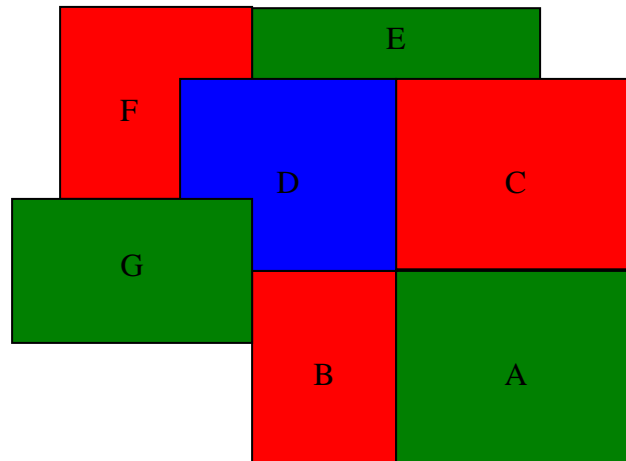


Artificial Intelligence
Qualification Exam
Spring 2003 - 1 hour

Question 1. (25%) Are the following sets of expressions unifiable? Find a most general unifier for each set if it is unifiable.

1. $S = \{q(g(a),g(x)), q(x, y), p(a)\}$.
2. $S = \{q(a, x,h(g(z))),q(z,h(y),h(y))\}$.

Question 2. Consider an example of the map-coloring problem:



This map can be colored by three colors (for instance, one solution is F-red, E-green, G-green, D-blue, C-red, B-red, A-green) such that no two adjacent countries have the same color. We say that the problem can be solved with three colors.

With two colors, we can show that for every color assignment there will be at least two adjacent countries with the same color. Thus, the problem is not solvable with two colors.

Use stable model programming to solve the map-coloring problem. In particular, do the following:

1. (25%) Develop a logic program using stable model programming that solves the map-coloring problem given a map and a set of colors. In other words, given a map M and a set of colors C , develop a logic program $P(M,C)$ with the following properties:
 - a) Each stable model of $P(M,C)$ corresponds to a solution of the problem (M,C) .
 - b) Each solution of the problem (M,C) corresponds to a stable model of $P(M,C)$.
2. (30%) Prove that your program correctly solves the problem.
3. (20%) Find a stable model for the program $P(M,C)$ where M is the above map and C is a set of three colors {red, blue, green}.

Hint: Your logic program should consist of a set of rules that describes the instance and a set of rules that uses the generate-and-test approach to find the solution.