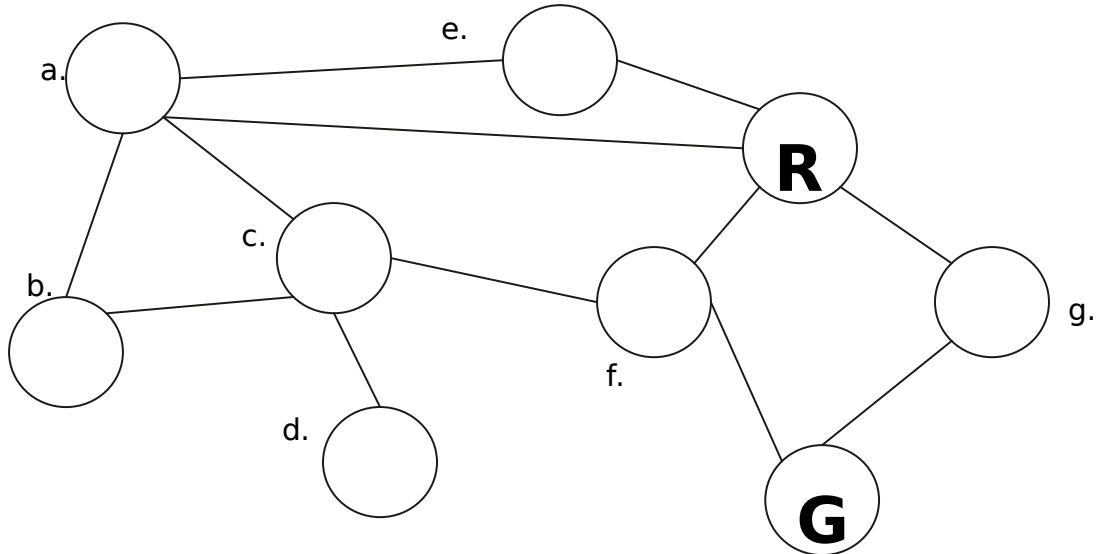# Homework 6:   Constraint Satisfaction Search

Consider the following graph coloring instance with the colors R, G, B. Two nodes have been colored already. Answer the questions that follow.

1. For each node, indicate the initial availability lists if we were to do one pass of forward checking (only) off of the two pre-colored nodes.
   a. GB
   b. RGB
   c. RGB
   d. RGB
   e. GB
   f. B
   g. B

2. For each node, indicate the availability lists after running complete constraint propagation, but without any search.
   a. GB
   b. RGB
   c. RG
   d. RGB
   e. GB
   f. B
   g. B

3. Now assume that we start the search from the availability lists from your answer to 2. Also assume that any nodes whose availability lists from 2 have only 1 value remaining have already been assigned those values by the search. If you were to use the variable ordering heuristic, most constrained variable, to pick the next node, which node (or nodes if there is a tie) are the most constrained? List them all if there are more than one.

   a,c,e

4. If there is a tie in your answer to 3, then if you were to break that tie using the variable ordering heuristic, most constraining variable, which node would be selected? If there is still a tie, list all nodes that are tied.

   a,c

5. For the variable (node) selected in 3 / 4 above, which value would you assign it if you were to use the value ordering heuristic, least constrained value (if you listed more than one node in 4 above, pick the one that is first alphabetically). If there is a tie, list all tied values.

   B

6. By hand, run constraint satisfaction search, applying constraint propagation at each step, only until a backtrack is necessary (if one is necessary). At each step, choose the next node using most constrained variable, breaking ties using most constraining variable, breaking any remaining ties in alphabetical order of the node labels. Once a node is selected choose the value using the heuristic least constrained value. If there are ties, break ties in the order R, G, B. Simply indicate the color of each node either when the problem is solved or once a backtrack would be necessary. If a backtrack is necessary, then for any nodes not assigned a value at the time of the backtrack, just leave it blank. You do not need to indicate each step you take. Just give the final result.
   a. B
   b. G
   c. R
   d. G
   e. G
   f. B
   g. B