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Midterm 2 for Statistics I Fall 2020

Answers to multiple choice questions

1. A
2. D
3. D
4. C
5. B

Answers to fill in the blank questions

6. 7.135
7. 0.33
8. 3.2

Question 1 part (a)

$$mean\ of\ \bar{X} = 0.05$$

$$s.d\ of\ \bar{X} = \frac{0.015}{\sqrt{100}} = 0.0015$$

Question 1 part (b)

$$z = \frac{\bar{X} - mean}{s.d}$$

$$P(0.048 < \bar{X} < 0.053) = P(-1.333 < z < 2) = 0.9772 - 0.0918 = 0.8854$$

Question 2 part (a)

$$mean = 14.9$$

$$s.d = 2.8$$

$$n = 55$$

$$\alpha = 1 - 0.95 = 0.05$$

$$P\left(\bar{X} - z_{\frac{\alpha}{2}}\frac{\sigma}{\sqrt{n}} < u < \bar{X} + z_{\frac{\alpha}{2}}\frac{\sigma}{\sqrt{n}}\right) = 1 - \alpha$$

$$z_{\frac{\alpha}{2}} = \frac{2.021 + 2.000}{2} = 2.010$$

$$P\left(14.9 - 2.010 * \frac{2.8}{\sqrt{55}} < u < 14.9 - 2.010 * \frac{2.8}{\sqrt{55}}\right) = 0.95$$

$$95\% \ confidence \ interval = 14.14 \ to \ 15.66$$

Question 2 part (b)

$$width = 2\left(z_{\frac{\alpha}{2}}\frac{\sigma}{\sqrt{n}}\right) = 2 * 2.010 * \frac{2.8}{\sqrt{55}} = 1.518$$

Question 2 part (c)

$$\alpha = 1 - 0.99 = 0.01$$

$$z_{\frac{\alpha}{2}} = \frac{2.704 + 2.660}{2} = 2.682$$

$$s.d = 2.8$$

$$n = \left(\frac{z_{\frac{\alpha}{2}} * \sigma}{E}\right)^2 = \left(\frac{2.682 * 2.8}{0.5}\right)^2 = 225.58$$

Question 3 part (a)

$$p = 0.894$$

$$n = 50$$

$$np = 44.7$$

$$P(X \geq 49) = P\left(z > \frac{49.5 - 44.7}{\sqrt{44.7 * (1 - 0.894)}}\right) = P(z > 2.20513) = 1 - 0.9864 = 0.0136$$

Question 3 part (b)

$$mean = np = 50 * 0.894 = 44.7$$

$$s.d = \sqrt{np(1 - p)} = \sqrt{44.7 * (1 - 0.894)} = 2.1767$$

Question 3 part (c)

$$np = 10 * 0.894 = 8.94$$

$$P(X = 6) = P\left(\frac{5.5 - 8.94}{\sqrt{8.94(1 - 0.894)}} \leq z \leq \frac{6.5 - 8.94}{\sqrt{8.94(1 - 0.894)}}\right) = P(-3.5337 < z < -2.5065)$$

$$= 0.0060 - 0.0002 = 0.0004$$

Question 4 part (a)

$$p = 0.07$$

$$n = 250$$

$$np = 17.5$$

$$P(X \leq 10) = P\left(z < \frac{10.5 - 17.5}{\sqrt{17.5(1 - 0.07)}}\right) = P(z < -1.7351) = 0.0418$$

Question 4 part (b)

$$P(11 \leq X \leq 18) = P\left(\frac{11.5 - 17.5}{\sqrt{17.5(1 - 0.07)}} < z < \frac{18.5 - 17.5}{\sqrt{17.5(1 - 0.07)}}\right)$$
$$= P(-1.4872 < z < 0.24787) = 0.5948 - 0.0694 = 0.5254$$