MMS

Vanessa Closius, Jonas Tietz, Tronje Krabbe

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1. a)

$$\begin{aligned}
E\{aX + bY + c\} &= \iint (ax + by + c)p(x, y)dxdy \\
&= \iint ax \cdot p(x, y) + by \cdot p(x, y) + c \cdot p(x, y)dxdy \\
&= \iint ax \cdot p(x, y)dxdy + \iint by \cdot p(x, y)dxdy + \iint c \cdot p(x, y)dxdy \\
&= \int ax \cdot p(x)dx + \int by \cdot p(y)dy + c \\
&= a \int x \cdot p(x)dx + b \int y \cdot p(y)dy + c \\
&= aE\{X\} + bE\{Y\} + c
\end{aligned}$$

b)

$$\begin{aligned}
E\{(X - \mu_x)^2\} &= E\{X^2 - 2X\mu_x + \mu_x^2\} \\
&= E\{X^2\} - E\{2X\mu_x\} + \mu_x^2 \\
&= E\{X^2\} - 2\mu_x E\{X\} + \mu_x^2 \\
&= E\{X^2\} - 2E\{X\}E\{X\} + E\{X\}^2 \\
&= E\{X^2\} - 2E\{X\}^2 + E\{X\}^2 \\
&= E\{X^2\} - E\{X\}^2 \\
&= E\{X^2\} - \mu_x^2
\end{aligned}$$