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Chapter 7 Problem Solving Set A:

Bronze:

a) $X \sim B(30, 0.36)$

$H_0: p = 0.36$

$H_1: p \neq 0.36$

5% significance level
(2.5% for each tail)

At the lower tail:

$$P(X \leq 5) = 0.0178 < 0.025$$

$\therefore X \leq 5$ is part of the critical region

At the upper tail:

$$\begin{aligned} P(X > 17) &= 1 - P(X \leq 16) \\ &= 1 - 0.9833 \\ &= 0.0168 < 0.025 \end{aligned}$$

$\therefore X > 17$ is part of the critical region

b) $0.0178 + 0.0168 = 0.0346$
 $\hookrightarrow \underline{3.46\%}$

c) 16 lies within the acceptance region so accept the null hypothesis

Silver:

a) $X \sim B(35, 0.45)$

$H_0: p = 0.45$

$H_1: p \neq 0.45$

10% significance level
(5% significance level for each tail)

At the lower tail:

$P(X \leq 10) = 0.0354 \rightarrow$ This is closest to 0.05 so $(X \leq 10)$ is part of critical region

$P(X \leq 11) = 0.0729$

At the upper tail:

$$\begin{aligned} P(X > 21) &= 1 - P(X \leq 20) \\ &= 1 - 0.9464 \\ &= 0.0536 \rightarrow \text{This is closest to } 0.05 \text{ so } (X > 21) \text{ is part of critical region.} \end{aligned}$$

b) $0.0354 + 0.0536 = \underline{0.089}$

c) 22 lies within the critical region so you reject the null hypothesis

Gold:

a) $X \sim B(20, 0.4)$

$H_0: p = 0.4$

$H_1: p \neq 0.4$

5% significance level
(2.5% significance level for each tail)

At the lower tail:

$$P(X \leq 3) = 0.01596 < 0.025$$

$\therefore X \leq 3$ is part of critical region

At the upper tail:

$$\begin{aligned} P(X > 13) &= 1 - P(X \leq 12) \\ &= 1 - 0.97897 \\ &= 0.02103 < 0.025 \end{aligned}$$

$\therefore X > 13$ is part of critical region

b) $0.01596 + 0.02103 = 0.03699$

$Y \sim B(15, 0.03699)$

$P(X < 4) = P(X \leq 3)$
 $\hookrightarrow 0.9482$

$1 - \text{Ans} = 1.84 \times 10^{-3} = \underline{0.00184}$