

# EXAM P QUESTIONS OF THE WEEK

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## Week of February 12/07

$X$  and  $Y$  have a bivariate normal distribution, and  $X$  and  $Y$  each have marginal distributions that are standard normal (mean 0, variance 1).

You are given  $P(X > Y + 1) = .2119$ .

Find  $P(X > Y + 2)$ .

**The solution can be found below.**

## Week of February 12/07 - Solution

Suppose that the covariance between  $X$  and  $Y$  is  $C$ . Then  $X - Y$  has a normal distribution with mean  $1 - 1 = 0$  and variance

$$\text{Var}[X - Y] = \text{Var}[X] + \text{Var}[Y] - 2 \text{Cov}(X, Y) = 1 + 1 - C = 2 - C .$$

$$\text{Then, } P(X - Y > 1) = P\left(\frac{X - Y}{\sqrt{2 - C}} > \frac{1}{\sqrt{2 - C}}\right) = .2119 .$$

$Z = \frac{X - Y}{\sqrt{2 - C}}$  has a standard normal distribution, and from the standard normal table,

$$\text{we get } \frac{1}{\sqrt{2 - C}} = .80 .$$

$$\text{Then, } P(X > Y + 2) = P(X - Y > +2) = P\left(\frac{X - Y}{\sqrt{2 - C}} > \frac{2}{\sqrt{2 - C}}\right) = P(Z > 1.6) = .0548.$$