What are Semantics in Belief Network? Describe the same.

A **Bayesian network**, **Bayes network**, **belief network**, **Bayes(ian) model** or **probabilistic directed acyclic graphical model** is a [probabilistic graphical model](https://en.wikipedia.org/wiki/Graphical_model) (a type of [statistical model](https://en.wikipedia.org/wiki/Statistical_model)) that represents a set of [random variables](https://en.wikipedia.org/wiki/Random_variables) and their [conditional dependencies](https://en.wikipedia.org/wiki/Conditional_independence) via a [directed acyclic graph](https://en.wikipedia.org/wiki/Directed_acyclic_graph) (DAG). For example, a Bayesian network could represent the probabilistic relationships between diseases and symptoms. Given symptoms, the network can be used to compute the probabilities of the presence of various diseases.

Formally, Bayesian networks are DAGs whose nodes represent random variables in the [Bayesian](https://en.wikipedia.org/wiki/Bayesian_probability) sense: they may be observable quantities, [latent variables](https://en.wikipedia.org/wiki/Latent_variable), unknown parameters or hypotheses. Edges represent conditional dependencies; nodes that are not connected (there is no path from one of the variables to the other in the bayesian network) represent variables that are [conditionally independent](https://en.wikipedia.org/wiki/Conditional_independence) of each other. Each node is associated with a [probability function](https://en.wikipedia.org/wiki/Probability_function) that takes, as input, a particular set of values for the node's [parent](https://en.wikipedia.org/wiki/Glossary_of_graph_theory#Directed_acyclic_graphs) variables, and gives (as output) the probability (or probability distribution, if applicable) of the variable represented by the node. For example, if {\displaystyle m} parent nodes represent {\displaystyle m} [Boolean variables](https://en.wikipedia.org/wiki/Boolean_data_type) then the probability function could be represented by a table of {\displaystyle 2^{m}} entries, one entry for each of the {\displaystyle 2^{m}} possible combinations of its parents being true or false. Similar ideas may be applied to undirected, and possibly cyclic, graphs; such are called [Markov networks](https://en.wikipedia.org/wiki/Markov_network).

Efficient algorithms exist that perform [inference](https://en.wikipedia.org/wiki/Inference) and [learning](https://en.wikipedia.org/wiki/Machine_learning) in Bayesian networks. Bayesian networks that model sequences of variables (*e.g.* [speech signals](https://en.wikipedia.org/wiki/Speech_recognition) or [protein sequences](https://en.wikipedia.org/wiki/Peptide_sequence)) are called [dynamic Bayesian networks](https://en.wikipedia.org/wiki/Dynamic_Bayesian_network). Generalizations of Bayesian networks that can represent and solve decision problems under uncertainty are called [influence diagrams](https://en.wikipedia.org/wiki/Influence_diagram).