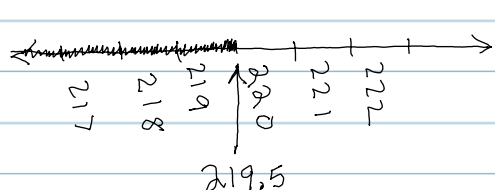


Math 110 ~ Chapter 7 Review Problems

1. The president's voter approval is 45%. If you pick 500 voters randomly, what is the probability that less than 220 approve? Use the normal approximation.

$$P(X < 220) = P(X < 219.5) = P(Z < -0.49) = 0.3121$$



Check ✓
 $p = .45, q = 1 - p = .55$
 $np = 500(.45) = 225 \geq 10$
 $nq = 500(.55) = 275 \geq 10$

$\mu = np = 225$
 $\sigma = \sqrt{npq} = \sqrt{500(.45)(.55)} = 11.12$

$$\leadsto X = 219.5 \rightarrow Z = \frac{X - \mu}{\sigma} = \frac{219.5 - 225}{11.12} = -0.49 \leadsto Z \rightarrow .09$$

Table A1 $\rightarrow -0.4 \rightarrow .3121$

2. You survey 500 people & find that 271 approve of the president. Give a 97% confidence interval for the approval ratings. (Approval rating = population proportion)

Check: @ least 10 successes/failures
 271 successes ≥ 10 ✓
 500 - 271 failures = 229 ≥ 10

$$E = Z_{\alpha/2} \sqrt{\frac{\hat{p}\hat{q}}{n}} = 2.17 \sqrt{\frac{.542 \cdot .458}{500}} = .048$$

$$\alpha = 1 - \text{Conf. level} = 1 - .97 = .03$$

$$1 - \alpha/2 = 1 - .03/2 = 1 - .015 = .9850$$

$$\hat{p} = \frac{X}{n} = \frac{271}{500} = .542$$

$$\hat{q} = 1 - \hat{p} = .458$$

Table A1
 $\alpha/2 = .015$
 $\uparrow$
 $.015 \rightarrow .9850$
 $\uparrow$
 $2.1 \leftarrow Z_{\alpha/2} = 2.17$

Conf. Int. $\hat{p} - E < p < \hat{p} + E$
 $.542 - .048 < p < .542 + .048$
 $.494 < p < .590$

We are 97% confident that the approval rating is between 49.4% and 59.0%.

3. What sample size would bring this to a 3% error with 95% confidence? ($\alpha = 1 - .95, 1 - \alpha/2 = .9750$)

$$n = \frac{Z_{\alpha/2}^2 \hat{p}\hat{q}}{E^2} = \frac{1.96^2 \cdot .542 \cdot .458}{.03^2} = 1059.6 \rightarrow 1060$$

Table A1
 $\alpha/2 = .025$
 $\uparrow$
 $.025 \rightarrow .9750$
 $\uparrow$
 $1.9 \leftarrow Z_{\alpha/2} = 1.96$