Designing with L-Systems, Part 6:
Generating T-Sequence Expressions

The article on creating graphic images from L-Systems [1] illustrated the power of interpretation in which characters are given meaning. For creating images, characters are interpreted as instructions for a drawing program.

The concept of interpretation is very general and very powerful. This article describes an interpretation that constructs t-sequence expressions [2-8].

This example illustrates the idea:

seed: S
rules: S → pal(T)
T → rpt(U,I)

This is a terminating L-System [9] with only two generations:

pal(T)
pal(rpt(U,I))

The interpretation of these strings, as the characters used suggest, is that pal is a function that produces a palindrome from its argument and rpt is a function that produces a repeat of its first argument a number of times specified by its second argument. Note that although p, a, l, r, and t, are individual constant characters in the L-System, pal and rpt can be treated as strings during interpretation.

If U is given the value [1, 2, 3, 4] and I the value 2 during interpretation, the result is

[1, 2, 3, 4, 1, 2, 3, 4, 3, 2, 1, 4, 3, 2, 1]

The L-System above could, of course, be derived from its final generation:

pal(rpt(U,I))

The value of using an L-System to characterize the patterns rather than just using the t-sequence expression it produces is that the components are represented in separate rules and hence easy to understand, while a t-sequence expression may be complicated and deeply nested, which is difficult for human beings (but not computer programs) to understand, and may be difficult to construct by hand.

The articles on t-sequneces cast operations in an abstract operator notation using a variety of mathematical symbols and typographical devices.

For example, the expression from the example above,

pal(rpt(U,I))

is written in the abstract operator notation as

$\cap(U \times i)$

The following correspondences between the abstract t-sequence notation and concrete L-System strings will be used in subsequence articles. Refer to the articles on t-sequences [2-8] for an explanation of the operations.

t-sequence operations		*L-System strings*
$S \mid T$	concatenation	cat(S,T)
$S \times i$	repetition	rpt(S,I)
$S \Rightarrow i$	extension	ext(S,I)
$i \rightarrow j$	simple run	run(I,J)
$\rightarrow S$	connected run	crun(S)
$S \,/\, T$	disconnected run	drun(S,T)
$\leftrightarrow S$	horizontal reflection	hor(S)
$\updownarrow S$	vertical reflection	vert(S)
$\cap S$	palindrome formation	pal(S)
$S \,@\, T$	motif along a path	motif(S,T)
$S \equiv i$	modular reduction	mod(S,I)
$\not\equiv S$	modular expansion	xmod(S)
$S \sim T$	collation	coll(S,T)

Some t-sequence expressions have options; the ones used here have the default options.

Note: As of this writing, the series of articles on t-sequneces is incomplete. As more articles are added, this table will be extended accordingly.

April 10, 2004; last revised November 25, 2004

References

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