Means and Values of Nodes

Question

How does BayesiaLab calculate the Means and Values in the **Monitors**? What is the difference?

Answer

For each node that has values associated with its states, an Expected Value v is computed by using the associated values and the marginal probability distribution of the node $$v = \sum_{s \in S} p_s \times V_s$$ where p_s is the marginal probability of state s and V_s is its associated value.

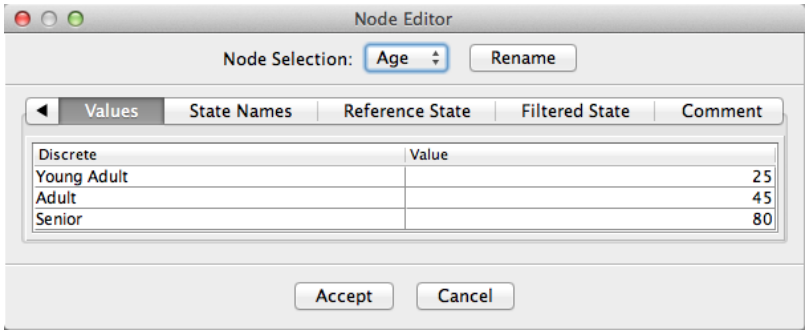
This *Expected Value* is displayed in the monitor.

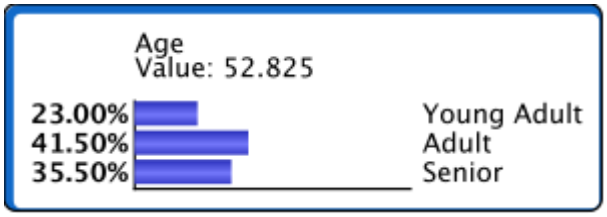
Example
Categorical Variable

Let's take a discrete node *Age* with three categorical states:

- Young Adult
- Adult
- Senior

The **Node Editor** allows associating numerical values with these states.

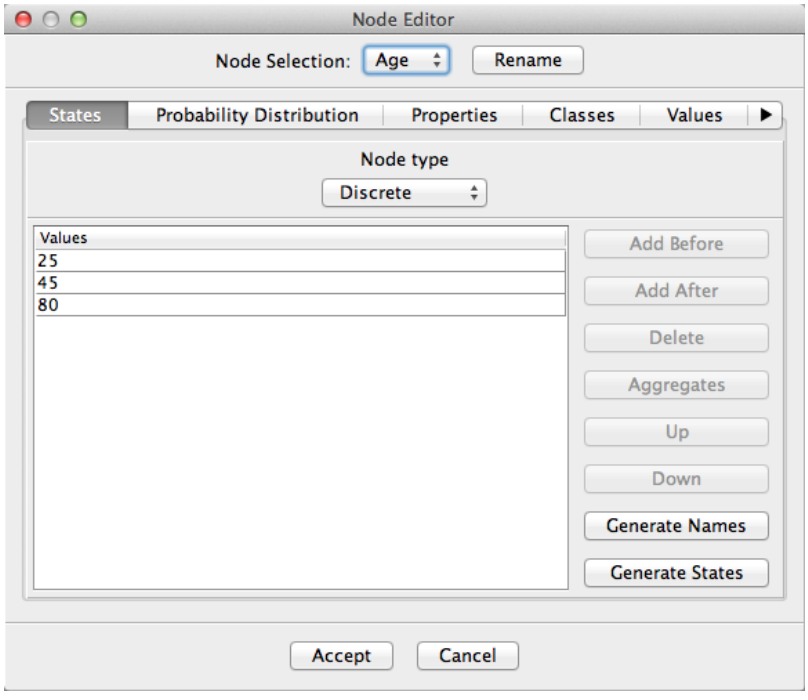




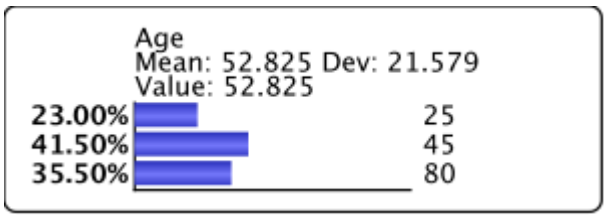
$$v = 0.23 \times 25 + 0.415 \times 45 + 0.355 \times 80 = 52.825$$

Discrete Numerical Variable

Let's suppose now that the variable *Age* has three numerical states.

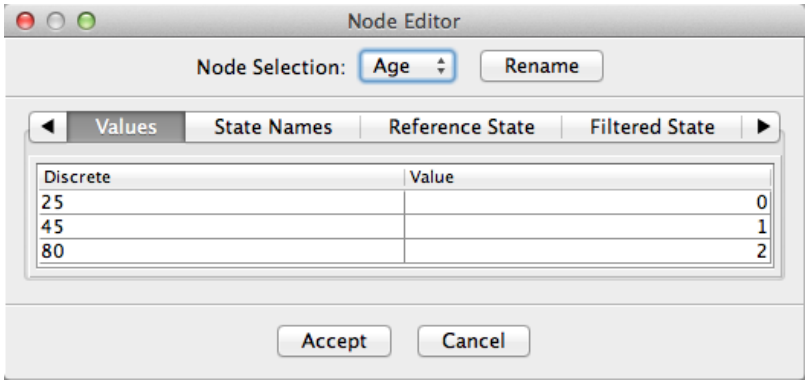


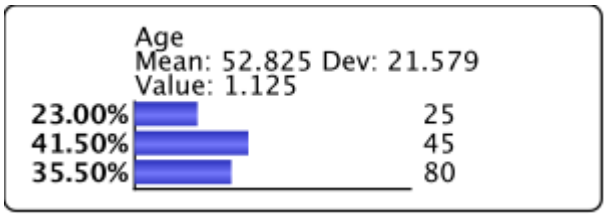
As it's a numerical node, its monitor will have a *Mean* value, a *Standard Deviation* and an *Expected Value*.



When the states do not have any associated values, V_s is automatically set to the numerical value of the state.

Otherwise, the state values defined by the user are used:



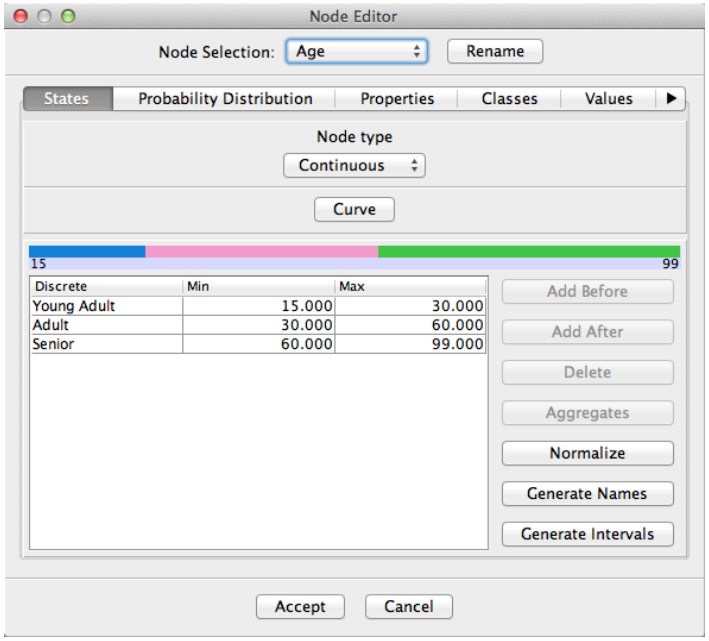


The Mean value m is computed with the following equation: $$m = \sum_{s \in S} p_s \times c_s$$ where c_s is the numerical value of the state.

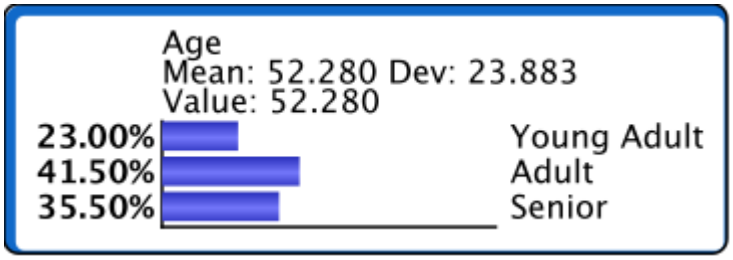
Continuous Numerical Variable

Let's consider now a continuous variable *Age* defined on the domain [15 ; 99], discretized into three states:

- Young Adult: [15 ; 30]
- Adult:]30 ; 60]
- Senior:]60 ; 99]



Since it's a numerical node, its monitor has a *Mean* value, a *Standard Deviation* and an *Expected Value* as well.



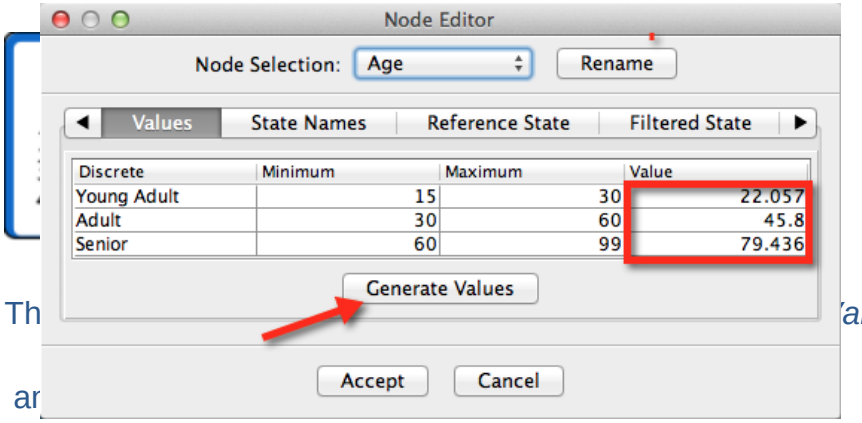
The Mean value m is computed with the following equation: $$m = \sum_{s \in S} p_s \times c_s$$ where c_s is the central tendency of the state defined as:

- the mid-range of the state when no data is associated,
- the arithmetic mean of the data points that are associated with the state.

When the states do not have any associated values, V_s is automatically set to the central tendency of the state.

When a dataset is associated with a continuous variable, clicking on the Generate Values buttons sets the values V_s to the current arithmetic means.

When new pieces of evidence are set, a the delta value is displayed in the monitor:



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- the previous one,
- the one corresponding to the reference probability distribution set with in the toolbar.

When only some states have an associated value, the Expected Value is computed on the states S^* that have associated values $$v = \sum_{s \in S^*} \frac{p_s}{P^*} \times V_s$$ where S^* is only made of one state, the node is considered as not having any associated values.