MIXED TREES A335362

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Abstract. We illustrate the layout of mixed trees (trees where a subset of edges is directed/oriented and another subset is undirected) for up to 5 nodes.

1. Nomenclature

Trees are unlabeled simple graphs without cycles. Mixed graphs are graphs where a (possibly empty) subset of the edges is undirected and all others are directed. We count mixed trees by an algorithm that starts from the simple undirected trees, selects a subset of the edges to be oriented, partitions that subset of oriented edges into the two possible orientations, and runs a check on each graph to reduce all these mixed graphs to unique representatives.

2. 2 nodes

2.1. 2 nodes 0 arcs. 

2.2. 2 nodes 1 arc. 

3. 3 nodes

3.1. 3 nodes 0 arcs. 

3.2. 3 nodes 1 arc. 

3.3. 3 nodes 2 arcs. 

4. 4 nodes

4.1. 4 nodes 0 arcs. 

4.2. 4 nodes 1 arc. 

4.3. 4 nodes 2 arcs. 

4.4. 4 nodes 3 arcs.

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5. 5 NODES

5.1. 5 nodes 0 arcs.

5.2. 5 nodes 1 arc.

5.3. 5 nodes 2 arcs.

5.4. 5 nodes 3 arcs.

5.5. 5 nodes 4 arcs.

6. SUMMARY

The number of mixed trees on $n$ nodes with $d$ arcs and $n - d - 1$ undirected edges is summarized as follows:
In the column $d = 0$ we find the number of simple trees [1, A55], and in the diagonal the number of oriented trees [1, A238]. Column $d = 1$ counts the graphs where removing the unique directed edge would split a graph of $n$ nodes into two rooted trees, so this represents [1, A106]. Row sums (as a check) are [1, A6956].

### References
   URL: http://www.mpia.de/~mathar

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