LinktoolÐMatrix file format

Matrix file format describes a type of file which can be sent to *readlink* as input. As an example, consider the following:

```
%L 3_1 L%
%Nx 3 Nx%
%M
r 2 d 2 u
r 3 d 3 u
r 1 d 1 u
M%
```

The different fields of information are delimited by "%" and key characters. "L" or "C" denotes the label, or title of the figure. (The underscore in the name tells *Linktool* to make the following characters be subscripts.) "Nx" denotes the number of crossings in the link or tangle. And, "M" denotes the actual matrix of the link or tangle. Let's take a closer look at the matrix:

```
r 2 d 2 u
r 3 d 3 u
r 1 d 1 u
```

Each row corresponds to a crossingÐthe first to crossing #1, the second to crossing #2, and so on.

The first entry in the row is either "r" or "l" depending on whether the crossing is oriented "right" or "left": if the crossing is viewed so that the over strand is directed up (by the direction assigned to the strand), then if the under strand points right, the orientation is right; if the under strand points left, the orientation is left.

The next two entries in each row correspond to the over strand of the crossing. The first of the two tells which crossing the over strand goes to next (in the direction assigned to the strand), and the second tells whether the over strand becomes the over strand of the next crossing ("u" for "up") or the under strand of the next crossing ("d" for "down"). The final two entries tell the same information for the under strand of the crossing.

Thus, in this matrix for the trefoil knot, at each crossing, the orientation is always right, and the over strand becomes the under strand of the next crossing, while the under strand becomes the over strand of the next crossing. Note that matrices are not at all unique for a given link. The numbering of the crossings is arbitrary, as are the directions assigned to each strand.

There is also a matrix format for tanglesÐknotted strands with four loose ends. In this format, the loose ends are considered pseudo-crossings, and must be numbered so that the NW end is 1, NE is 2, SW is 3, and SE is 4. Then, the irrelevant information at these ends (such as right/left orientation and where the down strand goes next) is filled in with zeroes. For example, a tangle (called 3 in Conway's notation) which becomes the trefoil knot when the two north strands are connected and the two south strands are connected can be represented like this:

```
0 5 d 0 0
0 0 0 0 0
0 5 u 0 0
0 0 0 0 0
```

r 6 d 6 u
r 7 d 7 u
r 2 0 4 0

Note that the NE and SE ends have rows of all zeroes, because those strands are directed so that there is no "next" crossing at NE and SE; the strands are directed out of the tangle. Also, at crossing #7 (the last row), since the over and under strands end up at "crossings" #2 and #4, which are really only loose ends, they don't become "up" or "down" strands, since they're the ONLY strands present.