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Module 6 Quiz

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$\bar{X} \sim N\left(\frac{1}{2}, \frac{1}{12 \times 30}\right)$

E(x) = (a+b)/2
V(x) = (b-a)^2/12

1. **Prompt 1:** Suppose 30 numbers are selected at random from the interval $[0, 1]$. That is, $X_i \sim U[0, 1]$ for $i = 1, 2, \ldots 30$. Given $\bar{X} = (1/30)\sum_{i=1}^{30} X_i$ estimate $P(0.5 \le \bar{X} \le 0.6)$. (Round your answer to three decimal places.) **1 / 1 point**

$P\left(\frac{0.5 - \frac{1}{2}}{\sqrt{\frac{1}{360}}} \le Z \le \frac{0.1}{\sqrt{\frac{1}{360}}}\right)$

0.471

Correct

$\phi\left(\frac{0.1}{\sqrt{\frac{1}{360}}}\right) - \phi(0) = 0.9711 - 0.5$
$= 0.4711$

2. **Prompt 2:** A company wants to compare the efficiency of two types of fuel for a car. 5 identical cars will be driven 500 kilometers each, two with the first type of fuel and three with the second type. Let X_1 and X_2 be the observed fuel efficiency for the first type and Y_1, Y_2, and Y_3 be the efficiency for the second type. Suppose these variables are independent and $X_i \sim N(20, 4)$ for $i = 1, 2$ and $Y_j \sim N(18, 9)$ for $j = 1, 2, 3$. Define a new random variable: $W = (X_1 + X_2)/2 - (Y_1 + Y_2 + Y_3)/3$. **1 / 1 point**

Find $E(W)$.

2

Correct

$E(W) = \frac{1}{2}(X_1 + X_2) - \frac{1}{3}(Y_1 + Y_2 + Y_3)$
$= \frac{1}{2}(E(X_1) + E(X_2)) - \frac{1}{3}(E(Y_1) + E(Y_2) + E(Y_3)) = \frac{1}{2}(20+20) - \frac{1}{3}(18+18+18)$
$= 20 - 18 = 2$

X and Y indep.

3. **Prompt 2:** A company wants to compare the efficiency of two types of fuel for a car. 5 identical cars will be driven 500 kilometers each, two with the first type of fuel and three with the second type. Let X_1 and X_2 be the observed fuel efficiency for the first type and Y_1, Y_2, and Y_3 be the efficiency for the second type. Suppose these variables are independent and $X_i \sim N(20, 4)$ for $i = 1, 2$ and $Y_j \sim N(18, 9)$ for $j = 1, 2, 3$. Define a new random variable: $W = (X_1 + X_2)/2 - (Y_1 + Y_2 + Y_3)/3$. **1 / 1 point**

Find $Var(W)$.

5

Correct

$Var(W) = Var\left(\frac{1}{2}X_1 + \frac{1}{2}X_2 - \frac{1}{3}Y_1 - \frac{1}{3}Y_2 - \frac{1}{3}Y_3\right) = \frac{1}{4}Var(X_1) + \frac{1}{4}Var(X_2) + \frac{1}{9}V(Y_1) + \frac{1}{9}V(Y_2) + \frac{1}{9}V(Y_3)$

$= \frac{1}{4}(4+4) + \frac{1}{9}(9+9+9)$
$= 2 + 3 = 5$

4. **Prompt 2:** A company wants to compare the efficiency of two types of fuel for a car. 5 identical cars will be driven 500 kilometers each, two with the first type of fuel and three with the second type. Let X_1 and X_2 be the observed fuel efficiency for the first type and Y_1, Y_2, and Y_3 be the efficiency for the second type. Suppose these variables are independent and $X_i \sim N(20, 4)$ for $i = 1, 2$ and $Y_j \sim N(18, 9)$ for $j = 1, 2, 3$. Define a new random variable: $W = (X_1 + X_2)/2 - (Y_1 + Y_2 + Y_3)/3$. **1 / 1 point**

Find $P(W \ge 0)$. Round answer to four decimal places.

$W \sim N(2, 5)$

0.8145

Correct

$P(W \ge 0) =$ round(1-pnorm(-2/sqrt(5)),0,1),4)
$= 0.8145$