Question: In your calculations please use at most three decimal points. F...

In your calculations please use at most three decimal points. For brief explanations, two or three sentences is enough.

A survey is done by a news agency for presidential elections. The agency reported that the Reds are leading Blues by 11%, because 48% of the participants supported Red Party's candidate while 37% supported Blue Party's candidate. Note that 400 people participated in the survey and the population size is significantly larger than 400.

a) What margin of error should be reported for each candidate's estimated vote rate?

b) What margin of error should be reported for the estimated lead?

c) Which candidate's margin of error is larger than the other? Explain the reason.

d) How would margin of errors change if there were 1800 participants in the survey? Briefly explain.

NOTE: Use 95% confidence interval for calculating margin of errors.

Expert Answer

Anonymous answered this
179 answers

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For population proportion,
Margin of error (M.E)

$$M.E = z^* \sqrt{\frac{p(1-p)}{n}}$$

$p \rightarrow$ Sample Proportion.
$z^* \rightarrow$ Value of z^* for selected Confidence levels
For 95% of Confidence level
$z^* = 1.9.6$

(a) For red party's Candidate.
Sample proportion $p = 48\% = 0.48$
Sample size $n = 400$
$z^* = 1.96$
Margin of Error (M.E) $= z^* \sqrt{\frac{p(1-p)}{n}}$.

$$M.E = 1.96 \times \sqrt{\frac{0.48(1-0.48)}{400}}$$

$$M.E = 1.96 \times \sqrt{\frac{(0.48) \times (0.52)}{400}}$$

$$= 1.96 \times \sqrt{0.000624}$$

$$= 1.96 \times 0.025 = 0.049$$

For red Party's Candidate
margin of error $= 0.049$

MOTHER BOOKS

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For Blue party Candidate
Sample proportion, $p = 37\% = 0.37$
Sample size $n = 400$
Table value of z Corresponding to Confidence level 95% is $z^* = 1.96$
Margin of error (M.E) $= z^* \sqrt{\frac{p(1-p)}{n}}$.
$p = 0.37$, $1-p = 1-0.37 = 0.63$
$z^* = 1.96$

$$M.E = 1.96 \times \sqrt{\frac{0.37 \times 0.63}{400}}$$

$$= 1.96 \times \sqrt{0.00058}$$

$$= 1.96 \times 0.0241 = 0.0472$$

For Blue Party Candidate
margin of error $= 0.0472$

(b) For estimated lead.
Sample proportion $p = 11\% = 0.11$
Sample size, $n = 400$
Margin of error (M.E) $= z^* \sqrt{\frac{p(1-p)}{n}}$
$p = 0.11$, $1-p = 1-0.11 = 0.89$
z^* (from table) $= 1.96$, $n = 400$

$$M.G = 1.96 \times \sqrt{\frac{0.11 \times 0.89}{400}}$$

$$= 1.96 \times \sqrt{0.000245}$$

$$= 1.96 \times 0.0157 = 0.031$$

For estimated lead,
margin of error $= 0.031$

(c) Margin of error for Red $= 0.049$
Margin of error for Blue $= 0.042$
Margin of error is larger for Red party.

Here sample size n and Confidence level are same,
Margin of error of Red party increase due to increase in proportion,

As Variability in the Proportion increases, Margin of error increases.
So the Margin of error of Red party is higher than the Blue party

(4) If there were 1800 participants in the survey, $n = 1800$.

Then, Margin of error of Red.

$$(M.G)_{Red} = z^* \sqrt{\frac{p(1-p)}{n}}$$

here $n = 1800$

$$(M.G)_{Red} = 1.96 \sqrt{\frac{(0.48)\times(0.52)}{1800}}$$

$$= 1.96 \times \sqrt{0.000139}$$

$$= 1.96 \times 0.0118$$

$$= 0.023$$

Margin of error Red when $n = 1800$ is 0.023

Margin of error of Blue when $n = 1800$

$$(M.G)_{Blue} = z^* \sqrt{\frac{p(1-p)}{1800}}$$

$$= 1.96 \times \sqrt{\frac{0.37 \times 0.63}{1800}}$$

$$= 1.96 \times \sqrt{0.000129}$$

$$= 1.96 \times 0.0114$$

$$= 0.022$$

MOTHER BOOKS

(5)

Margin of error of Blue Party when $n = 1800$ is 0.022.

Margin of error of estimated lead, when $n = 1800$

$$(M.E)_{lead} = z^* \sqrt{\frac{p(1-p)}{n}}$$

$$= 1.96 \times \sqrt{\frac{(0.11)\times(0.89)}{1800}}$$

$$= 1.96 \times \sqrt{0.0000544}$$

$$= 1.96 \times 0.00738$$

$$(M.G)_{lead} = 0.0145$$

Margin of error of estimated lead, when $n = 1800$ is 0.0145

As the Sample size increases margin of error decreases.

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