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Statistics for laboratory scientists

Solutions for the homework problems for lecture 10

1.
 - a. $\bar{X} \sim \text{normal}(\text{mean}=2, \text{SD} = 1.5/\sqrt{15}) = 0.387$. Let $Z = (\bar{X} - 2)/0.387$. Then $\Pr(\bar{X} > 3.2) = \Pr[Z > (3.2 - 2.0)/0.387] = \Pr(Z > 3.10) = (\text{approx}) \mathbf{1/1000}$.
 - b. $\bar{X} \sim \text{normal}(\text{mean}=3, \text{SD} = 0.387)$. Let $Z = (\bar{X} - 3)/0.387$. $\Pr(\bar{X} > 3.2) = \Pr[Z > (3.2 - 3.0)/0.387] = \Pr(Z > 0.516) = (\text{approx}) \mathbf{30\%}$.
 - c. $\bar{X} \sim \text{normal}(\text{mean}=2, \text{SD}=3/\sqrt{15}) = 0.775$. Let $Z = (\bar{X} - 2)/0.775$. $\Pr(\bar{X} > 3.2) = \Pr[Z > (3.2 - 2.0)/0.775] = \Pr(Z > 1.55) = (\text{approx}) \mathbf{6\%}$.
 - d. $\bar{X} \sim \text{normal}(\text{mean}=3, \text{SD} = 0.775)$. Let $Z = (\bar{X} - 3)/0.775$. $\Pr(\bar{X} > 3.2) = \Pr[Z > (3.2 - 3.0)/0.775] = \Pr(Z > 0.258) = (\text{approx}) \mathbf{40\%}$.
 - e. $\bar{X} \sim \text{normal}(\text{mean}=2, \text{SD} = 1.5/\sqrt{3}) = 0.866$. Let $Z = (\bar{X} - 2)/0.866$. Then $\Pr(\bar{X} > 3.2) = \Pr[Z > (3.2 - 2.0)/0.866] = \Pr(Z > 1.36) = (\text{approx}) \mathbf{8\%}$.
 - f. $\bar{X} \sim \text{normal}(\text{mean}=3, \text{SD} = 0.886)$. Let $Z = (\bar{X} - 3)/0.886$. $\Pr(\bar{X} > 3.2) = \Pr[Z > (3.2 - 3.0)/0.886] = \Pr(Z > 0.231) = (\text{approx}) \mathbf{41\%}$.
 - g. $\bar{X} \sim \text{normal}(\text{mean}=2, \text{SD} = 1.5/\sqrt{100}) = 0.15$. Let $Z = (\bar{X} - 2)/0.15$. Then $\Pr(\bar{X} > 3.2) = \Pr[Z > (3.2 - 2.0)/0.15] = \Pr(Z > 8) = (\text{approx}) \mathbf{0}$.
 - h. $\bar{X} \sim \text{normal}(\text{mean}=3, \text{SD} = 0.15)$. Let $Z = (\bar{X} - 3)/0.15$. $\Pr(\bar{X} > 3.2) = \Pr[Z > (3.2 - 3.0)/0.15] = \Pr(Z > 1.33) = (\text{approx}) \mathbf{9\%}$.
2. $\bar{X} \sim \text{normal}(\text{mean}=10, \text{sd}=2.5/\sqrt{100})=0.25$. Let $Z = (\bar{X} - 10)/0.25$.
 - a. $\Pr(|\bar{X} - 10| < 0.1) = \Pr(|Z| < 0.1/0.25) = \Pr(|Z| < 0.4) =$

(approx) **31%**.

b. $\Pr(\bar{X} > 10.25) = \Pr(Z > 1) =$ (approx) **16%**.

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