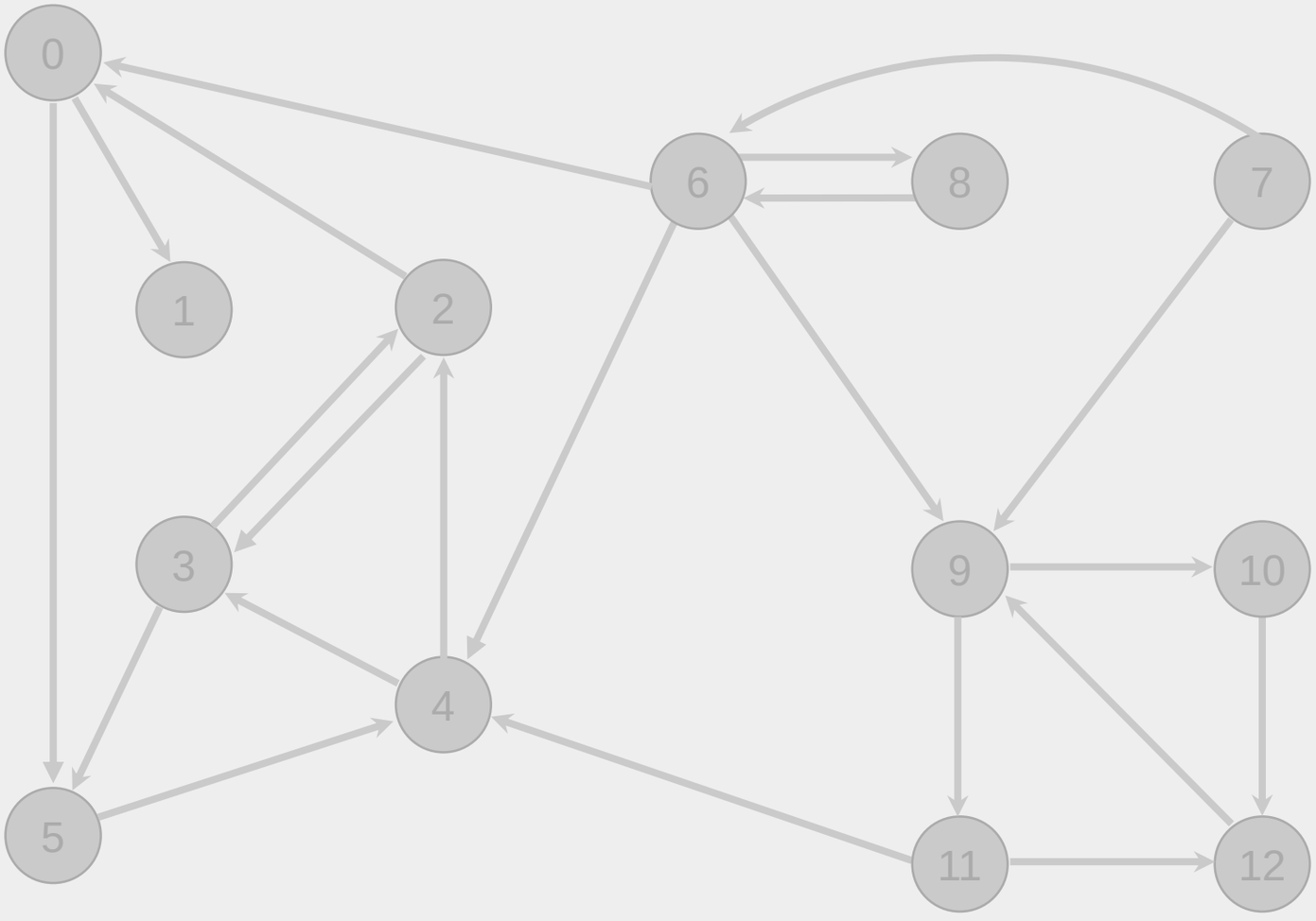


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	4
8	3
9	2
10	2
11	2
12	2

strong component: 7

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 **8**

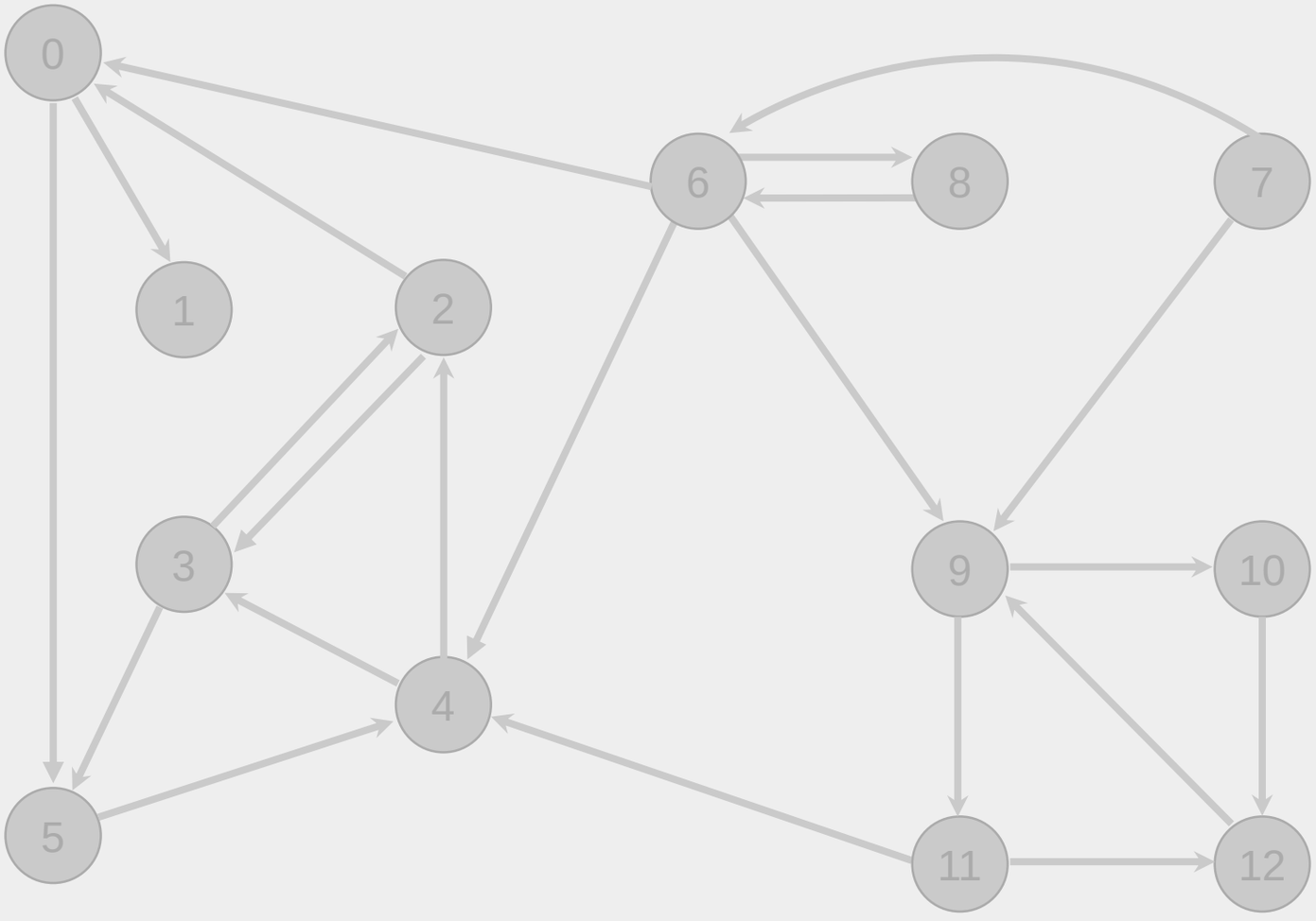


v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	4
8	3
9	2
10	2
11	2
12	2

check 8

Phase 2. Run DFS in G, visiting unmarked vertices in reverse postorder of G^R.

1 0 2 4 5 3 11 9 12 10 6 7 8



v	scc[v]
0	1
1	0
2	1
3	1
4	1
5	1
6	3
7	4
8	3
9	2
10	2
11	2
12	2

done