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November 2001 Course 1 Examination, Problem No. 40, also P Sample Exam Questions, Problem No. 84, and Dr. Ostaszewski's online exercise posted July 11, 2009

Let X and Y be the number of hours that a randomly selected person watches movies and sporting events, respectively, during a three-month period. The following information is known about X and Y : $E(X) = 50$, $E(Y) = 20$, $\text{Var}(X) = 50$, $\text{Var}(Y) = 30$,

$\text{Cov}(X, Y) = 10$. One hundred people are randomly selected and observed for these three months. Let T be the total number of hours that these one hundred people watch movies or sporting events during this three-month period. Approximate the value of $\Pr(T < 7100)$.

- A. 0.62 B. 0.84 C. 0.87 D. 0.92 E. 0.97

Solution.

We have

$$E(X + Y) = E(X) + E(Y) = 50 + 20 = 70,$$

and

$$\text{Var}(X + Y) = \text{Var}(X) + \text{Var}(Y) + 2\text{Cov}(X, Y) = 50 + 30 + 20 = 100.$$

for a randomly selected person. It follows from the Central Limit Theorem that T is approximately normal with mean $E(T) = 100 \cdot 70 = 7000$ and variance

$$\text{Var}(T) = 100 \cdot 100 = 100^2.$$

Therefore, denoting a standard normal random variable by Z ,

$$\Pr(T < 7100) = \Pr\left(\frac{T - 7000}{100} < \frac{7100 - 7000}{100}\right) \approx \Pr(Z < 1) = 0.8413.$$

Answer B.

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