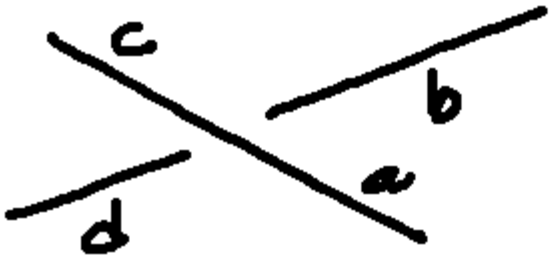
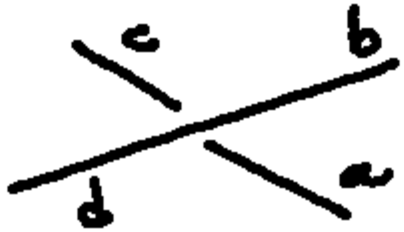
Crossing Code & Bracket Code



X[a, b, c, d]
= X[c, d, a, b]



X[b, c, d, a]
= X[d, a, b, c]

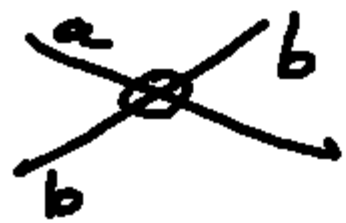
X[e, b, d, a]
X[a, d, f, c]
X[b, e, c, f]

Trefoil

X[b, d, c, a]
X[a, c, b, d]

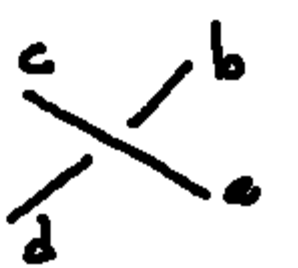
VTrefoil

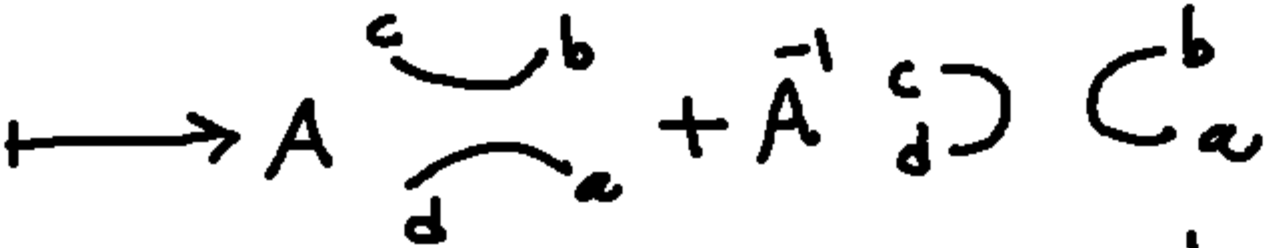
N.B.



} uncoded

Bracket expansion is based upon





$$X[a,b,c,d] \longmapsto A\,\delta^{cb}\delta_{da} + A^{-1}\delta^{c}_{d}\,\delta^{b}_{a}$$

Here δ^{ij} and δ^{i}_{j} are Kronecker deltas with $\delta^{aa} = \delta^{a}_{a} = d = -A^{2} - A^{-2}$.

In Mathematica we write $\delta^{a}_{b} = \delta_{ab}$ = del[a b] and give replacement rules for handling it.

Variants of the bracket can be coded in similar fashion.
e.g. Arrow Polynomial uses

and we need oriented crossing code and special Kronecker deltas. We will not elaborate on that here.