Name: _____

Exercise A5 (Module A Comprehensive Exercise), 2/4/05

Part 1: Mayan Script (Sample Problem 2)

In this exercise, you will practice many aspects involved in this module, using a quasi-practical problem of deciphering Mayan scripts. As you do this exercise, examine your understanding with respect to the evaluation criteria on the form. As noted on the form, in order to demonstrate your understanding, you may refer to your exercises (including this one), in your supporting notes. Note that providing a correct answer is not the focus of this (and other) exercise(s); in many cases, there won't even be a correct answer. Do you best to *apply* what you learned (as if you are developing a theory from axioms and rules of inference at a meta-level).

Problem

You found an ancient Mayan script that is supposed to indicate the location of hidden treasures. The only resources in this ancient language you have access to are: (1) an extensive list of synonyms and (2) a collection of sentences whose meaning are already known.

For example, let's imagine that you need to translate the following sentence (obviously, not real Mayan): "koregawakarukane" with the following resources:

Synonym list: "korega" = "maa", "ruka" = "nnee", "neene" = "darona", etc.
Sentences whose meaning are known: "maawakanneedarona", "mosikasitarawakarukamone", etc.

A sample session of analysis/translation by substituting synonyms would be (underlined words are replaced with *italic* words):
"korega<u></u>wakarukane" → "*maa*wakarukane" → "maawakan*nee*ne" → "maawakanneedarona"

Then, we can tell that "koregawakarukane" means the same thing as "maawakanneedarona." The latter sentence is among the known, so we should be able to understand the former as well. If there are many sentences to analyze and the synonym list is extensive, we will naturally think of doing the task with a computer. Unfortunately, it is known that there is ***no*** algorithm for this problem.

Hint: Try to use schematic diagrams!

Task 1: The collection of sentences whose meaning can be deciphered (in this problem) may be defined as a "theory" derived from axioms and rules of inference. **Identify** the axiom(s) and rule(s) of inference.

Task 2: Represent this problem as a set. Use the predicate notation and try to make the description part (the right of '|') as precise as possible so that each instance could be used as an input to some Turing machine.

Task 3: It has been known that this problem does not admit any algorithm. This suggests that any general programming attempt must be either wrong or forced to loop on at least some input. Suppose that you came up with a Turing machine that makes no errors but could loop. Informally **describe** (part of) the mechanism/behavior of the TM.

Task 4: Since there is no algorithm, this problem is not decidable. But what about the other properties/classes: undecidable, TM-recognizable, non-TM-recognizable, and semi-decidable? For each of these classes, **analyze**/**explain** whether this problem belong to it (i.e., say whether or not the problem is undecidable, TM-recognizable, etc.).

Part 2: Evaluation Form and Supporting Notes

Review the evaluation procedure. Then, complete your evaluation form and supporting notes. Your supporting notes are supposed to *reflect* and *communicate* your thoughts. This type of skill is essential for every one of us to be able to improve from what we are now. Bring them to the evaluation workshop (hard copy). Print them well in advance so that you can avoid potential problems, e.g., not being able to print just before the evaluation.

Survey: Time spent between classes: _____

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