

Re: Computability and logic

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- *From:* "MoeBlee" <jazzmobe@xxxxxxxxxxxx>
 - *Date:* 26 Sep 2006 06:20:12 -0700
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Tom wrote:

MoeBlee wrote:

Tom wrote:

Please, may I ask for a reading suggestion, as well as, perhaps, some kind commentary, as regards a mathematical formulation of a substring replacement?

Are you asking for a rigorous mathematical definition of replacing a substring in a string with another substring?

Yes please, Moe.

It seems to me that there are at least two methods in the context I just described.

One method is to use "dummy variables". For example, suppose we want to replace the term t in the formula P with the term t' (P is a string and t and t' are strings). Then we choose (with certain technical restrictions) a dummy variable, say v (which is a string of exactly one symbol). Meanwhile, by recursion, we will have already defined 'the result of substituting a term for a variable in a formula'. That recursive definition will be easy since we are substituting a term (which is a string of possibly many symbols) for a variable (which is a single symbol), and such "many for one" substitutions are easy to do recursively. The notation for this will look like:

We set P to

$P'[t|v]$

where v is a variable not in P .

In other words, P has the term t in P all along, but we "mark" where t

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occurs in P by "pretending" that t is substituted for v everywhere v occurs in P' ; so v marks where t occurs.

Then the result of substituting a term t' for term t in a formula P will be the formula:

$P'[t|v]$

In other words, instead of v marking where t occurs, now v marks where t' occurs, and t' occurs exactly where t occurred, viz. where v occurred.

I'm leaving out some of the technicalities, but this is the general idea. I suggest Enderton's 'A Mathematical Introduction To Logic' for background. As I recall, he doesn't get into replacing term for term, but he does explain replacing term for variable, which is the first step needed. And van Dalen's 'Logic And Structure' discusses the dummy variable technique.

Another method is more general but more complicated (I haven't gone through the details myself). Say we want to substitute a string t' for a substring t in a string s (t , t' , and s being any strings, not necessarily terms and formulas). Then we note the positions that t occupies in s (e.g., in the string 'xyzuvwyzux', the substring 'yzu' occupies positions 3–5 and positions 8–10). Then we note the length of t' . Then we concatenate:
positions 1–2 of t with
 t' with
positions 6–7 of t with
 t' with
position 11 of t .

Formalizing a GENERAL definition of such a concatenation operation would be somewhat complicated, but I am pretty sure that it can be done, especially since computer programs such as word processors do those kinds of concatenations (e.g., substituting a word for another word throughout a document).

MoeBlee

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