Margin of error. M.E.

Crude way of find M.E

$$= \frac{1}{\sqrt{n}}$$

n = number in sample.

What is margin of error in sume of 1001 people.

$$ME = \frac{1}{\sqrt{n}} = \frac{1}{\sqrt{1001}} = 3\%$$

We say we are 95% confident margin of error is 3% = ±

SF 31%

95% of confidence 28% and 34%

A beauty company surveys a sample of 97 people. Find the margin of error.
63 say they look younger. Form a confidence intervale for "cream making you look younger".

Margin of error $= \frac{1}{\sqrt{n}}$ at 95% confidence interval.

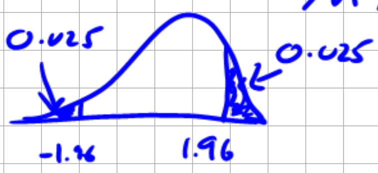
$n = 97$ Margin of error $= M.E.$

$$= \frac{1}{\sqrt{97}} = 0.10$$

Better formula

Sample of 97 $\Rightarrow$ agree 63

Sample proportion $= \hat{p} = \frac{63}{97} = 0.65$



$$ME = 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$= 1.96\sqrt{\frac{\frac{63}{97}\left(\frac{34}{97}\right)}{97}} = 0.094$$

$$= 0.09$$

95% confidence for the population proportion p.

$$\hat{p} - \frac{1}{\sqrt{n}} \leq p \leq \hat{p} + \frac{1}{\sqrt{n}} \quad \text{(crude)}$$

$$\hat{p} - 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \leq p \leq \hat{p} + 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \quad \text{(better)}$$

$$0.65 - 0.09 \leq p \leq 0.65 + 0.09$$

$0.56 \leq p \leq 0.74$ of the population agree cream works. I am 95% sure this is true.

$\hat{p}$ = sample proportion.

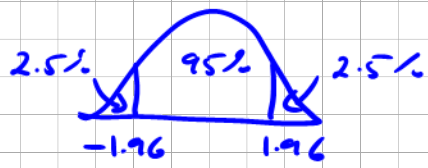
p = population proportion.

Standard error = $\sqrt{\dfrac{\hat{p}(1-\hat{p})}{n}}$ (tables)

Margin of error at 95% is

$\pm \dfrac{1}{\sqrt{n}}$ or

$\pm 1.96 \sqrt{\dfrac{\hat{p}(1-\hat{p})}{n}}$



Confidence interval

$$\hat{p} - ME \le p \le \hat{p} + ME.$$

In a sample of 453 people 201 would vote F.G.. Set up a 95% confidence interval for those who vote F.G.

$$\hat{p} = \frac{201}{453} = 0.44$$

S.E = standard error

$$\sigma_{\hat{p}} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} =$$

M.E = margin of error

$$ME = 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = 1.96\sqrt{\frac{\frac{201}{453}\left(\frac{252}{453}\right)}{453}}$$

$$= 0.045$$

$$= 0.05$$

$$\hat{p} - ME \le p \le \hat{p} + ME$$

$$0.44 - 0.05 \le p \le 0.44 + 0.05$$

$$0.39 \le p \le 0.49$$

I'm 95% sure support is between 39% and 49% for F.G.

Hypothesis Testing

A company claims vaccine has an 86% success rate. From a sample of 863 people 790 have immunity. Form a null hyp and test the hyp.

Null hyp = the claim = H_0

H_0 . 86% = 0.86 success rate

Alternative = the negative

H_A = Not 86% success rate

Set up the confidence interval.

$$\hat{p} = \frac{790}{863} = 0.915$$

$$\text{Standard error} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{\frac{\frac{790}{863}\left(\frac{173}{863}\right)}{863}}$$

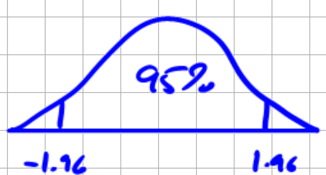
$$= 0.01$$

$$\text{Margin of error} = \pm 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$= \pm 1.96(\text{standard error})$$

$$= \pm 1.96(0.01)$$

$$= \pm(0.018) = 0.018$$



Confidence interval for population

$\hat{p} - ME \leq p \leq \hat{p} + ME$ ME = margin of error

$0.915 - 0.018 \leq p \leq 0.915 + 0.018$

$0.897 \leq p \leq 0.933$

0.86 is not in this interval

We reject H_0.

Conclusion Immunity is not at 86%

Note We reject or we fail to reject.

A company produces new chocolate bar. It claims 78% of customers are satisfied with the bar. Out of 963 people 732 claim they are satisfied with bar. Form a hypothesis test for satisfaction.

H_0 . 78% satisfaction

H_A . Not 78% satisfaction.

$$\hat{p} = \frac{732}{963} = 0.76$$

Margin of error $\quad 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

$$= 1.96\sqrt{\frac{\left(\frac{244}{321}\right)\left(\frac{77}{321}\right)}{963}} = 0.03$$

$$\hat{p} - ME \le p \le \hat{p} + ME$$

$$0.76 - 0.03 \le p \le 0.76 + 0.03$$

$$0.73 \le p \le 0.79$$