This is a preview of what students will see when they are submitting the assignment. Interactive features are disabled.

Quiz 2

Due: Thursday September 24, 2020 6:45 PM (EDT)

Assignment description

You have 45 minutes to do this quiz. That's more time than you should need.

Submit your assignment

Help

After you have completed the assignment, please save, scan, or take photos of your work and upload your files to the questions below. Crowdmark accepts PDF, JPG, and PNG file formats.

Q1 (4 points)

Let $\mathbf{A}$ and $\mathbf{B}$ be square matrices of the same size, and assume that both inverses exist. Pick one of the statements below and prove it.

- $(\mathbf{AB})^{-1} = \mathbf{A}^{-1}\mathbf{B}^{-1}$.
- $(\mathbf{AB})^{-1} = \mathbf{B}^{-1}\mathbf{A}^{-1}$.

Q2 (6 points)

Let X_1 and X_2 be independent random variables, with $X_1 \sim N(\mu_1, \sigma_1^2)$ and $Y = X_1 + X_2 \sim N(\mu_1 + \mu_2, \sigma_1^2 + \sigma_2^2)$. Prove that $X_2 \sim N(\mu_2, \sigma_2^2)$.

Quiz 2 Key

(1) Show $(AB)^{-1} = B^{-1}A^{-1}$

$$B^{-1}\underbrace{A^{-1}A}_{I}B = B^{-1}B = I \quad \text{done}$$

Implicitly, we are using a fact from lecture that you only have to show the product $= I$ in one order. They do not need to say this.

(2) By independence, $M_Y(t) = M_{X_1}(t)\, M_{X_2}(t)$

$$\Rightarrow e^{(\mu_1+\mu_2)t + \frac{1}{2}(\sigma_1^2+\sigma_2^2)t^2} = e^{\mu_1 t + \frac{1}{2}\sigma_1^2 t^2} M_{X_2}(t)$$

$$\Rightarrow \cancel{e^{\mu_1 t + \frac{1}{2}\sigma_1^2 t^2}}\, e^{\mu_2 t + \frac{1}{2}\sigma_2^2 t^2} = \cancel{e^{\mu_1 t + \frac{1}{2}\sigma_1^2 t^2}}\, M_{X_2}(t)$$

$$\Rightarrow M_{X_2}(t) = e^{\mu_2 t + \frac{1}{2}\sigma_2^2 t^2},$$

MGF of $N(\mu_1, \sigma_1^2)$