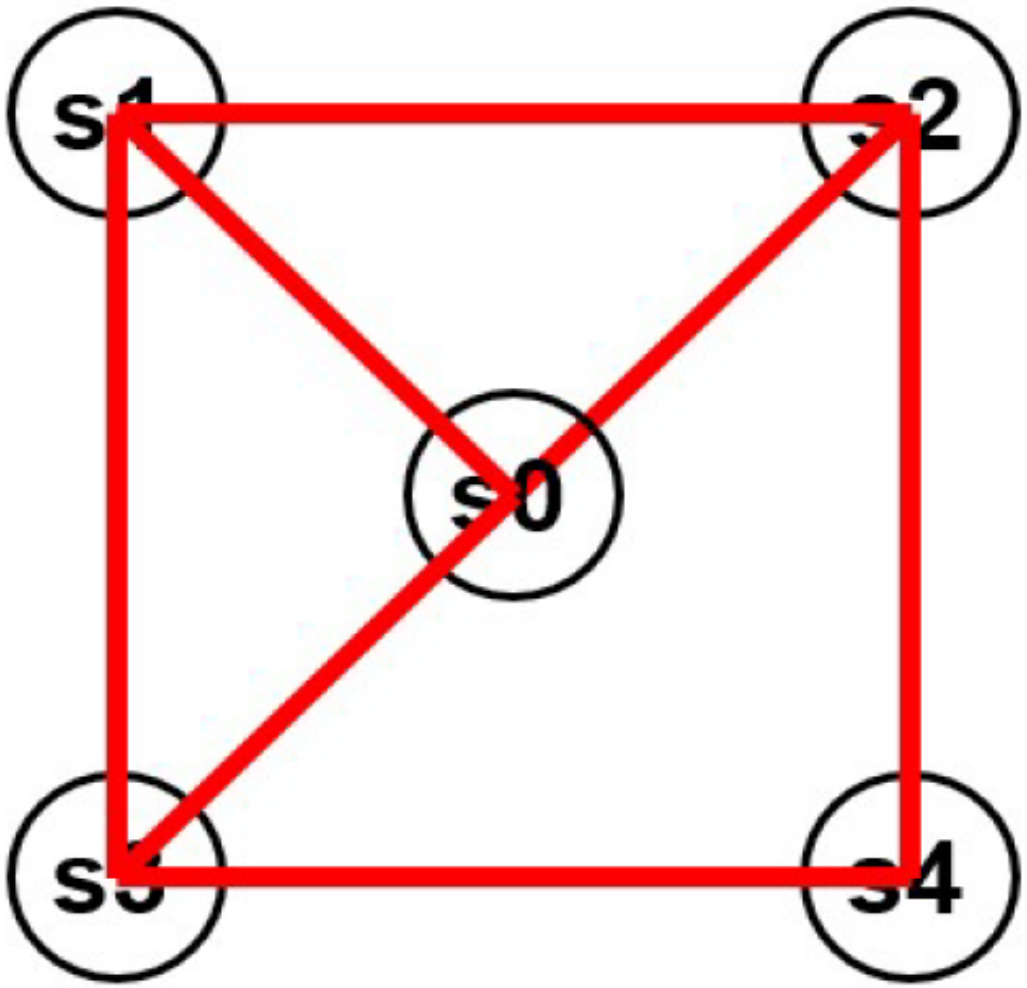
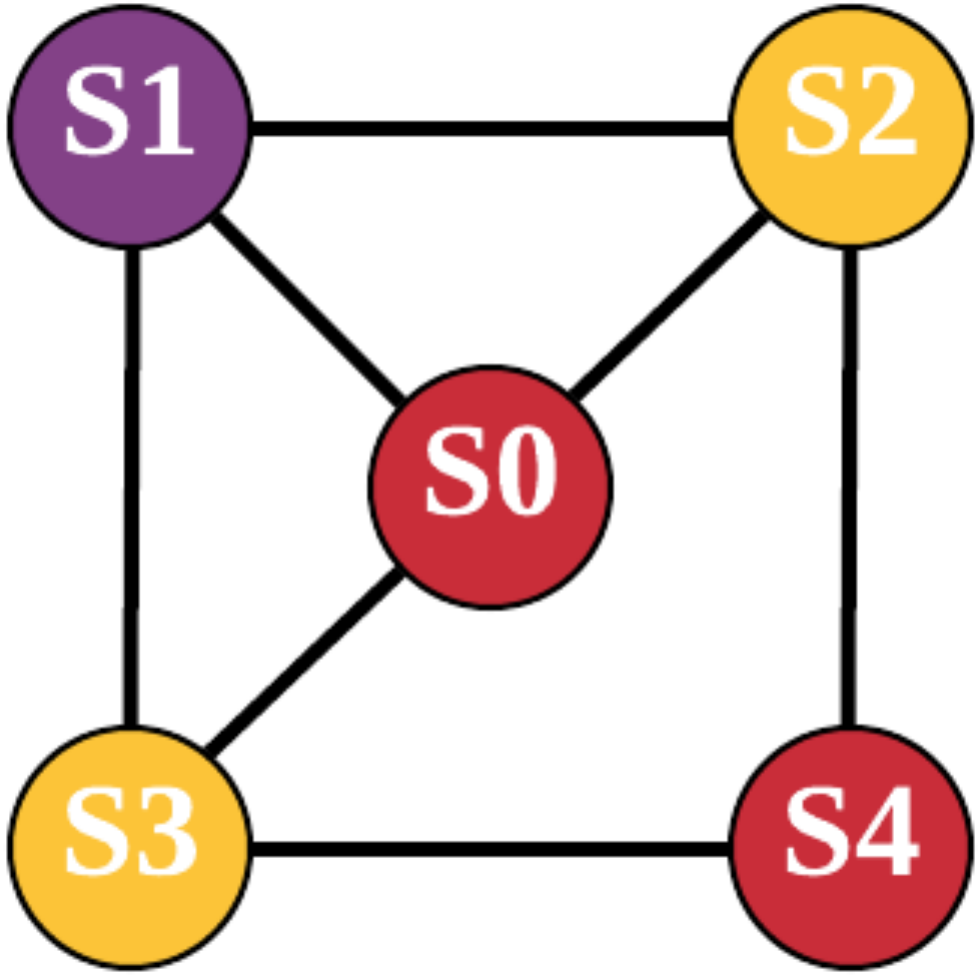
Worksheet-12 Solution

(From Lecture given on 02/20/2019)

Color the interference graph below with the minimum number of colors. Indicate if this coloring can be obtained using the Chaitin or Chaitin-Briggs algorithms studied in class.

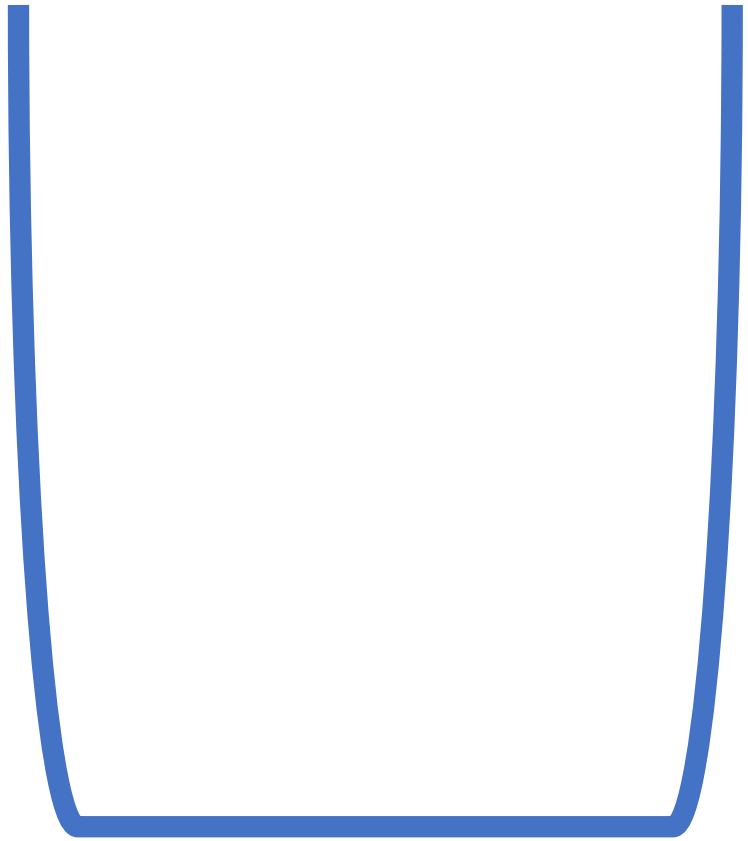


Minimum number of colors needed = **3**



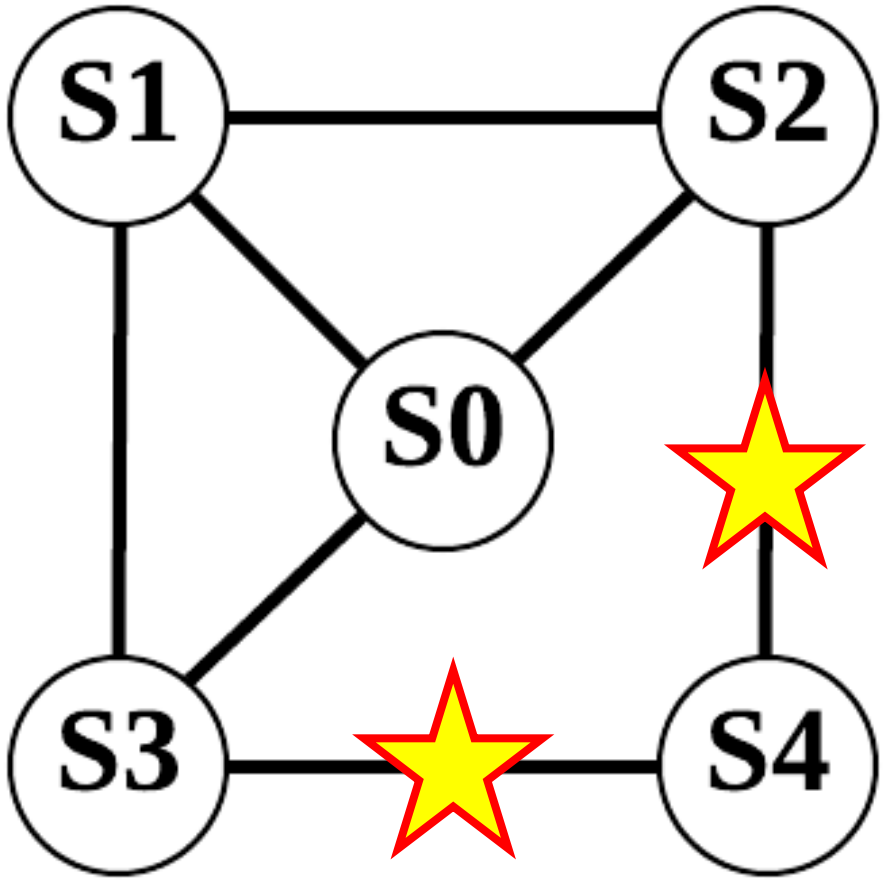
Now,
let's set **K = 3** and see if Chaitin's algorithm or Chaitin-Briggs algorithm can color the graph without any spills.

Chaitin's algorithm – 1 (pushing stage)

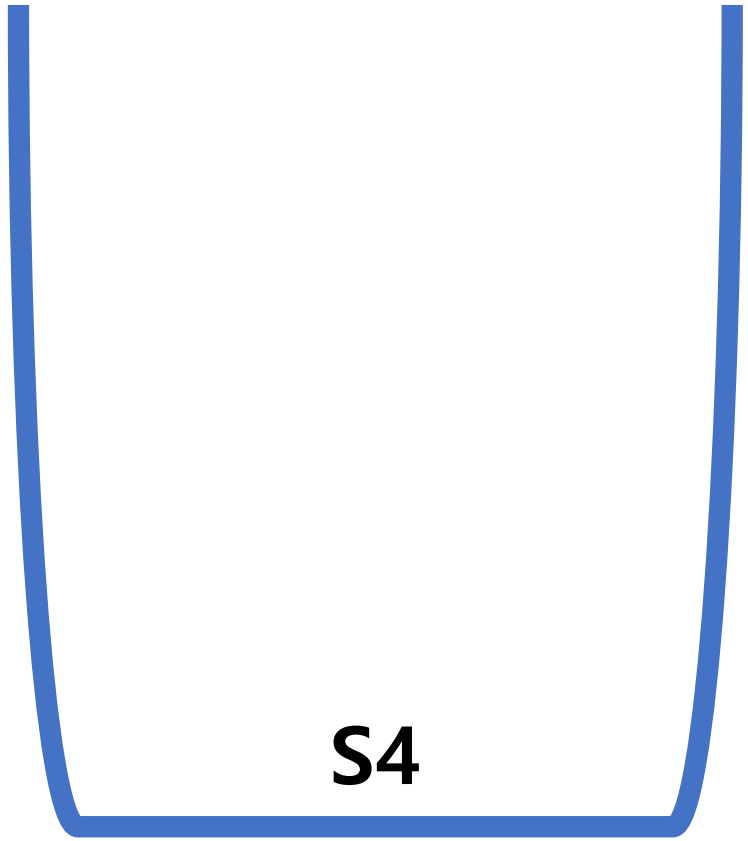


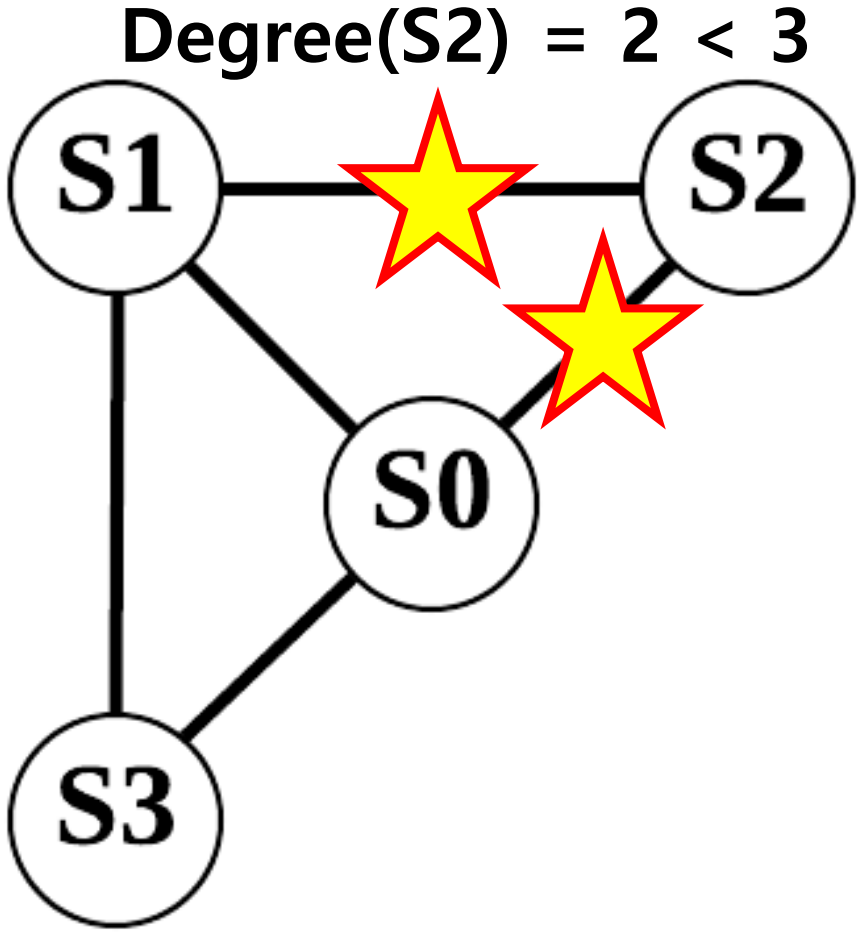
STACK

Degree(S4) = 2 < 3

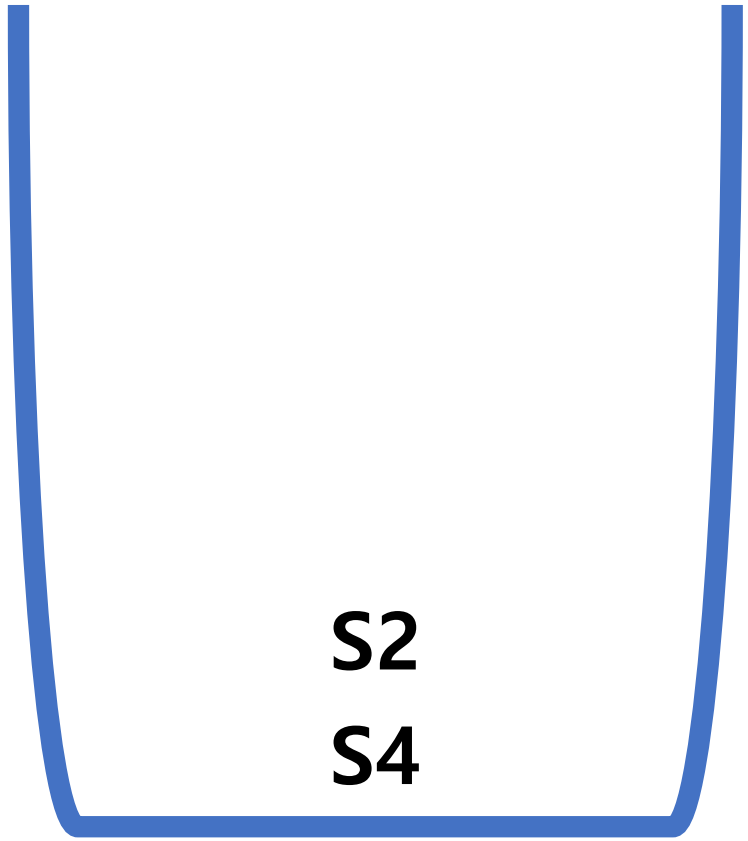


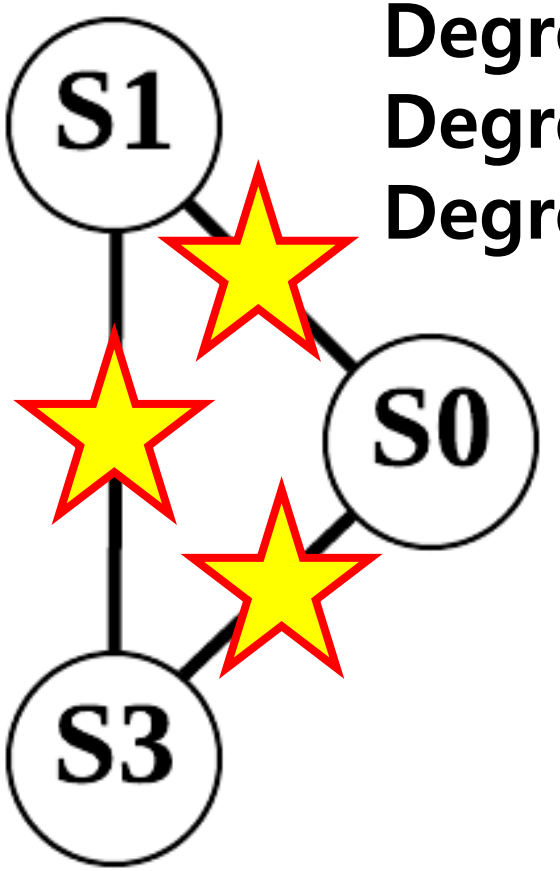
Chaitin's algorithm – 2 (pushing stage)





Chaitin's algorithm – 3 (pushing stage)

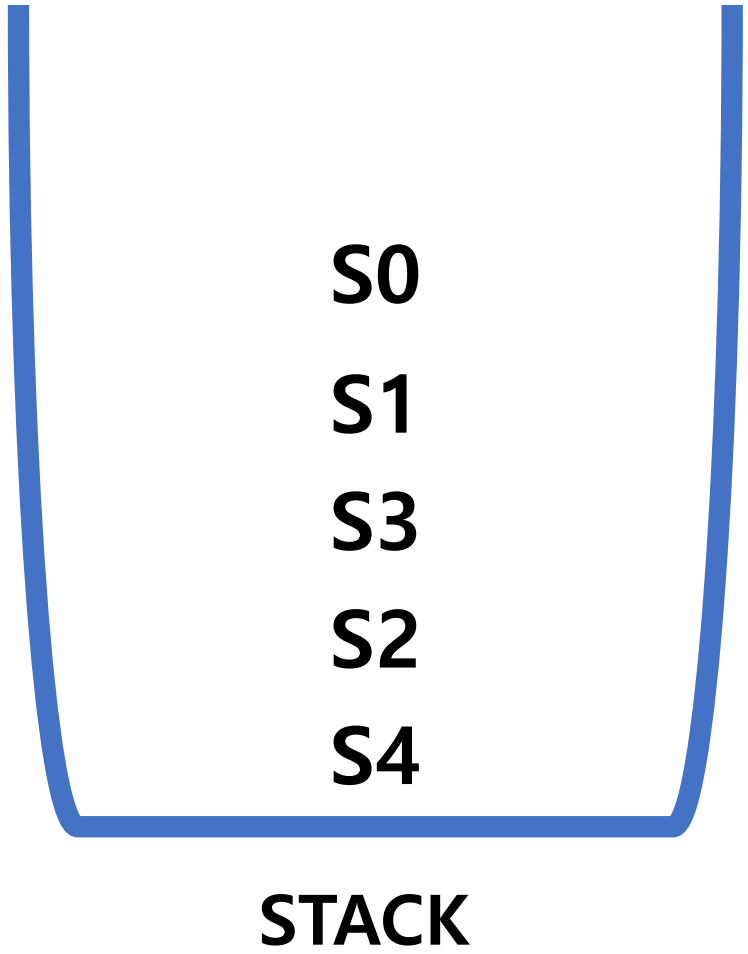




Degree(S0) = 2 < 3
Degree(S1) = 2 < 3
Degree(S3) = 2 < 3

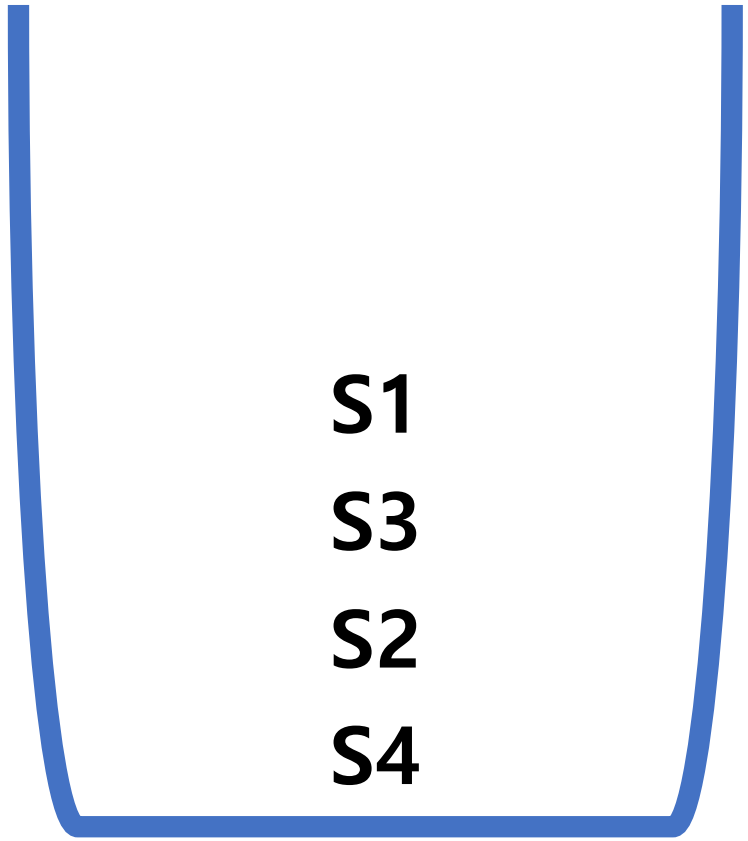
Chaitin's algorithm – 4 (pushing done)

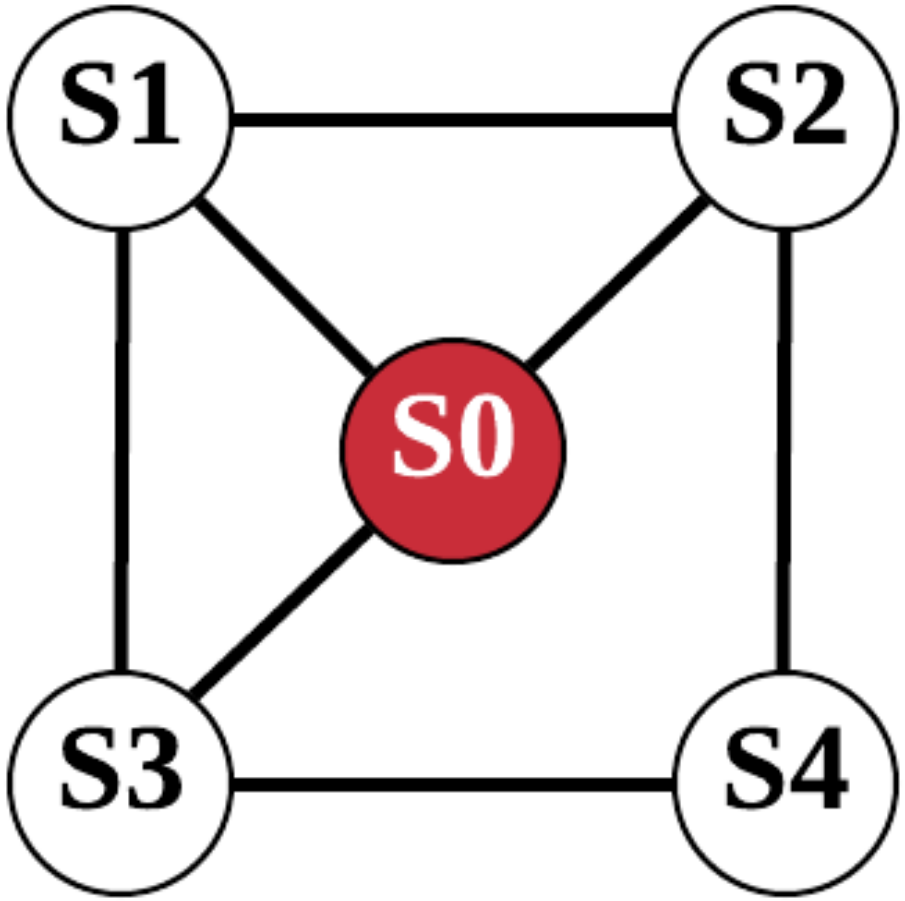
3 COLORS :



Chaitin's algorithm – 5 (popping stage)

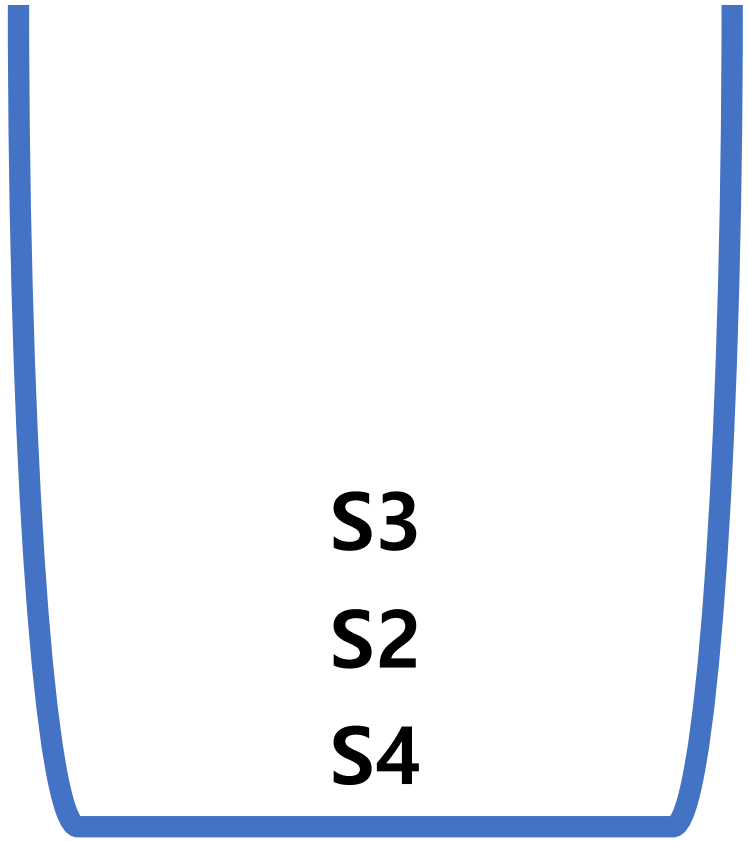
3 COLORS :

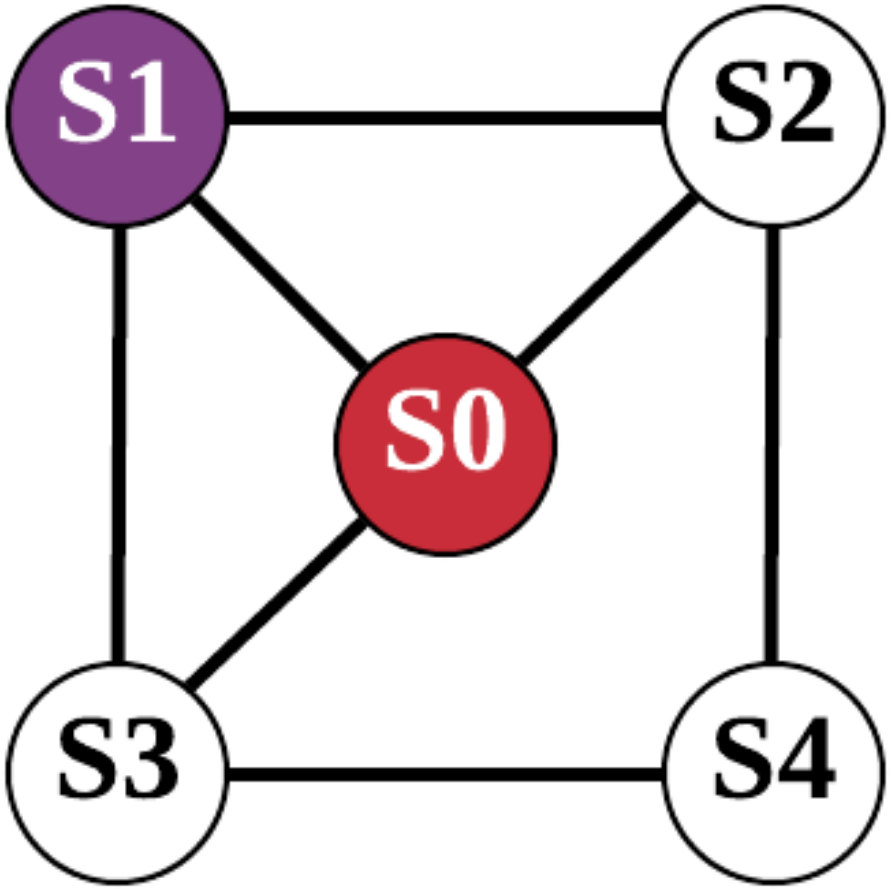




Chaitin's algorithm – 6 (popping stage)

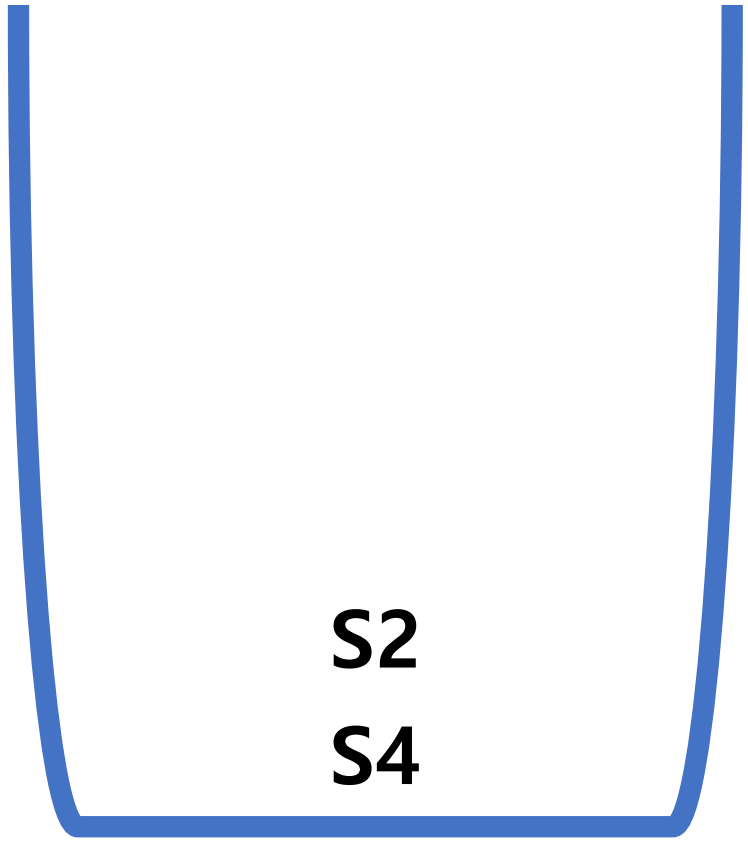
3 COLORS :

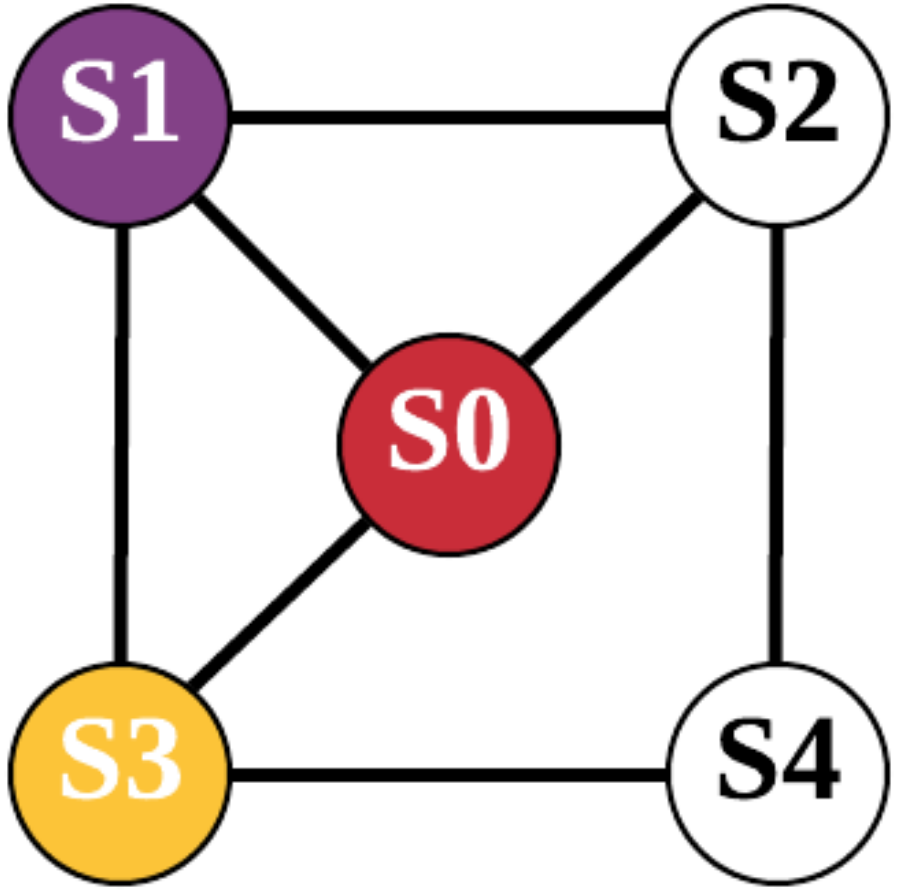




Chaitin's algorithm – 7 (popping stage)

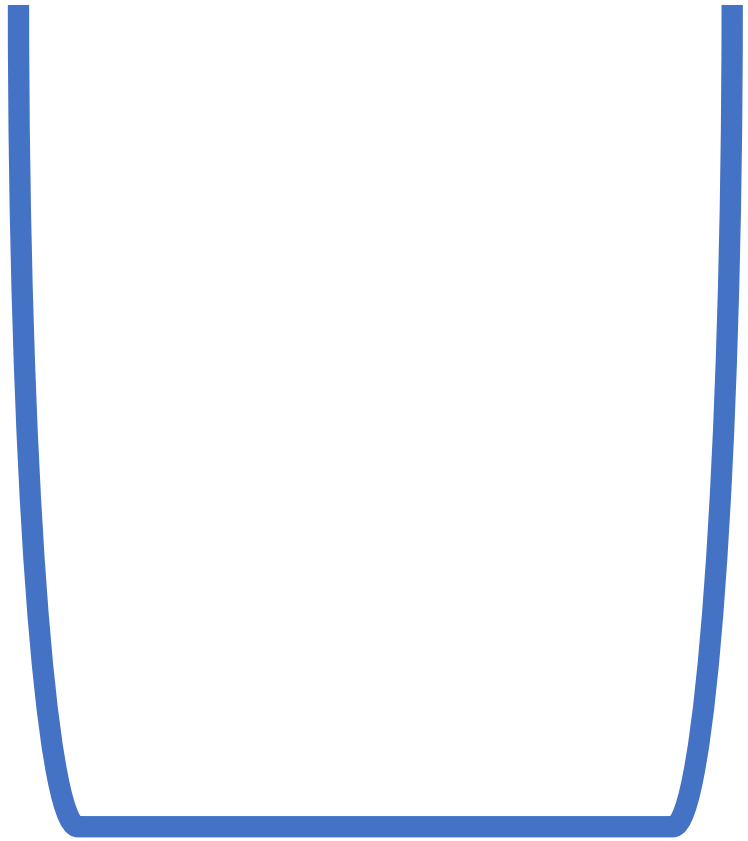
3 COLORS :





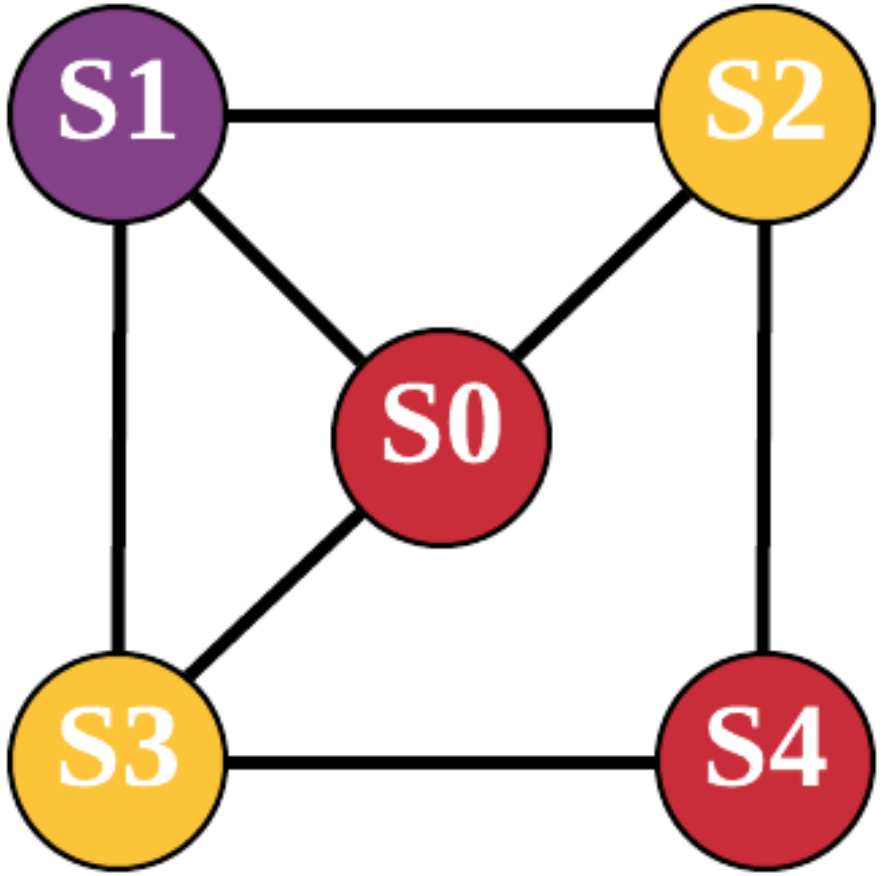
Chaitin's algorithm – 8 (popping done)

3 COLORS :



STACK

3-COLORABLE! (No Spills)



Questions from students

- The worksheet didn't provide the number of registers available for use. Is it possible to solve the worksheet without it?
- How should I set **K** when using Chaitin's or Chaitin-Briggs algorithm? Do I always have to set K to the number of registers available to my machine?
- Can dead-code elimination be done during the register allocation stage?

Chaitin vs **Chaitin-Briggs**

- During the pushing stage,
  when all nodes in the interference graph have Degree bigger than **K,**

- **Chaitin**
  immediately spills one of the nodes in the graph with the smallest spill-cost.
- **Chaitin-Briggs**
  simply pushes the node with the smallest spill-cost to the stack, without spilling. Spilling is done later, only if there is no available color left to color the popped node during the popping stage.

- For the worksheet's interference graph, there is always a node with degree less than K(=3) during the pushing stage.

  Both algorithms (Chaitin, Chaitin-Briggs) can identify that the given interference graph is 3-colorable.