# A Brief Description of the ISMAGS Algorithm Software Syntax

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For this description please refer to the jupyter notebook 'ismags_demo" included with the source code for ISMAGS in python.

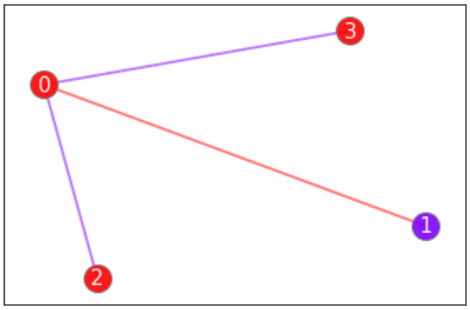
The ISMAGS algorithm as it was originally written in java can only indicate edge types/colors and not node types/colors and edges can be either directed or undirected. However, as we shall see, we can use directed/undirected to imply node types and also certain graph configurations.

Edge types (or Link types) are indicated by the notation"A u t t" (for undirected) and "A d t t" for directed. Connections of a particular edge type are stored in its own text file. For instance, in Example 1, there is a single directed (purple) edge type "A d t t" and its edges are stored in the text file 'graph1_Ad.txt'. In this text file are edges connecting nodes of one (red) type to nodes of another (purple) type. The directed-ness insures that a red type node is always the source edge and thus as a result we only find subgraphs where the red type node is at the hub of the 3-star. For our purposes the "t t" in "A u t t" are dummy variables indicating the nodes on either end of the edge of type "A", however they can be utilized for search purposes (which we forego, since we have enough for our search purposes).

The motif description is a string simplification of the adjacency matrix of the motif/subgraph. For instance, in Example 2, the motif description 'AB0B00' is split into 3 parts, A-B0-B00, and dropped into the columns of a 4-by-4 matrix starting with the second column.

$$\begin{bmatrix} * & A & B & B \\ * & * & 0 & 0 \\ * & * & * & 0 \\ * & * & * & * \end{bmatrix}.$$

If the nodes are numbered $0, 1, 2, 3$ then the matrix says that node 0 is connected to node 1 with an edge of type A, and node 0 is connected to nodes 2 and 3 each with an edge of type B. The rest of the matrix gives no further information, since it is symmetric and we do not allow for loops in our graph.




Continuing with this example, notice that the edge/link types are “A d t t” and “B u t t”. Since the nodes on either end of a type B edge type are nodes of the same type we therefore leave this undirected, while the nodes on either end of a type A edge are different and therefore the edge is set to directed. In the file ‘graph2_Ad.txt’ the first column will consist of red node types, while the second column will be nodes of purple edge type. This will all insure that the resulting matches ISMAGS finds will be of the proper configuration.

With Examples 1 and 2 carefully explained, the syntax for rest of the examples in the jupyter notebook should now make sense.