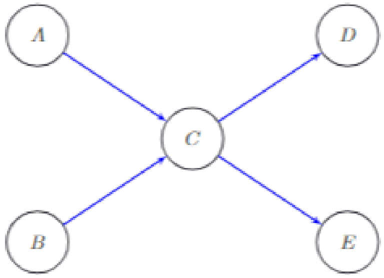
We want to compute $P(D)$ in the Bayesian network structure



Which of the following elimination orders is preferable?

A: A, C, B, E

B: C, A, B, E

C: A, B, E, C

D: E, A, B, C

Course description – what we have covered so far:

- Graphical representations of dependence and conditional independence
- Standard probability propagation algorithms in a network
- Standard examples of Bayesian networks
- master the graph terminology
- master the relation between graphs and probability models
- be able to decide conditional independence by d-separation
- be able to implement simulations of variables from a Bayesian network

How do you find the course so far:

A: The quick questions/polls/exercises are helpful

B: The exercise classes help me solidify my understanding

C: I'm positive about the book and the assigned chapters help my understanding

D: Overall, the course is teaching me the competences announced

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The mean and variance of a real valued random variable X with density p are

$$E(X) = \int xp(x)\ \mathrm{d}x$$
$$V(X) = \int (x - E(X))^2 p(x)\ \mathrm{d}x = E((X - E(X))^2)$$

Let X and Y be exponentially distributed with rate parameter 2.

Which of the following statements are correct?

A: $E(X + Y) = 1$
B: $E(X^2) = \frac{1}{4}$
C: $V(X) = \frac{1}{4}$
D: $V(X + Y) = \frac{1}{2}$

Let $X \sim \mathcal{N}(\mu_0, \sigma_0^2)$ and let

$$Y \mid X = x \sim \mathcal{N}(\mu(x), \sigma^2(x)).$$

Which of the following statements are correct?

A: $E(X) = \mu_0$ and $V(X) = \sigma_0^2$
B: The marginal distribution of Y is Gaussian
C:

$$\mu_1 = E(Y) = \frac{1}{\sqrt{2\pi\sigma_0^2}} \int \mu(x) e^{-\frac{(x-\mu_0)^2}{2\sigma_0^2}}\ \mathrm{d}x$$

D: It holds that

$$E(XY) = \mu_0 \mu_1.$$

The fundamental theorem of calculus states that for $f : (a, b) \to \mathbb{R}$,

$$\int_a^b f(x)\ \mathrm{d}x = F(b) - F(a)$$

given that F is an **anti-derivative** of f, that is

$$F'(x) = f(x).$$

Which of the identities below follow from this?

A: $\int_0^x e^y \mathrm{d}y = e^x$
B: $\int_0^x e^{\lambda y} \mathrm{d}y = e^{\lambda x}$
C: $\int_0^x y^n \mathrm{d}y = nx^{n-1}$
D: $\int_0^x y^n \mathrm{d}y = \frac{1}{n+1} x^{n+1}$
E: $\int_{-1}^1 |x| \mathrm{d}x = 1$
F: $\int_{-\infty}^{\infty} e^{-|x|} \mathrm{d}x = 2$

Consider the four update equations

$$
\begin{aligned}
X_0 &= Z_0 \\
X_1 &= 0.5Z_1 \\
X_2 &= X_0 + 4Z_2 \\
X_3 &= X_1 + 3X_2 + 0.3Z_3
\end{aligned}
$$

Decide which of the following statements are true (it may help to draw the corresponding Bayesian network structure)?

A: $P(X_3 \mid X_1 = x_1, X_2 = x_2) = \mathcal{N}(x_1 + 3x_2, 0.09)$

B: $X_3 \perp X_0 \mid X_1, X_2$

C: $X_2 \perp X_1$

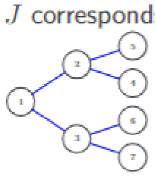
D: $X_2 \perp X_1 \mid X_3$

E: $P(X_0 \mid X_2 = x_2) = \mathcal{N}(x_2, 16)$

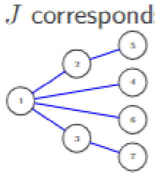
Consider a Gaussian distribution of $X_1, \ldots, X_7$ with information matrix

$$
J = \begin{pmatrix}
* & * & * & 0 & 0 & 0 & 0 \\
* & * & 0 & * & * & 0 & 0 \\
* & 0 & * & 0 & 0 & * & * \\
0 & * & 0 & * & 0 & 0 & 0 \\
0 & * & 0 & 0 & * & 0 & 0 \\
0 & 0 & * & 0 & 0 & * & 0 \\
0 & 0 & * & 0 & 0 & 0 & *
\end{pmatrix}.
$$

A: J corresponds to



B: J corresponds to



C: Marginalizing out X_1, X_2, X_3 gives $J' = \begin{pmatrix} * & 0 & 0 & 0 \\ 0 & * & 0 & 0 \\ 0 & 0 & * & 0 \\ 0 & 0 & 0 & * \end{pmatrix}$

D: Marginalizing out X_7, X_6, X_5, X_4 gives $J' = \begin{pmatrix} * & * & * \\ * & * & 0 \\ * & 0 & * \end{pmatrix}$

E: A good elimination order is $X_7, X_6, X_5, X_4, X_3, X_2, X_1$