# Learning Bayesian Networks

## Introduction to Bayesian Networks

### Markov Condition

***Definition 1.9*** Suppose we have a joint probability distribution of the random variables in some set and a DAG = . We say that satisfies *the Markov condition* if for each variable conditionally independent of the set of all of its non-descendants given the set of all its parents. If we denote the sets of parents and non-descendants of by and , respectively, then

When satisfies *the Markov condition*, we say and satisfy Markov condition with each other.

If is a root, then its parent set is empty. So in this case it means that the Markov condition means is independent of - . But implies . We have . So we can rewrite the Markov condition as:

***Theorem 1.4*** If satisfies *the Markov condition*, then P is equal to the product of its conditional distributions of all nodes given values of their parents, whenever these conditional distributions exist.

*Proof*: We prove the case where is discrete. Order the nodes in their ancestral ordering. Let , , … , be the resultant ordering. For a given set of values , , … , let be the subset of these values containing the values of ’s parents. We need to show that whenever for ,