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HW4 for Statistics 1 Fall 2020

Answer to problem 1 part (a) (textbook problem 6.100 parts a, b, c)

$$P(50 < X < 60) = P\left(\frac{50-52}{17.2} < z < \frac{60-52}{17.2}\right) = P(-0.12 < z < 0.47) = 0.6808 - 0.4522$$
$$= 0.2286 = 22.86\%$$

Answer to problem 1 part (b)

$$P(X > 40) = P\left(z > \frac{40-52}{17.2}\right) = P(z > -0.70) = 1 - 0.2420 = 0.7580 = 75.80\%$$

Answer to problem 1 part (c)

$$z = 1.28$$

$$X = 52 + 1.28 * 17.2 = 74.02$$

Interpretation: 90% of urchins have weight below 74.02g

Answer to problem 2 part (a) (textbook problem 6.167)

$$\mu = 100 * 0.304 = 30.4$$

$$\sigma = \sqrt{np(1-p)} = \sqrt{30.4 * (1-0.304)} = 4.6$$

$$P(X = 0) = P\left(\frac{31.5 - 30.4}{4.6} < z < \frac{32.5 - 30.4}{4.6}\right) = P(0.24 < z < 0.46) = 0.6772 - 0.5948 = 0.0824$$

Answer to problem 2 part (b)

$$P(30 \leq X \leq 35) = P\left(\frac{29.5 - 30.4}{4.6} < z < \frac{35.5 - 30.4}{4.6}\right) = P(-0.2 < z < 1.11) = 0.8665 - 0.4207 = 0.4458$$

Answer to problem 2 part (c)

$$P(X \geq 25) = P\left(\frac{24.5 - 30.4}{4.6} < z < \frac{100.5 - 30.4}{4.6}\right) = P(-1.28 < z < 15.25) = 1 - 0.1003 = 0.8997$$

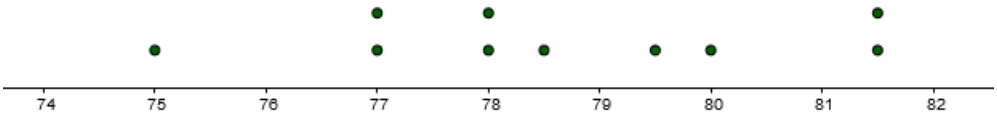
Answer to problem 3 part (a) (textbook problem 7.11 & 7.41)

$$mean = \frac{83 + 76 + 80 + 74 + 80}{5} = 78.6$$

Answer to problem 3 part (b)

Sample	Heights	$\bar{x}$
B, W	83, 76	79.5
B, J	83, 80	81.5
B, C	83, 74	78.5
B, H	83, 80	81.5
W, J	76, 80	78.0
W, C	76, 74	75.0
W, H	76, 80	78.0
J, C	80, 74	77.0
J, H	80, 80	80.0
C, H	74, 80	77.0

Answer to problem 3 part (c)



Answer to problem 3 part (d)

0

Answer to problem 3 part (e)

4 samples are between 77.6 and 79.6.

$$\frac{4}{10} = 40\%$$

If a random sample of two players is taken, there is a 40% chance that the mean height of the two players selected will be within 1 inch of the population mean height.

Answer to problem 3 part (f)

$$\frac{79.5 + 81.5 + 78.5 + 81.5 + 78.0 + 75.0 + 78.0 + 77.0 + 80.0 + 77.0}{10} = 78.6$$

Answer to problem 3 part (g)

$$u_{\bar{x}} = \bar{x} = 78.6$$

Answer to problem 4 part (a) (textbook problem 7.47)

Population = all babies

Variable = birth weight

Answer to problem 4 part (b)

mean of all possible sample mean weights $= \mu = 3369$

standard deviation of all possible sample mean weights $= \frac{581}{\sqrt{200}} = 41.1$

Answer to problem 4 part (c)

mean of all possible sample mean weights $= \mu = 3369$

standard deviation of all possible sample mean weights $= \frac{581}{\sqrt{400}} = 29.1$

Answer to problem 5 (textbook problem 7.73)

$$standard\ deviation = \frac{1150}{\sqrt{500}} = 51.43$$

$$z = \frac{u - 100 - u}{51.43} = -1.94$$

$$z = \frac{u + 100 - u}{51.43} = 1.94$$

$$P(within\ 100\ of\ mean) = 0.9738 - 0.0262 = 0.9476$$

Answer to problem 6 part (a) (textbook 8.118)

$$t_{0.05} = 1.860$$

Answer to problem 6 part (b)

$$t_{0.10} = 1.397$$

Answer to problem 6 part (c)

$$-t_{0.01} = -2.896$$

Answer to problem 6 part (d)

$$t_{0.025} = 2.306$$

$$-t_{0.025} = -2.306$$

$$area\ divided\ by -2.306\ and\ 2.306$$

Answer to problem 7 (textbook problem 8.74)

$$n = 30$$

$$mean = 2.27\ million$$

$$population\ s.d = 0.5\ million$$

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

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

$$z_{\frac{\alpha}{2}} = 2.576$$

$$P\left(2.27 - 2.576 * \frac{0.5}{\sqrt{30}} < u < 2.27 + 2.576 * \frac{0.5}{\sqrt{30}}\right) = 0.99$$

$$99\%\ confidence\ interval = 2.03\ to\ 2.51$$

Interpretation: 99% confident that mean gross earning of concerts is between 2.03 million to 2.51 million.

Answer to problem 8 part (a) (textbook problem 8.90)

$$z_{\frac{\alpha}{2}}\frac{\sigma}{\sqrt{n}} = 2.576 * \frac{0.5}{\sqrt{30}} = 0.24$$

Answer to problem 8 part (b)

We can be 99% confident that the error will not exceed 0.24 million.

Answer to problem 8 part (c)

$$a = 1 - 0.95 = 0.05$$

$$z_{0.025} = 1.960$$

$$n = \left(\frac{z_{\frac{\alpha}{2}} * \sigma}{E}\right)^2 = \left(\frac{1.96 * 0.5}{0.1}\right)^2 = 96.04 \approx 97$$

Answer to problem 8 part (d)

$$mean = 2.35$$

$$n = 97$$

$$P\left(2.35 - 1.96 * \frac{0.5}{\sqrt{97}} < u < 2.35 + 1.96 * \frac{0.5}{\sqrt{97}}\right) = 0.95$$

$$95\%\ confidence\ interval: 2.25\ to\ 2.45\ million$$

Answer to problem 9 part (a) (textbook problem 8.130 a)

$$mean = 5.16$$

$$s.d = 2.3$$

$$n = 20$$

$$\alpha = 1 - 0.90 = 0.1$$

$$z_{\frac{0.1}{2}} = 1.729$$

$$P\left(5.16 - 1.729 * \frac{2.3}{\sqrt{20}} < u < 5.16 + 1.729 * \frac{2.3}{\sqrt{20}}\right) = 0.95$$

$$90\%\ confidence\ interval = 4.27\ to\ 6.05$$

Answer to problem 10 part (a) (not in textbook)

$$null: average \leq 3800$$

$$alternative: average > 3800$$

Answer to problem 10 part (b)

$$null: average \geq 3800$$

$$alternative: average < 3800$$