Unit A4 Supplement, 2/1/05

Here are sample response to Exercise A3 Part 1

Task 1 (Program Verification): One of the software industry's biggest concern is how to check whether their products are really correct with respect to the specification that the developer and the user both agreed. According to a variety of sources, inability to do so will cost us an incredible amount of money in the future (well, this must be already happening). As you know, *generality* is a prime concern in Computer Science. So, why don't we write a single program that could verify whether the program correctly solves a problem with respect to a given specification? **Give** the set representation of the computational problem involved here. **Speculate** the basic Theory properties (i.e., possibility to solve computationally, the simplest mechanism, practicality with large data), referring to the set (a concise, informal description suffices). Can you think of such a program?

{(*s*, *p*) | Specification *s* specifies program *p*}
{(*s*, *p*, *i*) | Specification *s* specifies program *p* when run on input *i*}
Note 1: It would be difficult to make the notion of "specification" more precise for this exercise.
Note 2: Including collections of specifications and programs in this representation would view the problem at a level higher than the original.

Task 2 (Map Coloring): It has been shown that with four distinct colors, we can color any map so that the neighboring countries (or whatever political boundaries) do not share the same color. With three colors, we may or may not be able to do the same thing. **Give** the set representation of the computational problem involved here. **Speculate** the basic Theory properties, referring to the set.

{(*R*, *C*, *N*, *a*) |
R is a non-empty set of regions,
C is a non-empty set of colors where $|C| = k$ (for some positive integer *k*),
N is a binary relation on *R* specifying the neighboring regions,
a is a function from *R* to *C* assigning a color to a region,
To specify different colors for two neighboring country: if $(x, y) \in N$, $a(x) \neq a(y)$}

E.g., $\{(\{r_1, ..., r_n\}, \{c_1, ..., c_4\}, \{(r_1, r_2), (r_1, r_3), ...\}, \{(r_1, c_2), (r_2, c_3), ...\}), ...\}$

// End