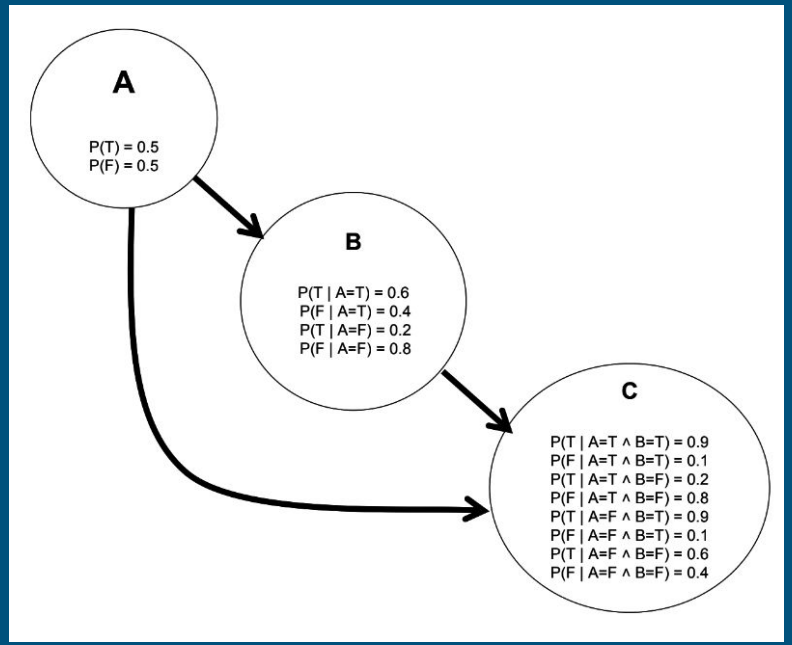
Bayesian Networks

Greta Pataki, 2021.11.10.

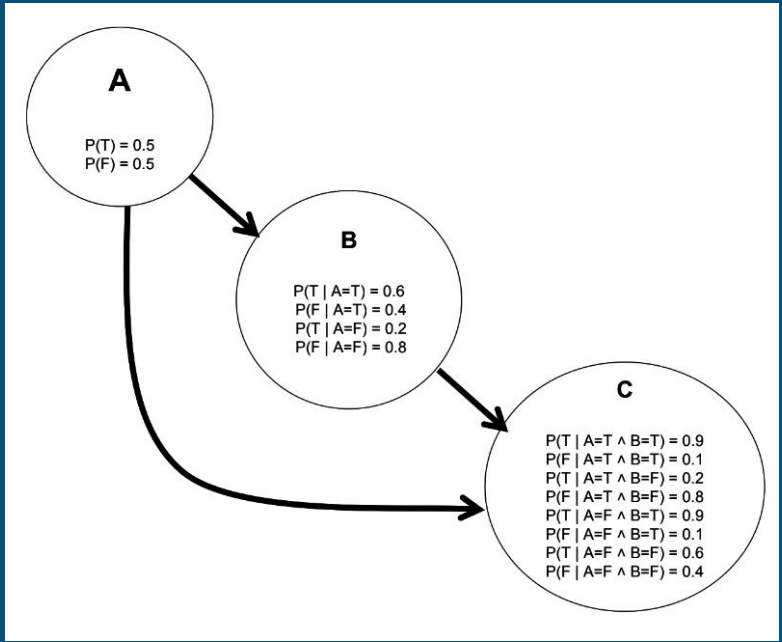
Bayesian Networks

- calculate the prediction for the case B=T AND C = F!



Bayesian Networks

- calculate the prediction for the case B=T AND C = F!
- $P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$

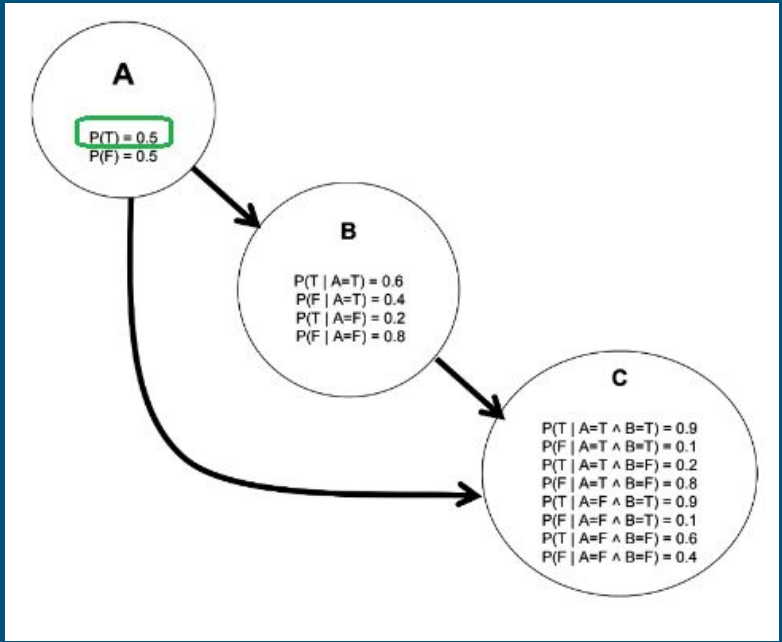


Bayesian Networks

- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

0.5 *

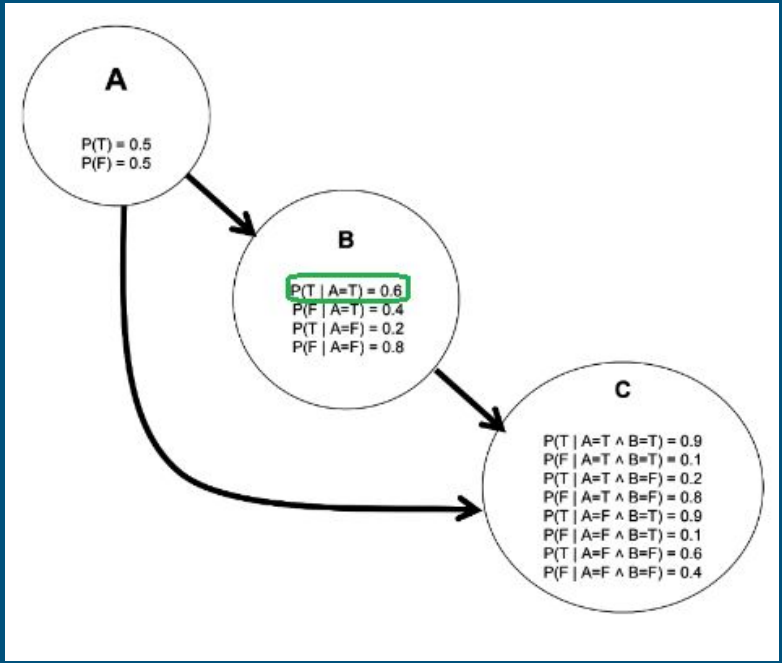


Bayesian Networks

- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

0.5 * 0.6 *

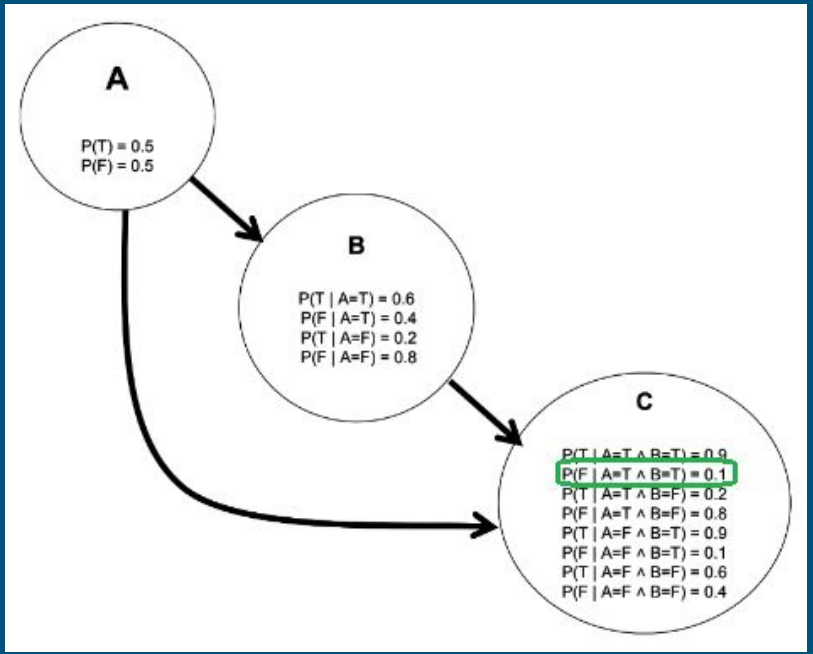


Bayesian Networks

- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

0.5 * 0.6 * 0.1 =

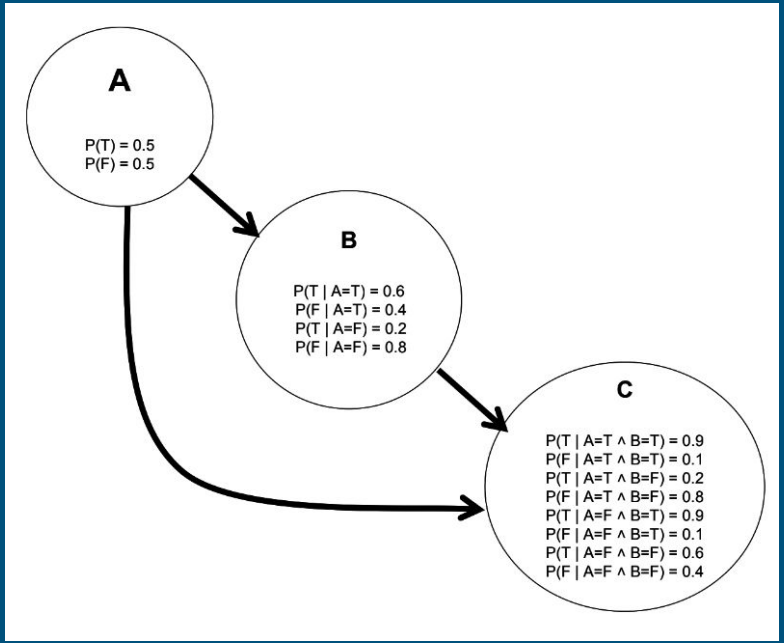


Bayesian Networks

- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

0.5 * 0.6 * 0.1 = 0.03



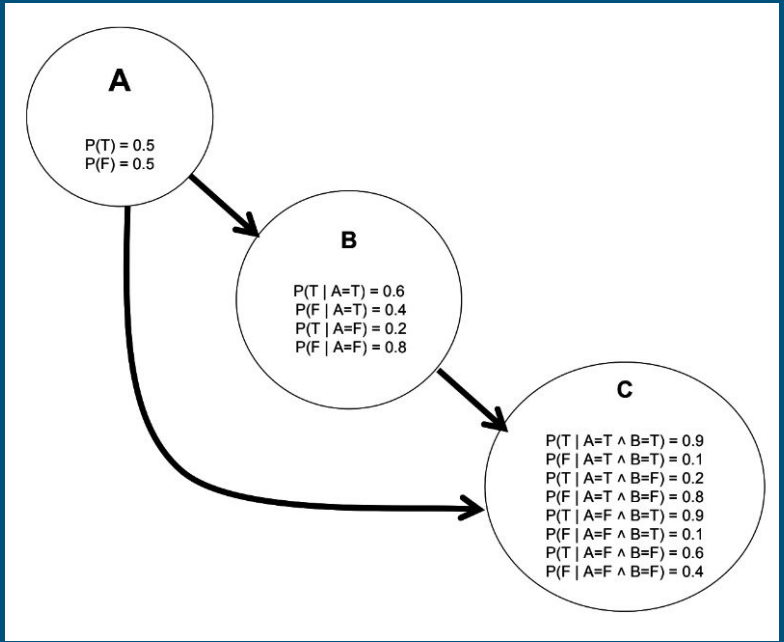
Bayesian Networks

- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

0.5 * 0.6 * 0.1 = 0.03

$$P(\neg A \wedge B \wedge \neg C) = P(\neg A) * P(B|\neg A) * P(\neg C \mid \neg A \wedge B)$$



Bayesian Networks

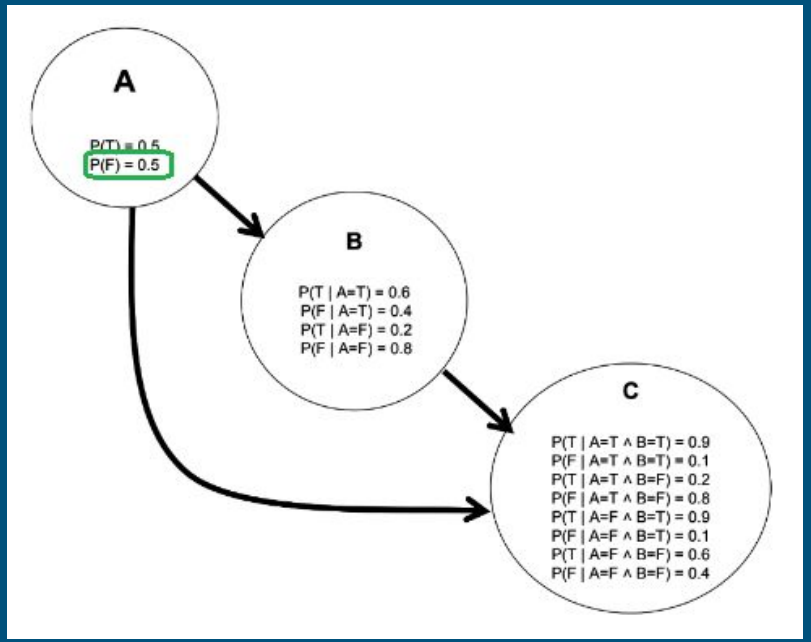
- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

0.5 * 0.6 * 0.1 = 0.03

$$P(\neg A \wedge B \wedge \neg C) = P(\neg A) * P(B|\neg A) * P(\neg C \mid \neg A \wedge B)$$

0.5 *



Bayesian Networks

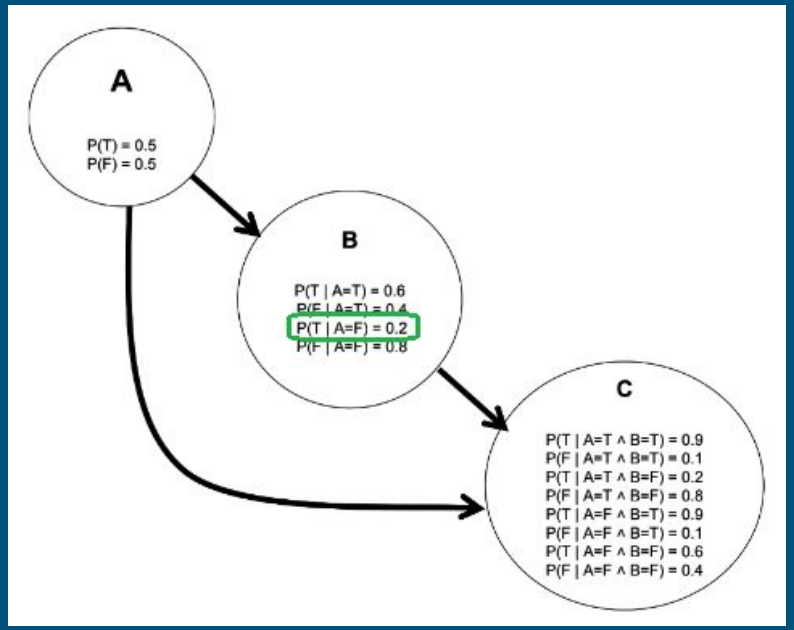
- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

0.5 * 0.6 * 0.1 = 0.03

$$P(\neg A \wedge B \wedge \neg C) = P(\neg A) * P(B|\neg A) * P(\neg C \mid \neg A \wedge B)$$

0.5 * 0.2 *



Bayesian Networks

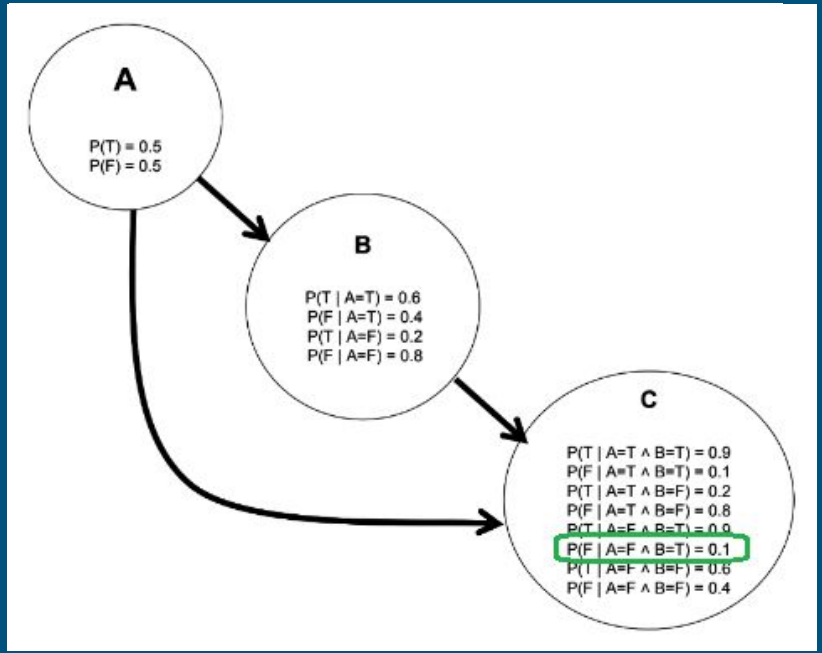
- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

0.5 * 0.6 * 0.1 = 0.03

$$P(\neg A \wedge B \wedge \neg C) = P(\neg A) * P(B|\neg A) * P(\neg C \mid \neg A \wedge B)$$

0.5 * 0.2 * 0.1 =



Bayesian Networks

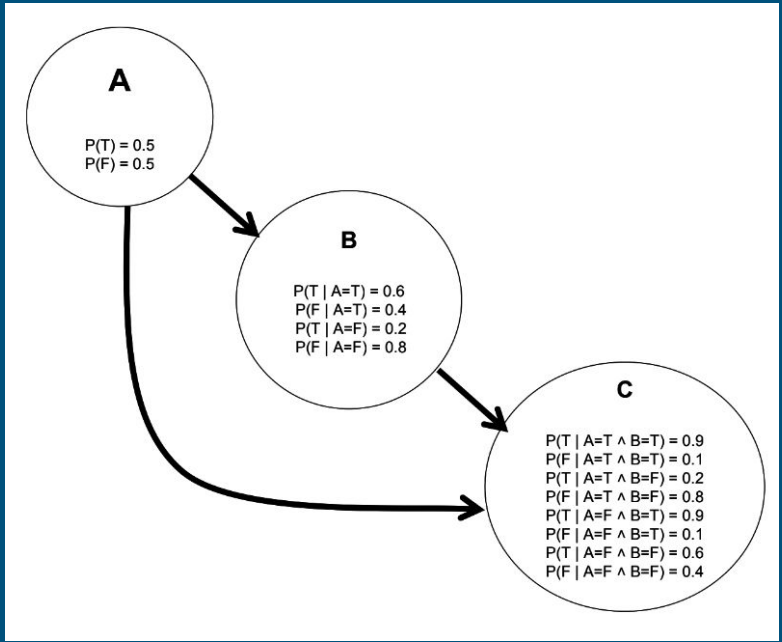
- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

0.5 * 0.6 * 0.1 = 0.03

$$P(\neg A \wedge B \wedge \neg C) = P(\neg A) * P(B|\neg A) * P(\neg C \mid \neg A \wedge B)$$

0.5 * 0.2 * 0.1 = 0.01



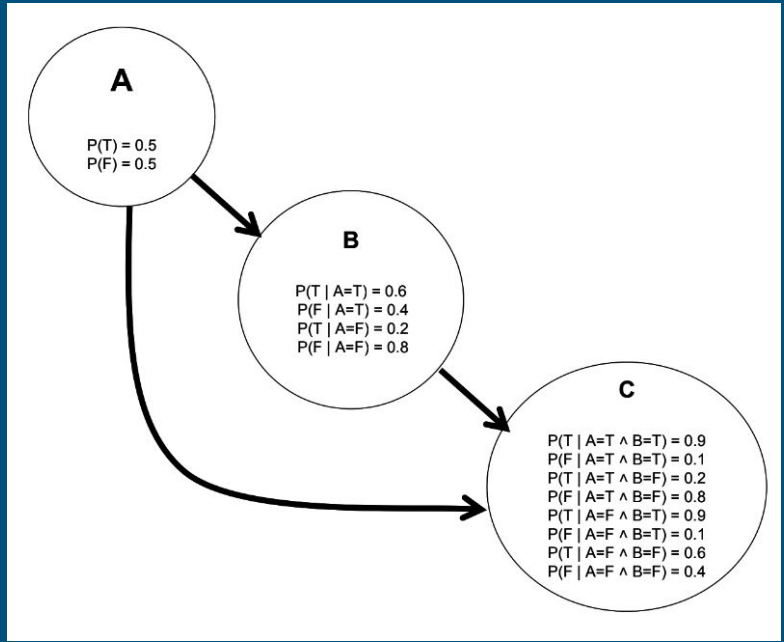
Bayesian Networks

- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

$$P(\neg A \wedge B \wedge \neg C) = P(\neg A) * P(B|\neg A) * P(\neg C \mid \neg A \wedge B)$$

$$P(A \mid B \wedge \neg C) = \frac{P(A \wedge B \wedge \neg C)}{P(B \wedge \neg C)} = \frac{P(A \wedge B \wedge \neg C)}{P(A \wedge B \wedge \neg C) + P(\neg A \wedge B \wedge \neg C)})$$



Bayesian Networks

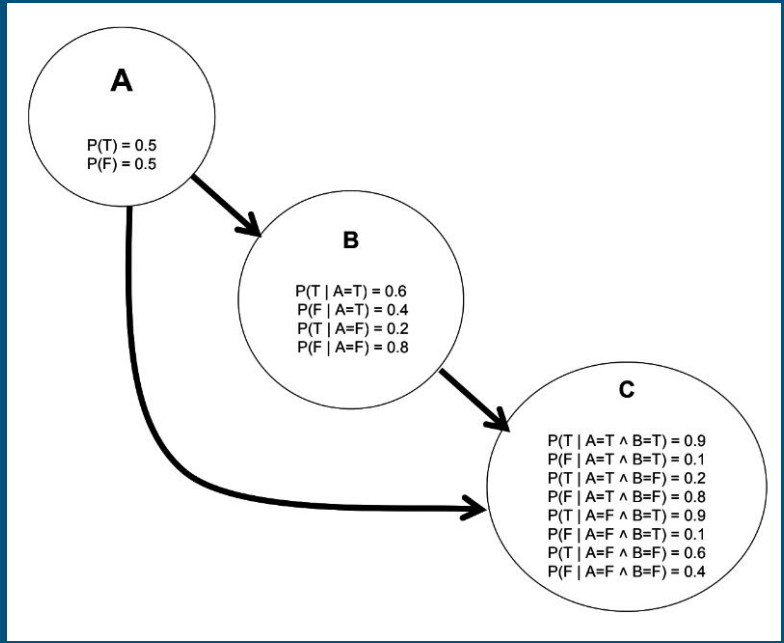
- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

$$P(\neg A \wedge B \wedge \neg C) = P(\neg A) * P(B|\neg A) * P(\neg C \mid \neg A \wedge B)$$

$$P(A \mid B \wedge \neg C) = \frac{P(A \wedge B \wedge \neg C)}{P(B \wedge \neg C)} = \frac{P(A \wedge B \wedge \neg C)}{P(A \wedge B \wedge \neg C) + P(\neg A \wedge B \wedge \neg C)})$$

$$P(A \mid B \wedge \neg C) = \frac{0.03}{0.03 + 0.01} = 0.75$$



Bayesian Networks

- calculate the prediction for the case B=T AND C = F!

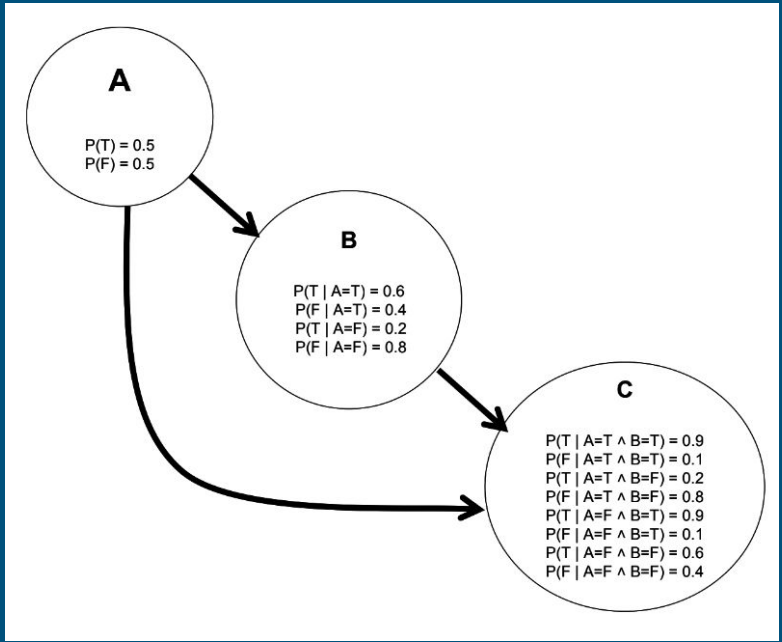
$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

$$P(\neg A \wedge B \wedge \neg C) = P(\neg A) * P(B|\neg A) * P(\neg C \mid \neg A \wedge B)$$

$$P(A \mid B \wedge \neg C) = \frac{P(A \wedge B \wedge \neg C)}{P(B \wedge \neg C)} = \frac{P(A \wedge B \wedge \neg C)}{P(A \wedge B \wedge \neg C) + P(\neg A \wedge B \wedge \neg C)})$$

$$P(A \mid B \wedge \neg C) = \frac{0.03}{0.03 + 0.01} = 0.75$$

$$P(\neg A \mid B \wedge \neg C) = \frac{P(\neg A \wedge B \wedge \neg C)}{P(B \wedge \neg C)} = \frac{P(\neg A \wedge B \wedge \neg C)}{P(A \wedge B \wedge \neg C) + P(\neg A \wedge B \wedge \neg C)})$$



Bayesian Networks

- calculate the prediction for the case B=T AND C = F!

$$P(A \wedge B \wedge \neg C) = P(A) * P(B|A) * P(\neg C \mid A \wedge B)$$

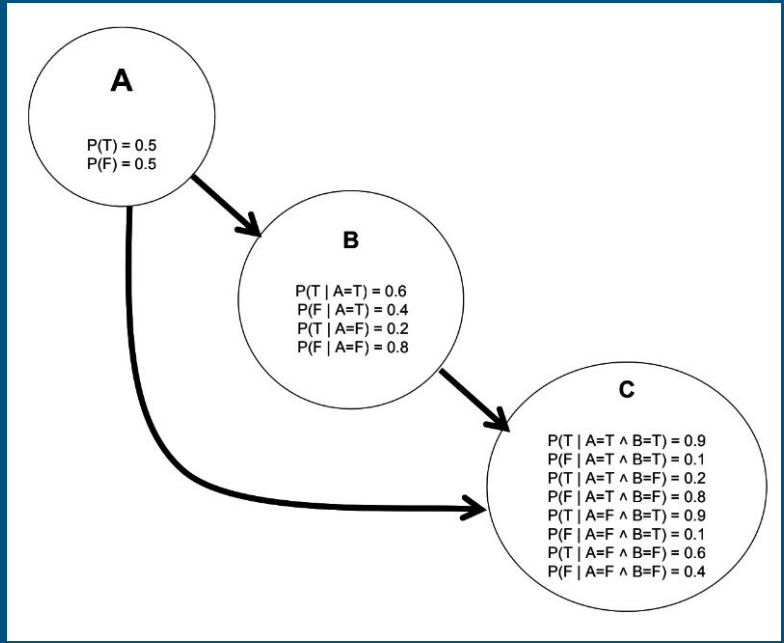
$$P(\neg A \wedge B \wedge \neg C) = P(\neg A) * P(B|\neg A) * P(\neg C \mid \neg A \wedge B)$$

$$P(A \mid B \wedge \neg C) = \frac{P(A \wedge B \wedge \neg C)}{P(B \wedge \neg C)} = \frac{P(A \wedge B \wedge \neg C)}{P(A \wedge B \wedge \neg C) + P(\neg A \wedge B \wedge \neg C)})$$

$$P(A \mid B \wedge \neg C) = \frac{0.03}{0.03 + 0.01} = 0.75$$

$$P(\neg A \mid B \wedge \neg C) = \frac{P(\neg A \wedge B \wedge \neg C)}{P(B \wedge \neg C)} = \frac{P(\neg A \wedge B \wedge \neg C)}{P(A \wedge B \wedge \neg C) + P(\neg A \wedge B \wedge \neg C)})$$

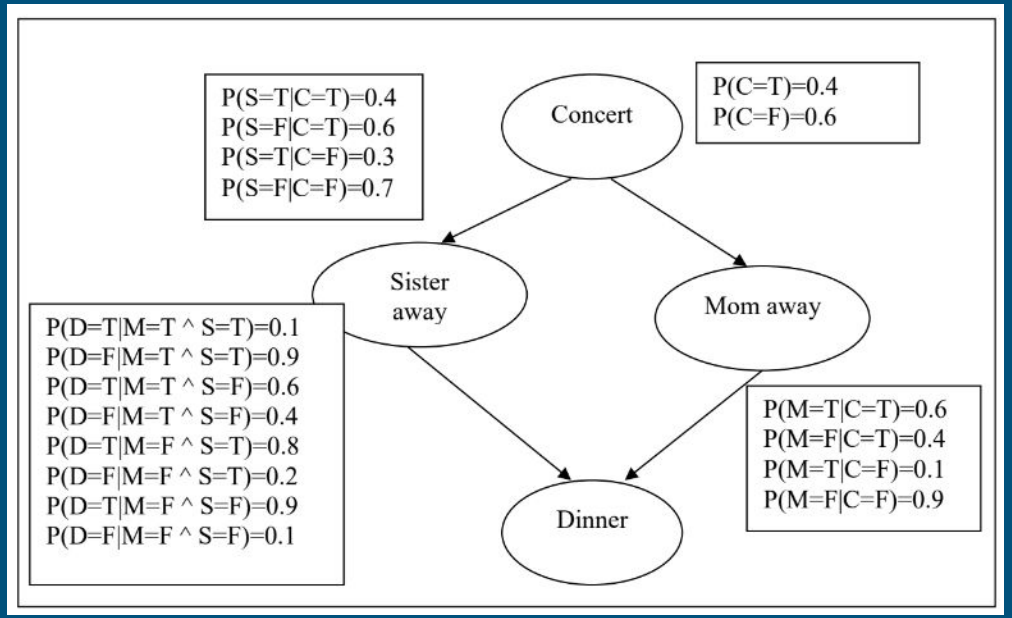
$$P(\neg A \mid B \wedge \neg C) = \frac{0.01}{0.03 + 0.01} = 0.25$$



Bayesian Networks

- calculate the prediction for the case:

Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

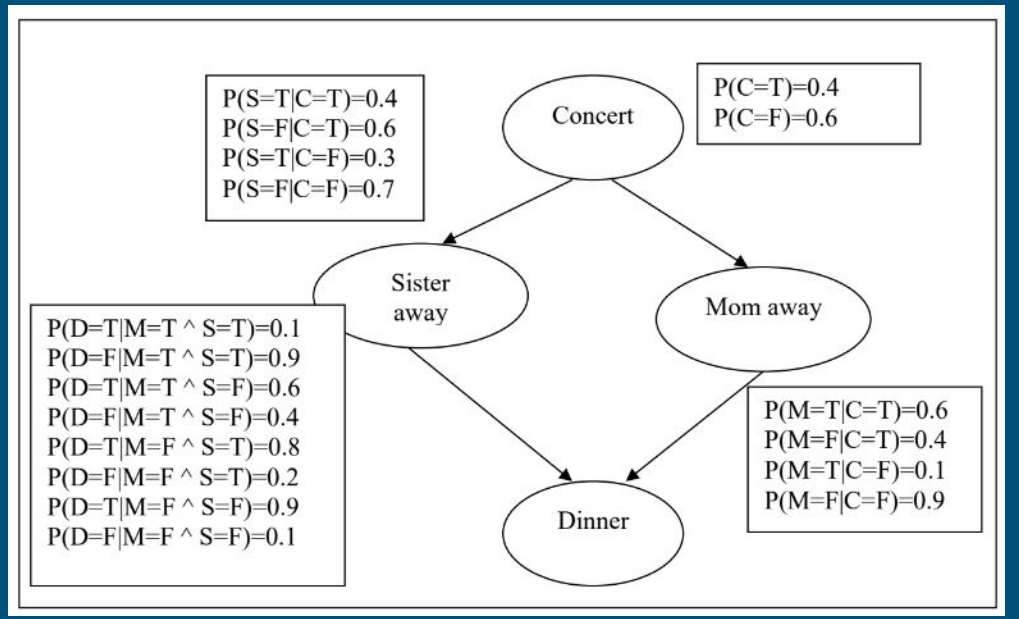


Bayesian Networks

- calculate the prediction for the case:

Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$



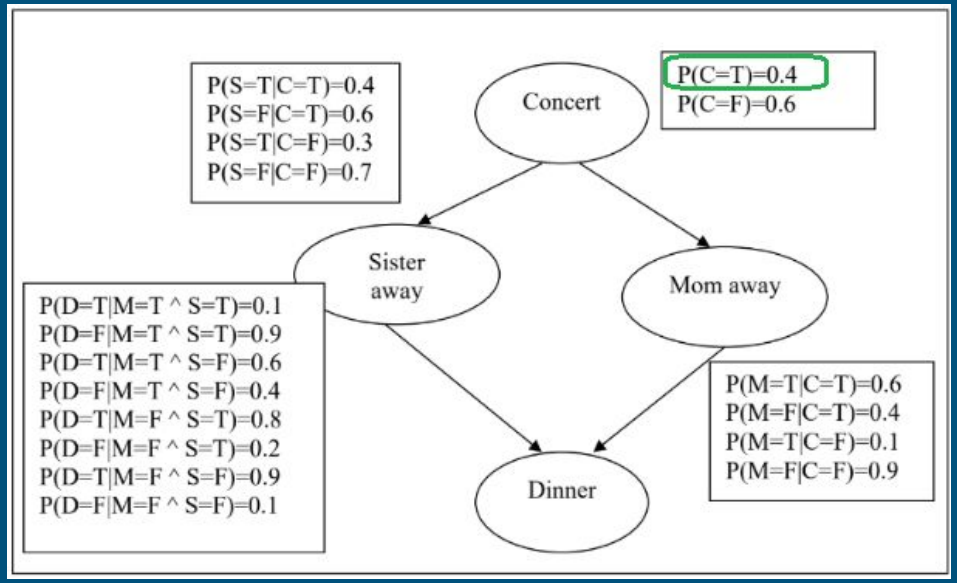
Bayesian Networks

- calculate the prediction for the case:

Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$

0.4 *



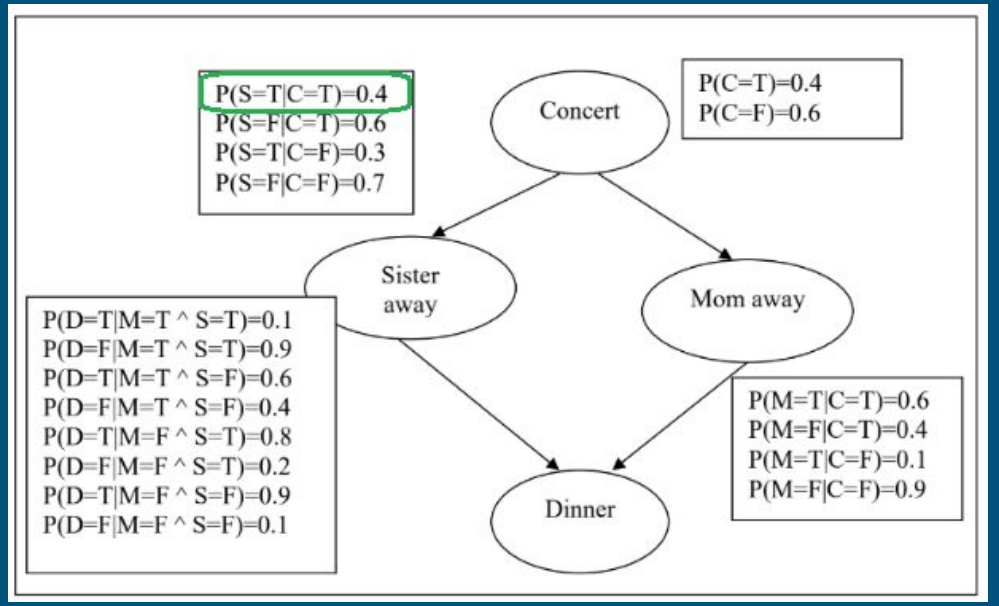
Bayesian Networks

- calculate the prediction for the case:

Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$

0.4 * 0.4 *



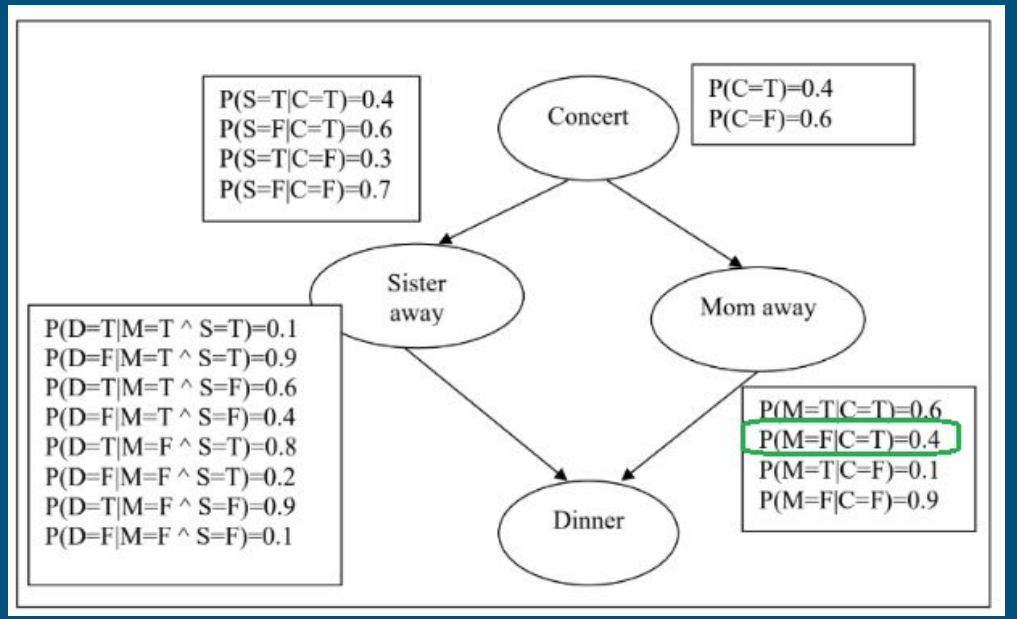
Bayesian Networks

- calculate the prediction for the case:

Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$

0.4 * 0.4 * 0.4 =



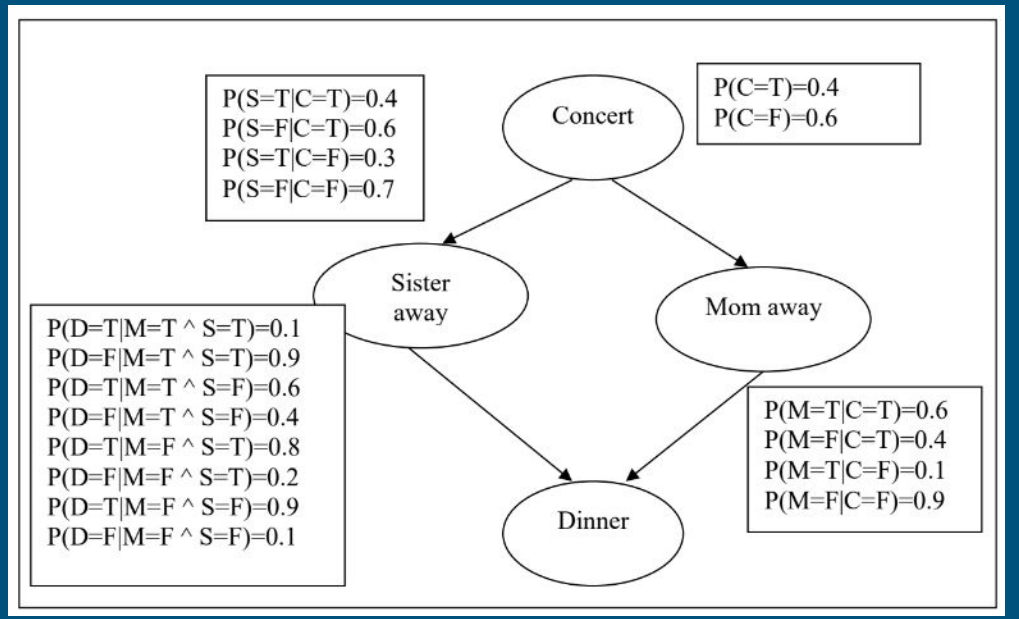
Bayesian Networks

- calculate the prediction for the case:

Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$

0.4 * 0.4 * 0.4 = 0.064



Bayesian Networks

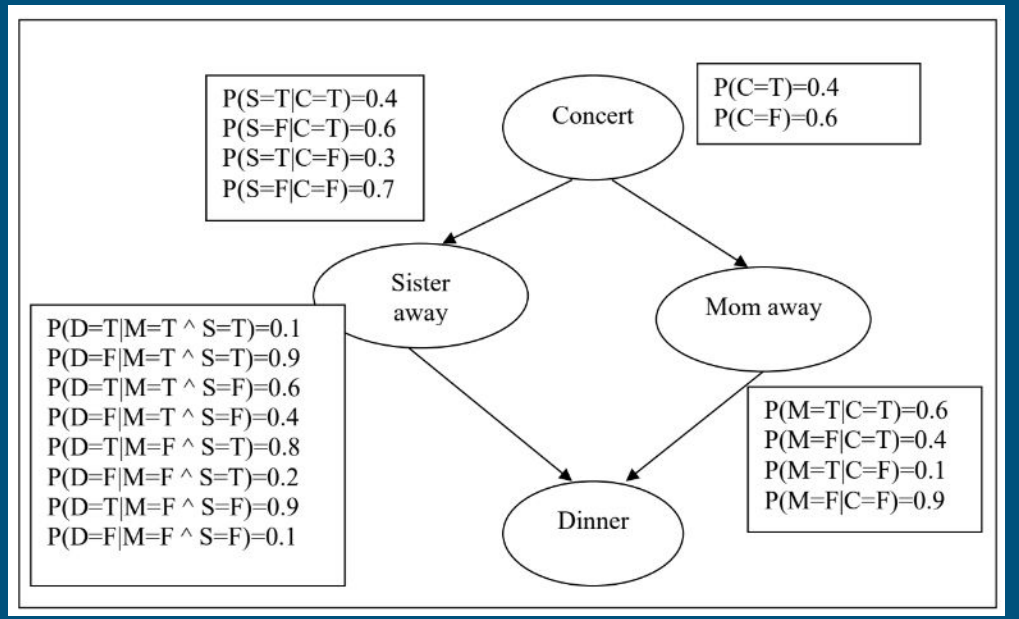
- calculate the prediction for the case:

Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$

0.4 * 0.4 * 0.4 = 0.064

$$P(\neg C \wedge D \wedge \neg M) = P(\neg C) * P(S|\neg C) * P(\neg M \mid \neg C)$$



Bayesian Networks

- calculate the prediction for the case:

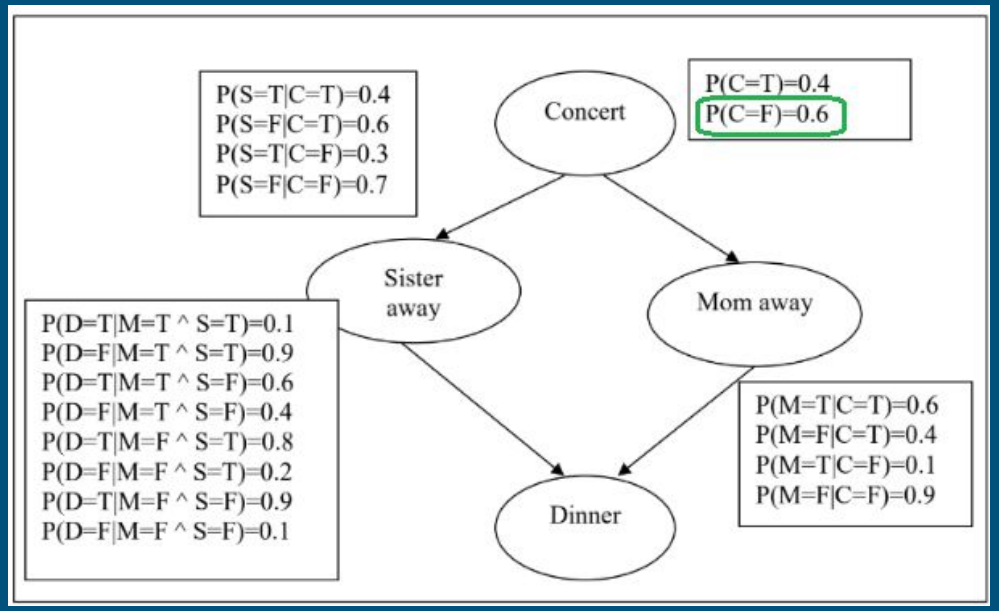
Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$

0.4 * 0.4 * 0.4 = 0.064

$$P(\neg C \wedge D \wedge \neg M) = P(\neg C) * P(S|\neg C) * P(\neg M \mid \neg C)$$

0.6 *



Bayesian Networks

- calculate the prediction for the case:

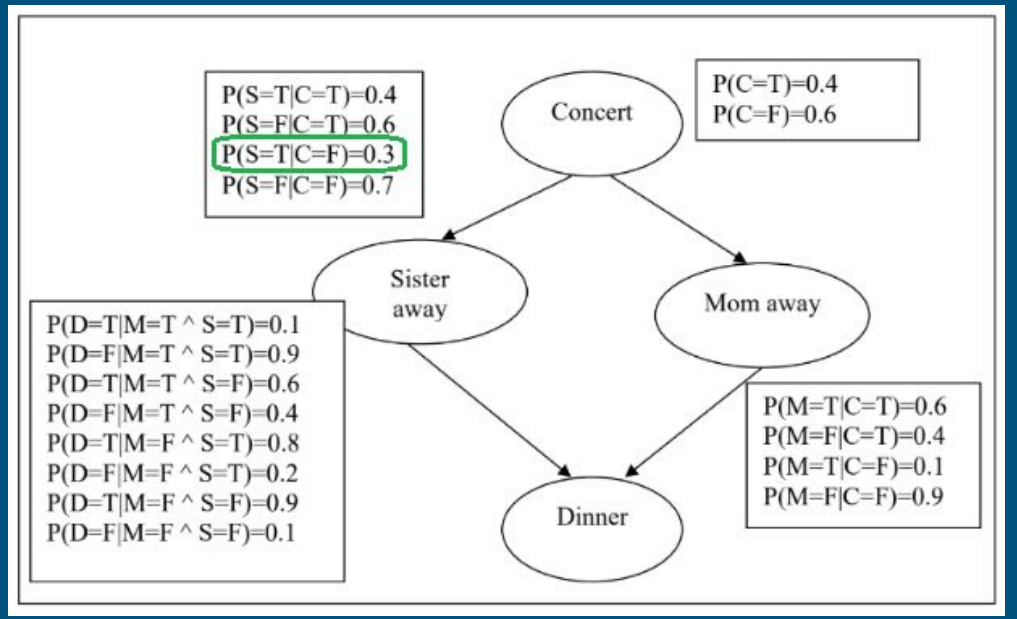
Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$

0.4 * 0.4 * 0.4 = 0.064

$$P(\neg C \wedge D \wedge \neg M) = P(\neg C) * P(S|\neg C) * P(\neg M \mid \neg C)$$

0.6 * 0.3 *



Bayesian Networks

- calculate the prediction for the case:

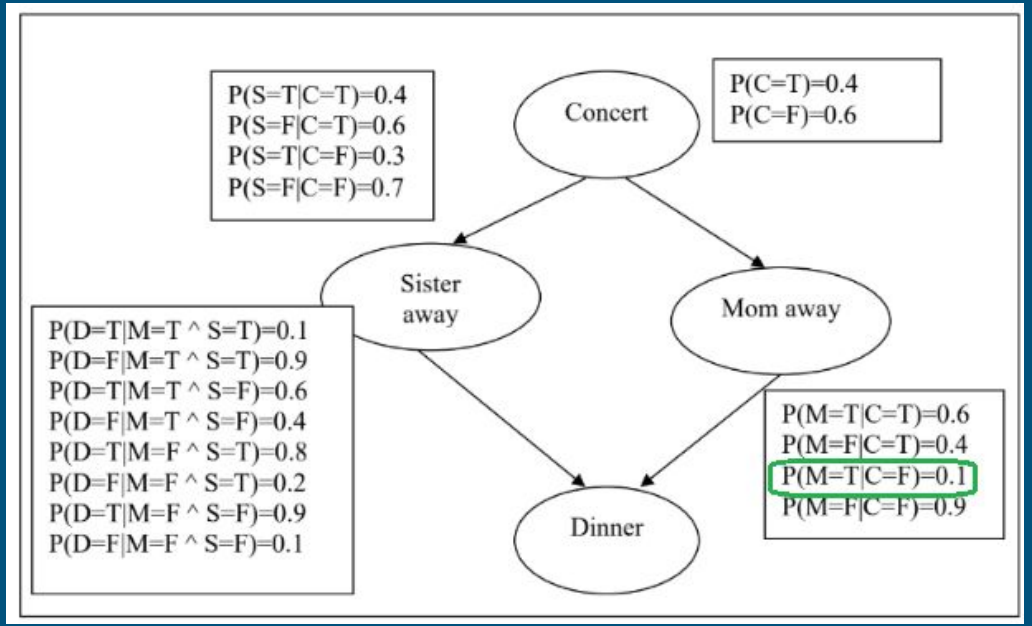
Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$

0.4 * 0.4 * 0.4 = 0.064

$$P(\neg C \wedge D \wedge \neg M) = P(\neg C) * P(S|\neg C) * P(\neg M \mid \neg C)$$

0.6 * 0.3 * 0.1 =



Bayesian Networks

- calculate the prediction for the case:

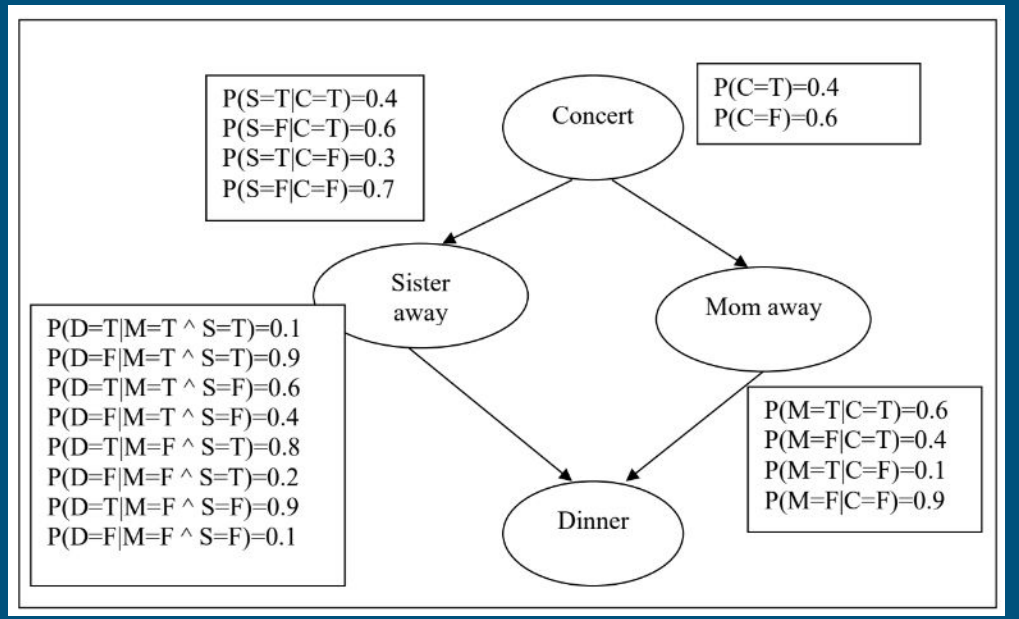
Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$

0.4 * 0.4 * 0.4 = 0.064

$$P(\neg C \wedge D \wedge \neg M) = P(\neg C) * P(S|\neg C) * P(\neg M \mid \neg C)$$

0.6 * 0.3 * 0.1 = 0.018



Bayesian Networks

- calculate the prediction for the case:

Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

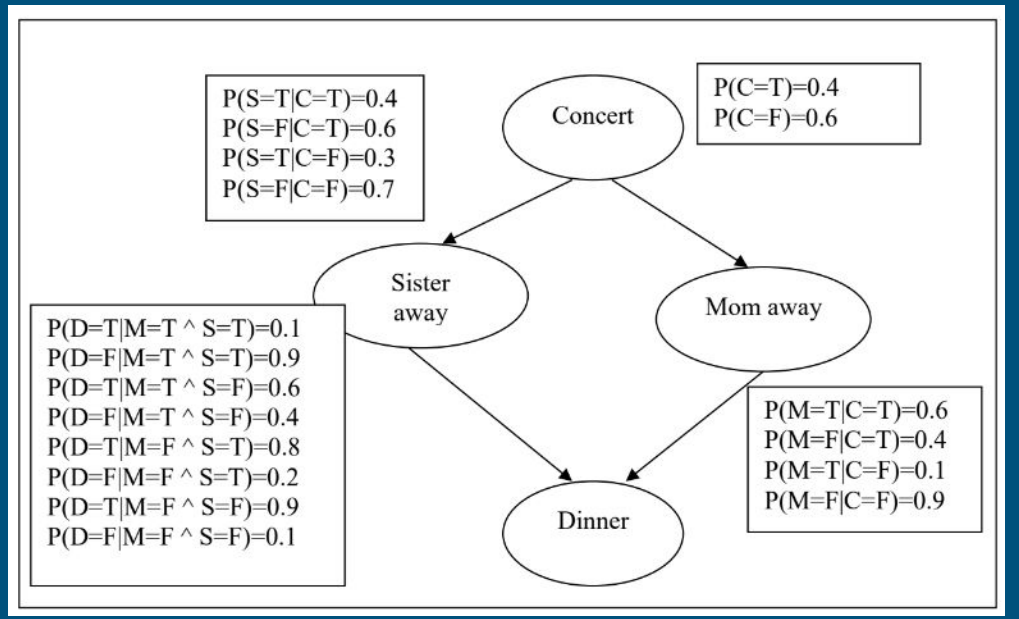
$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$

0.4 * 0.4 * 0.4 = 0.064

$$P(\neg C \wedge D \wedge \neg M) = P(\neg C) * P(S|\neg C) * P(\neg M \mid \neg C)$$

0.6 * 0.3 * 0.1 = 0.018

$$P(C \mid S \wedge \neg M) = \frac{0.064}{0.064 + 0.018} = 0.78$$



Bayesian Networks

- calculate the prediction for the case:

Dinner	Sister away	Mom away	**Concert**
	T	F	**?**

$$P(C \wedge S \wedge \neg M) = P(C) * P(S|C) * P(\neg M \mid C)$$

0.4 * 0.4 * 0.4 = 0.064

$$P(\neg C \wedge D \wedge \neg M) = P(\neg C) * P(S|\neg C) * P(\neg M \mid \neg C)$$

0.6 * 0.3 * 0.1 = 0.018

$$P(C \mid S \wedge \neg M) = \frac{0.064}{0.064 + 0.018} = 0.78$$

$$P(\neg C \mid S \wedge \neg M) = \frac{0.018}{0.064 + 0.018} = 0.22$$