REFERENCES


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In many dynamic programming (DP) algorithms with 2-D tables, backpointers from a cell $D(i, j)$ are to adjacent cells and can thus be accommodated easily with arrows. However, in DP algorithms such as that for matrix chain parenthesization [1, Section 15.2] and optimal independent base-pairs for RNA secondary structure [2, Section 8.1], backpointers may be to non-adjacent cells; worse still, as is this case in these two algorithms, backpointers may be arranged in pairs to the cells $D(i, k - 1)$ and $D(k, j)$ for some $k$, $i < k < j$. In such cases, it is useful to adopt the following conventions:

1. If the only backpointers are to adjacent cells, denote with arrows as usual;
2. Otherwise, label the cell with the values of $k$ for which back-pointer pairs exist.

The use of these conventions relative to the independent base-pairs algorithm for RNA secondary structure is illustrated in Figures 1 and 2. The example done here is Question #2, Assignment 3 relative to a free-energy function in which canonical base-pairs, i.e., G-C and A-U, have score -2 and all other base-pairs have score 1. Note that though the backpointers in Figure 2 seem to form a path, they actually form a tree; however, as the only side branch in this tree is to a 0-entry in one of the bottom two base-case “rows” of the matrix, it does not contribute to the base-pairing and can thus be left out of the traceback.

References


Figure 1: Example Version #1: Backpointer Tree. Note that due to problems with LaTeX, all negative numbers have had to be written as their positive equivalents.
Figure 2: Example Version #2: Backpointer “Path”.