# Advanced Machine Learning

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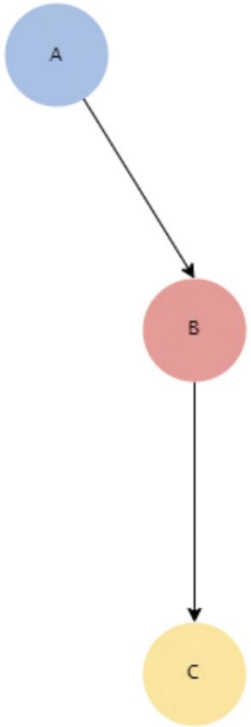
# Bayesian Networks to Markov Networks




P(A)

| A | 0 | 1 |
|---|---|---|
| | 0.5 | 0.5 |

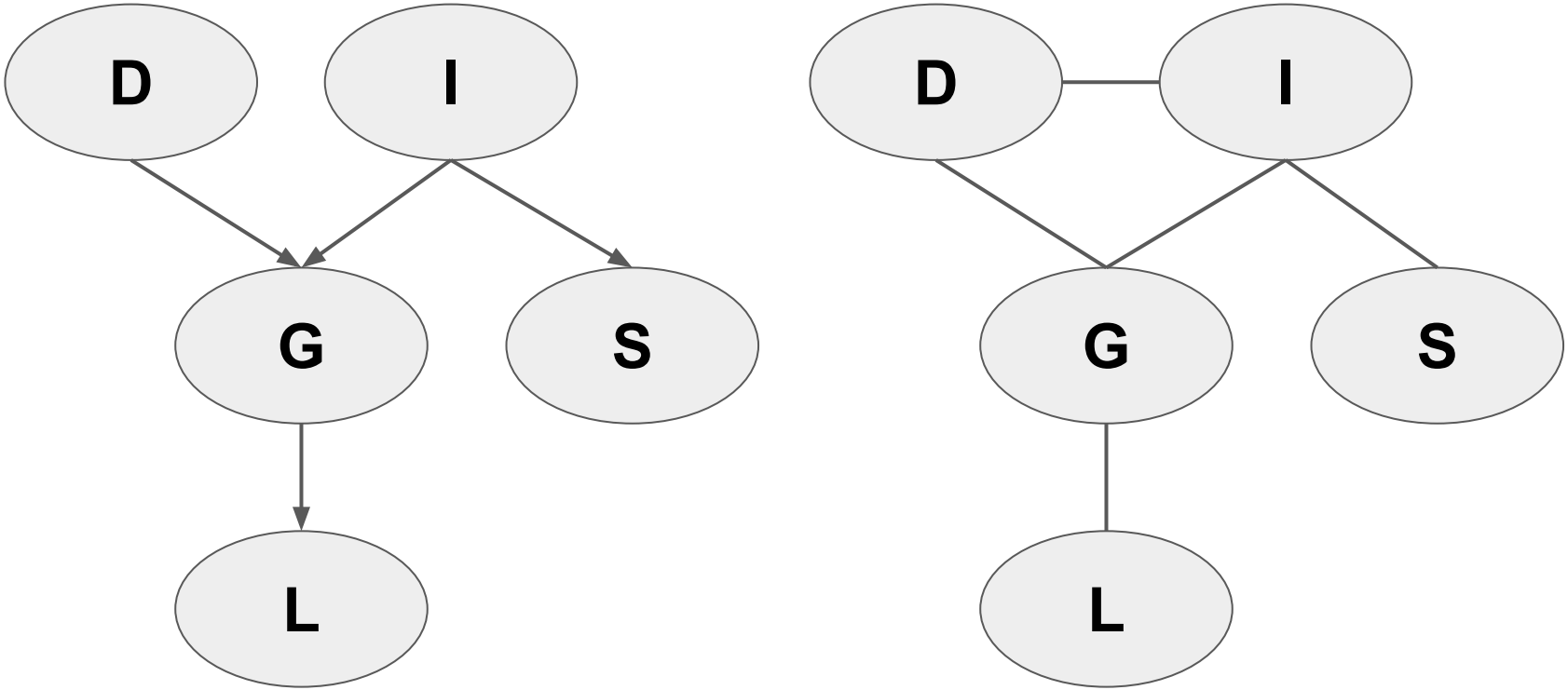
P(B|A)

| A \ B | 0 | 1 |
|---|---|---|
| 0 | 0.25 | 0.75 |
| 1 | 0.50 | 0.50 |

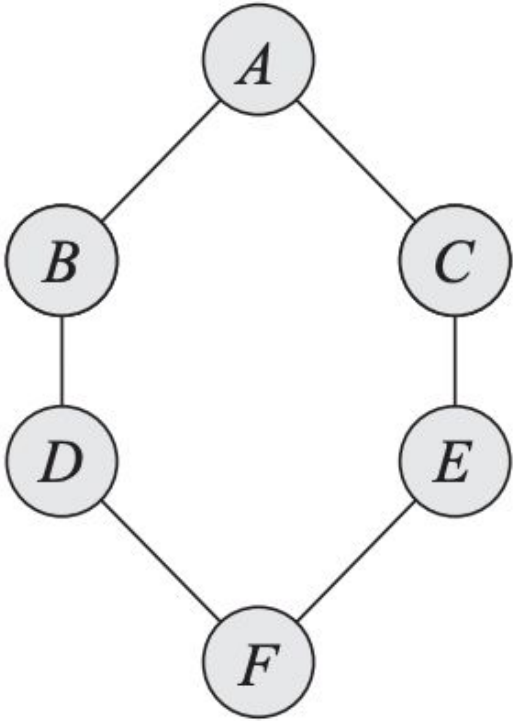
P(C|B)

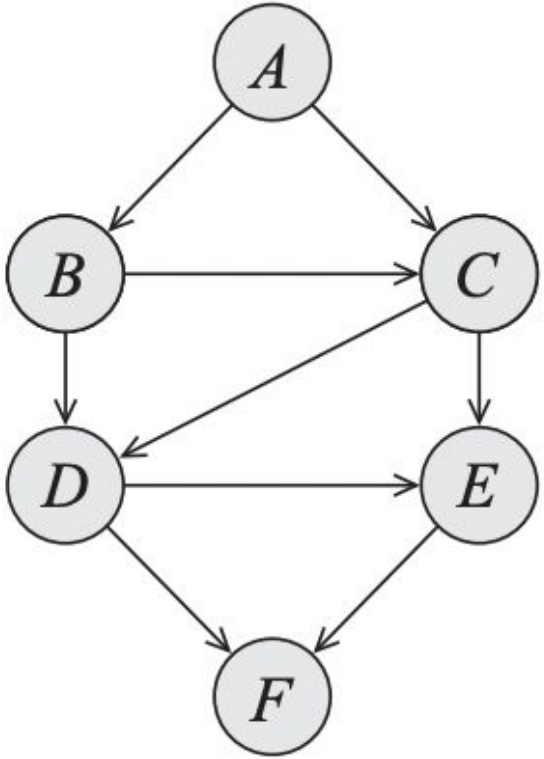
| B \ C | 0 | 1 |
|---|---|---|
| 0 | 0.40 | 0.60 |
| 1 | 0.65 | 0.35 |

# Bayesian Networks to Markov Networks



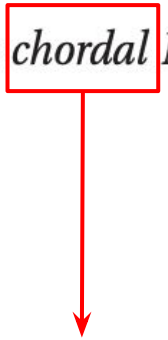
# Markov Networks to Bayesian Networks



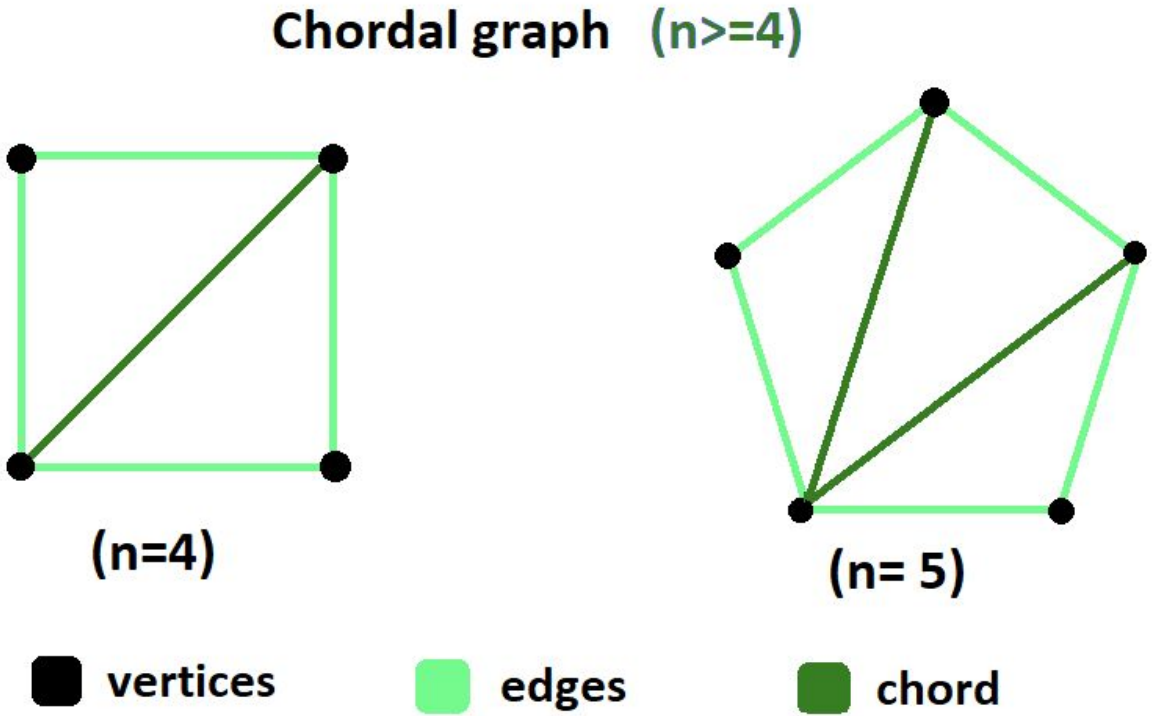
# Markov Networks to Bayesian Networks

*Let $\mathcal{H}$ be a chordal Markov network. Then there is a Bayesian network $\mathcal{G}$ such that $\mathcal{I}(\mathcal{H}) = \mathcal{I}(\mathcal{G})$*

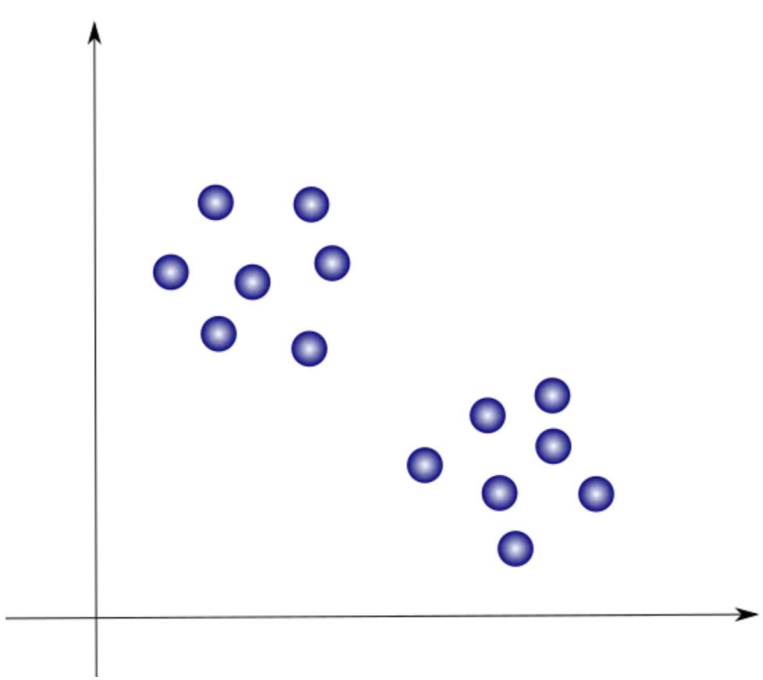


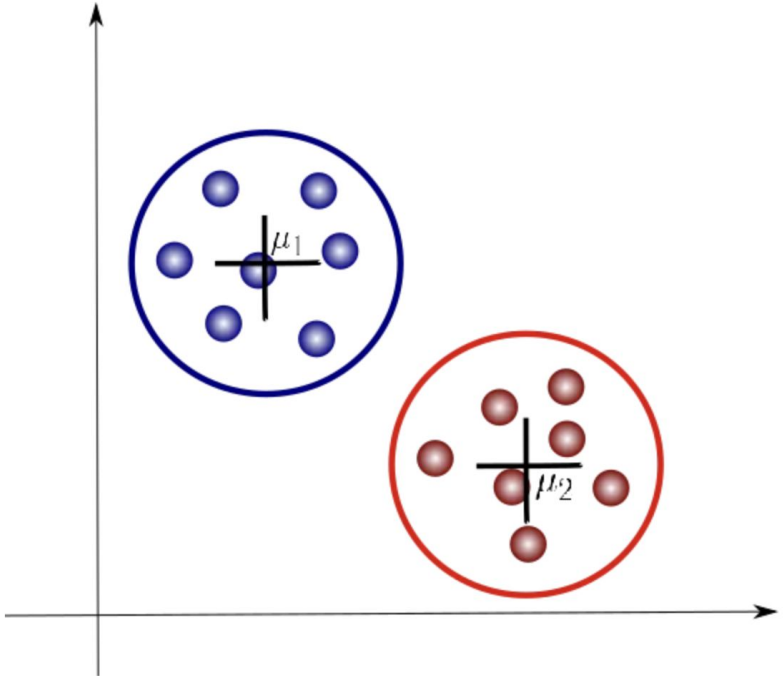
*Let $X_1 — X_2 — \cdots — X_k — X_1$ be a loop in the graph; a* chord *in the loop is an edge connecting $X_i$ and $X_j$ for two nonconsecutive nodes $X_i, X_j$. An undirected graph $\mathcal{H}$ is said to be* chordal *if any loop $X_1 — X_2 — \cdots — X_k — X_1$ for $k \geq 4$ has a chord.*

# Chordal Graphs



# Gaussian Mixture Models (GMM)





# Gaussian Mixture Models (GMM)

A Gaussian Mixture Model (GMM) is a function that is comprised of several Gaussians, each identified by $k \in \{1,\ldots, K\}$, where $K$ is the number of clusters of our dataset. Each Gaussian $k$ in the mixture is comprised of the following parameters:

1. A mean $\mu$ that defines its centre.
2. A covariance $\Sigma$ that defines its width.
3. A mixing probability $\pi$ that defines how big or small the Gaussian function will be

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