Confidence Intervals for the Population Proportions (p)

Assumptions : Binomial Event, $n\,p \geq 5$, $n\,q \geq 5$

1. Find $\hat{p} = \frac{x}{n}$, $\hat{q} = 1 - \hat{p}$

2. Determine the critical value $\pm z_{\alpha/2}$

   Calculate $\frac{\alpha}{2}$ where α = 1 – (Confidence Level)

   Look for $\frac{\alpha}{2}$ in body of the table (use Table A-2 “backwards”)

   The corresponding z score is the critical value.

3. Calculate $E = z_{\alpha/2}\sqrt{\frac{\hat{p}\,\hat{q}}{n}}$

4. $\hat{p} - E < p < \hat{p} + E$

Confidence Intervals for the Population Mean (μ)

Assumptions : Central Limit Theorem applies, $\bar{x}$ is known or can be calculated

1. Choose z or t : If σ is known use the Normal Distribution ($z_{\alpha/2}$)

   If σ is unknown use the Student’s t Distribution ($t_{\alpha/2}$)

2. Determine the critical value using either Table A-2 or A-3

   To find $z_{\alpha/2}$: Calculate $\frac{\alpha}{2}$ where α = 1 – (Confidence Level)

   Look for $\frac{\alpha}{2}$ in body of the table (use A-2 “backwards”)

   The corresponding z score is the critical value.

   To find $t_{\alpha/2}$: α = 1 – (Confidence Level)
   ROW = degrees of freedom = n – 1
   COLUMN = α under “Area in two tails”

3. Calculate $E = \frac{z_{\alpha/2}\,\sigma}{\sqrt{n}}$ or $E = \frac{t_{\alpha/2}\,s}{\sqrt{n}}$

4. $\bar{x} - E < \mu < \bar{x} + E$

Sample Size (n) Needed to Estimate the Population Proportion (p)

$$n = \frac{\left(z_{\alpha/2}\right)^2 \hat{p}\,\hat{q}}{E^2}$$

$z_{\alpha/2}$: Calculate $\frac{\alpha}{2}$ where α = 1 – (Confidence Level)

Look for $\frac{\alpha}{2}$ in body of the table (use Table A-2 “backwards”)

The corresponding z score is the critical value.

$\hat{p}$ = estimated proportion from a prior study. If $\hat{p}$ is unknown, use 0.5

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

E : Margin of Error (usually given)

Sample Size (n) Needed to Estimate the Population Mean (μ)

$$n = \left[\frac{z_{\alpha/2}\,\sigma}{E}\right]^2$$

$z_{\alpha/2}$: Calculate $\frac{\alpha}{2}$ where α = 1 – (Confidence Level)

Look for $\frac{\alpha}{2}$ in body of the table (use Table A-2 “backwards”)

The corresponding z score is the critical value.

σ : use s from a sample or $\frac{range}{4}$ (Range Rule of Thumb)

E : Margin of Error (usually given)

Hypothesis Testing for Claims about a Proportion

Assumptions : Binomial Event, $n\,p \geq 5$, $n\,q \geq 5$

1. Write the claim symbolically in terms of p.

2. Write the opposite symbolically in terms of p.

3. Identify the Null and Alternative Hypothesis : H_0 must contain $=, \geq$, or $\leq$
   H_1 must contain $\neq, <$, or $>$

4. Choose the Significance Level (α). This is usually given in the word problem.

   Identify the test type :

Symbol in H_1	Test Type	
<	left tailed	
>	right tailed	
$\neq$	two tailed	

5. Find the Critical Value z_{CRIT} using Table A-3

   z_{CRIT} : ROW = bottom row Column = α and Test Type

6. Calculate the Test Statistic : $z_{TEST} = \dfrac{\hat{p} - p}{\sqrt{\dfrac{p\,q}{n}}}$

7. Draw the bell curve to locate both the Critical Region(s) and the Test Statistic.

8. Reject H_0 if the Test Statistic lies beyond the Critical Value.

9. Write the conclusion using the chart on p. 397.

10. Calculate p-value

    Left Tailed Test : p-value = area to the left of z_{TEST}

    Right Tailed Test : p-value = area to the right of z_{TEST}

    Two Tailed Test : p-value = 2 × (area outside z_{TEST})

Hypothesis Testing for Claims about a Mean

Assumptions : Central Limit Theorem applies

1. Write the claim symbolically in terms of μ.

2. Write the opposite symbolically in terms of μ.

3. Identify the Null and Alternative Hypothesis : H_0 must contain $=, \geq$, or $\leq$
   H_1 must contain $\neq, <$, or $>$

4. Choose the Significance Level (α). This is usually given in the word problem.

   Identify the test type :

Symbol in H_1	Test Type	
<	left tailed	
>	right tailed	
$\neq$	two tailed	

5. Choose z or t : If σ is known use the Normal Distribution (z)

   If σ is unknown use the Student's t Distribution (t)

6. Find the Critical Value using Table A-3 (We only use one or the other, not both!)

   z_{CRIT} : ROW = bottom row column = α and Test Type
   t_{CRIT} : ROW = n –1 column = α and Test Type

7. Calculate the Test Statistic (We only use one or the other, not both!)

   $z_{TEST} = \dfrac{\bar{x} - \mu_{\bar{x}}}{\dfrac{\sigma}{\sqrt{n}}}$ $t_{TEST} = \dfrac{\bar{x} - \mu_{\bar{x}}}{\dfrac{s}{\sqrt{n}}}$

8. Draw the bell curve to locate both the Critical Region(s) and the Test Statistic.

9. Reject H_0 if the Test Statistic lies beyond the Critical Value.

10. Write the conclusion using the chart on p. 397.

11. Calculate p-value if z_{TEST} was used (see Step 10 at left)