Teknillinen korkeakoulu
**Johdatus solmuteoriaan, kevät 2002**
**Exercise 12.** (26.4.)

1. Compute the normalized Alexander polynomial for the knot $4_1$ and check the result from the table overleaf.
2. (Computer exercise?) Compute the Alexander polynomial for the Whitehead link using the orientation indicated below.
3. Find out the effect of the Reidemeister move I on the Alexander polynomial.

4. a) Let us consider an $n \times n$-matrix $M$ with which we form the Alexander polynomial of an $n$-crossing diagram. Show that the sum of elements in each row is zero, and that the same is true for columns as well.
   b) Let now $A$ be any $n \times n$-matrix and let $A_{ij}$ be the $(i, j)$ minor of $A$; i.e. the $(n-1) \times (n-1)$-submatrix obtained by deleting from $A$ row $i$ and column $j$. Prove: If the sum of elements in each row of $A$ is zero, then $\det(A_{ip}) = \pm\det(A_{iq})$ for all $1 \leq i, p, q \leq n$.
   c) A similar result is true, when rows and columns are interchanged. What has all this to do with the definition of the Alexander polynomial?

Finally, a voluntary problem that can be best solved using two ropes.

- In some books the Whitehead link is drawn as below. Show that it is equivalent with the form used in this course.

Note: Much material about knots can be found in the internet also. One page is

http://www.cs.ubc.ca/nest/imager/contributions/scharein/KnotPlot.html

**The exam** will be on Sat 18.5. at 10-13. Beside calculations, there may also be essay-type problems.