The *Primula* System: user's guide
Version 3.0
Example: `Generalized inference: blue attributes probabilities`

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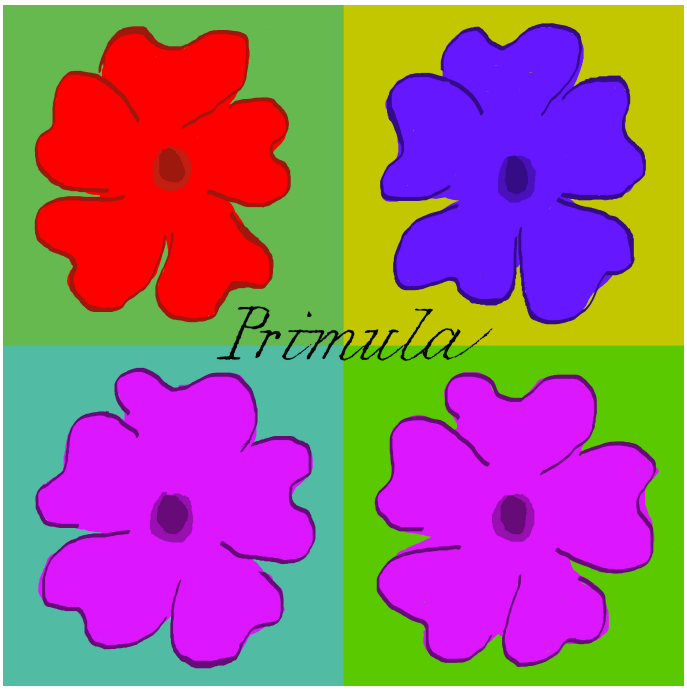
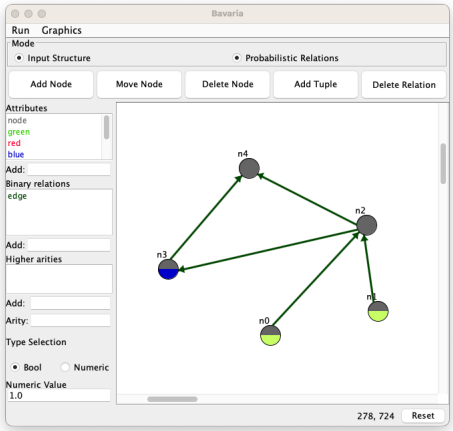


Generalized inference: blue attributes probabilities

Load the model file `rbn_acr.rbn` and the data file `alpha1-blue.rdef` from the folder.

Select in the *Primula* console Modules:Bavaria to open the graphical data editor. In *Bavaria* press the toggle Probabilistic Relations to view also the attributes of nodes, blue color is for the blue attribute, lime color is for the α_1 attribute, while no colors or grey means nodes without any assignments. You will see something like this:



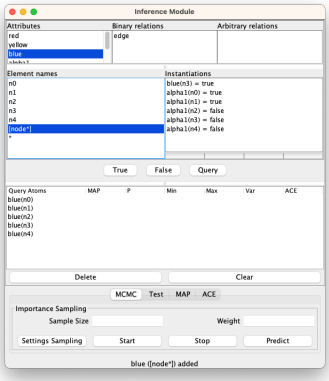
The *Bavaria* window displays the relational structure contained in `alpha-blue.rdef`.

NB: With RBNs and in Primula all the graphs are directed, as you can see also in this graphs edges have direction, but the RBN we have just imported do not take in consideration the direction of the edges.

The model `rbn_acr.rbn` is a RBN which represents an ACR-GNN model. The model is a single-layer ACR-GNN, and it was trained on a synthetic dataset by taking inspiration from the paper of The Logical Expressiveness of Graph Neural Networks of Barceló et al (2019). For more details about the model and the dataset, see the paper *Generalized Reasoning with Graph Neural Networks by Relational Bayesian Network Encodings* from Pojer et al (2023). For a more easy reading, we report here the formula of the α_1 logical classifier we have adopted in this example:

$$\alpha(x) := \exists^{[2,3]} y(\text{Blue}(y) \wedge \neg\text{edge}(x, y)). \tag{1}$$

Compute the probability of the blue color for each node. Open the Modules:Inference Module to compute the probabilities of the blue color for each node in the graph. Select the 'Query' button to activate the query mode. Now select the blue attribute from the 'Attributes' list and click on the `[node*]` to select all the nodes.



Use MCMC to compute the probabilities Select the 'MCMC' at the bottom of the window and press the 'Start' button. After few seconds you will see the results in the table above, under the 'P' column. Press the 'Stop' button to stop the computation.