Practice Test

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Q3.2. given:

$$Z = 2X_1X_2^2 + 3X_2X_3^3$$

find $E[Z] = E[2X_1X_2^2 + 3X_2X_3^3]$

a) Apply linearity of Expectation

$$E[2X_1X_2^2 + 3X_2X_3^3] = \underbrace{E[2X_1X_2^2]} + E[3X_2X_3^3]$$

* property of expectation value

$$= 2E[X_1X_2^2] + 3E[X_2X_3^3]$$

* since they are independent

$$= 2E[X_1]E[X_2^2] + 3E[X_2]E[X_3^3]$$

* We can do one more time

$$= 2E[X_1]E[X_2]E[X_2]$$
$$+ 3E[X_2]E[X_3]E[X_3]E[X_3]$$

* 3 integrals $E[X_1]$, $E[X_2]$, $E[X_3]$

Reserve for integration of Q3.2

$$E[X_1] = \int_0^1 2x^2\,dx = \frac{2x^3}{3}\Bigg|_0^1 = \frac{2}{3}$$

* Similar integration for $E[X_2]$ & $E[X_3]$ since they are independent

$$E[2X_1X_2^2 + 3X_2X_3^3] = 2E[X_1]E[X_2]E[X_2]$$
$$+ 3E[X_2]E[X_3]E[X_3]E[X_3]$$
$$= 2\left(\frac{2}{3}\right)^3 + 3\left(\frac{2}{3}\right)^4$$
$$= \frac{16}{27} + \frac{16}{27}$$
$$= \frac{32}{27}$$
$$= 1.19$$