

HW#2

This is a follow-up of Exercise (b), HW#1. Let us refer to your program for Exercise (b) of HW#1 as HW1b. Now we additionally consider the following two possible modifications on HW1b.

1. (M1) *Arbitrary initial values*. In the previous exercise, you probably assume that each node is NOT in the set initially. We now assume that the initial decision of a node is randomly determined. It could be IN or OUT of the set with equal probability.
2. (M2) *Anonymous algorithm*. We now assume no process id to break tie when comparing priorities between two neighboring nodes.

The TA will provide you two input data files. Please answer the following questions for each data file.

Question (a)

Modify HW1b to generate random initial value for each node (M1 without M2). Call the new program HW2a. Note that different initial values MAY lead to different results. To find out, HW2a performs 1,000 tests to see if all test results are identical. Did these tests produce the same result?

Question (b)

Modify HW1b to be an anonymous algorithm with arbitrary initial values (M1 plus M2). In the new program called HW2b, a node can be **in** the set if all of its neighboring nodes with **larger or equal** $W(v) / (\deg(v) + 1)$ values are all **out** of the set, and it must be **out** of the set otherwise. HW2b performs 1,000 tests on the same input data file, each with different randomized initial values. ① Is it possible that HW2b does not stop for some input? Why? ② If HW2b does stop for some input file, please list all possible results (one line for each set of duplicated results) with respective percentages. Are all these results correct (independent sets)?

Question (c)

Modify HW1b to be an anonymous algorithm that allows arbitrary initial values (M1 plus M2). In the new program called HW2c, a node can be **in** the set if all of its neighboring nodes with **larger** $W(v) / (\deg(v) + 1)$ values are all **out** of the set, and it must be **out** of the set otherwise. HW2b performs 1,000 tests on the same input data file, each with different randomized initial values. ① Is it possible that HW2c does not stop for some input? Why? ② If HW2c does stop for some input file, please list all possible results (one line for each set of duplicated results) with respective percentages. Are all these results correct (independent sets)?

Question (d)

Could you suggest a way to correct HW2b? HW2c is certainly not an answer. Hint: Exploit what you have learnt from HW2a. This part is optional. Those who have a correct answer to this question will receive a bonus score.