Newtoffel 8485

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Chapter 8

Example 8.1

$\bar{X} = 7 \quad EBM = 2.5$

Find confidence interval (C.I) = ?

$C.I = \bar{X} \pm EBM$

$C.I = \bar{X} - EBM$	$C.I = \bar{X} + EBM$
$C.I = 7 - 2.5$	$C.I = 7 + 2.5$
$C.I = 4.5$	$C.I = 9.5$

Try It 8-1

$\bar{X} = 15, \quad EBM = 3.2$

Find $C.I = ?$

$C.I = \bar{X} \pm EBM$

$C.I = \bar{X} + EBM$	$C.I = \bar{X} - EBM$
$C.I = 15 + 3.2$	$C.I = 15 - 3.2$
$C.I = 18.2$	$C.I = 11.8$

Example 8.2

$\sigma = 3, \quad n = 36, \quad \bar{X} = 68$

Find C.I 90%.

$C.I = \bar{X} \pm EBM$

$EBM = (Z_{1-\alpha/2})(\sigma/\sqrt{n})$

$C.I = 90\%$

$1 - \alpha = 90\%$

$\alpha = 10\%$

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$\alpha = 0.10\%$

$\alpha/2 = \frac{0.10}{2}$

$\alpha/2 = 0.05$

$1-\alpha/2 = 1-0.05$

$1-\alpha/2 = 0.95 \rightarrow$ Find Table

$1-\alpha/2 = 1.65$

$EBM = (1.65)(3/\sqrt{36})$

$EBM = (1.65)(0.5)$

$EBM = 0.825$

$C.I = \bar{X} + EBM$	$C.I = \bar{X} - EBM$
$C.I = 68 + 0.825$	$C.I = 68 - 0.825$
$C.I = 68\ 825$	$C.I = 67-175$

Try It 8.2

$\sigma = 6,\ n = 28,\ \bar{x} = 36$

Find C.I 90%

$C.I = \bar{X} \pm EBM$

$EBM = (Z_{1-\alpha/2})(\sigma/\sqrt{n})$

$C.I = 90\%$

$1-\alpha = 90\%$

$1-\alpha = 10\%$

$1-\alpha = 0.10\%$

$1-\alpha/2 = 0.10$

$1-\alpha/2 = 0.05$

$1-\alpha/2 = 1-0.05$

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$1-\alpha/2 = 0.95$

$1-\alpha/2 = 1.65$

$EBM = (1.65)(6/\sqrt{28})$

$EBM = (1.65)(1.1339)$

$EBM = 1.8709$

$C.I = \bar{X} + EBM$	$C.I = \bar{X} - EBM$
$C.I = 36 + 1.8709$	$C.I = 36 - 1.8709$
$C.I = 37.8709$	$C.I = 34.1291$

Example 8.4

$\sigma = 3, \ n = 36, \ \bar{x} = 68$

Find C.I 95%

$C.I = \bar{X} \pm EBM$

$EBM = (Z_{1-\alpha/2})(\sigma/\sqrt{n})$

$C.I = 95\%$

$C.I = 0.95$

$1-\alpha = 1-0.95$

$1-\alpha = 0.05$

$1-\alpha/2 = \frac{0.05}{2}$

$1-\alpha/2 = 0.025$

The area is right and the area is left

$1-\alpha/2 = 1-0.025$

$1-\alpha/2 = 0.975$

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$1-\alpha/2 = 1.96$

$EBM = (1.96)(3/\sqrt{36})$

$EBM = (1.96)(0.5)$

$EBM = 0.98$

$C.I = \bar{x} + EBM$	$C.I = \bar{x} - EBM$
$C.I = 68 + 0.98$	$C.I = 68 - 0.98$
$C.I = 68.98$	$C.I = 67.02$

Try it 8.4

$\sigma = 6$, $\bar{x} = 36$, $n = 20$

Find C.I 95%

$C.I = 95\%$ | $C.I = \bar{x} - EBM$

$EBM = (Z_{1-\alpha/2})(\sigma/\sqrt{n})$

$C.I = 0.95$

$1-\alpha = 1-0.95$

$1-\alpha = 0.05$

$1-\alpha/2 = \frac{0.05}{2}$

The area is right $1-\alpha/2 = 0.025$

$1-\alpha/2 = 1-0.025$

$1-\alpha/2 = 0.975$

The area is left $1-\alpha/2 = 1.96$

$EBM = (1.96)(6/\sqrt{20})$

$EBM = (1.96)(1.3416)$

$EBM = 2.6295$

$C.I = \bar{x} + EBM$	$C.I = \bar{x} - EBM$
$C.I = 36 + 2.6295$	$C.I = 36 - 2.6295$
$C.I = 38.6295$	$C.I = 33.3705$

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Example 8.5

C.I = 90%, σ = 3, n = 100, n = 25. Find EBM

C.I = 90%

$1-\alpha = 90$

$\alpha = 10 \Rightarrow \alpha = 0.10$

$\alpha/2 = \frac{0.10}{2}$

$\alpha/2 = 0.05$

$1-\alpha/2 = 1-0.05$

$1-\alpha/2 = 0.95$

$1-\alpha/2 = 1.65$

$EBM = (Z_{1-\alpha/2})\,\sigma/\sqrt{n}$

$EBM = (Z_{1-\alpha/2})(\sigma/\sqrt{n})$	$EBM = (Z_{1-\alpha/2})(\sigma/\sqrt{n})$
$EBM = (1.65)(3/\sqrt{100})$	$EBM = (1.65)(3/\sqrt{25})$
$EBM = (1.65)(0.3)$	$EBM = (1.65)(0.6)$
$EBM = 0.495$	$EBM = 0.99$

Try It 8.5

$\bar{x} = 36$, $\sigma = 6$, $n = 50$

Find C.I 90%.

Solution: yeh question Exp 8.2 ki tarah karni hai bus value change hain

Example 8.6

C.I = (67.18, 68.82), $\bar{x} = 68$

Use Sample mean

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$EBM = 68.82 - 68$

$\boxed{EBM = 0.82}$

Don't Use Sample mean

$EBM = \frac{68.82 - 67.18}{2}$

$EBM = \frac{1.64}{2}$

$\boxed{EBM = 0.82}$

Use EBM

$\bar{x} = 68.82 - 0.82$

$\boxed{\bar{x} = 68}$

Don't Use EBM

$\bar{x} = \frac{67.18 + 68.82}{2}$

$\bar{x} = \frac{136}{2}$

$\boxed{\bar{x} = 68}$

Try It 8.6

C.I = (42.12, 47.88)

Find EBM and $\bar{x}$

$EBM = \frac{47.88 - 42.12}{2}$

$EBM = \frac{5.76}{2}$

$\boxed{EBM = 2.88}$

$\bar{x} = \frac{42.12 + 47.88}{2}$

$\bar{x} = \frac{90}{2}$

$\boxed{\bar{x} = 45}$

Example 8.3

Total amount of phones = 1.11 + 1.48 + 1.43 + --- + 1.38

= 30.712

Total number of phones = 30

σ = 0.337, Find 98% CI

Solution.

$$\bar{x} = \frac{30.712}{30}$$

$\bar{x}$ = 1.024

n = 30

$$EBM = (Z_{(1-\alpha/2)})\left(\frac{\sigma}{\sqrt{n}}\right)$$

C.I = 98%

C.I = 0.98

$1-\alpha = 1-0.98$

$1-\alpha = 0.02$

$1-\alpha/2 = \frac{0.02}{2}$

$1-\alpha/2 = 0.01$ → The ared is right

$1-\alpha/2 = 1-0.01$

$1-\alpha/2 = 0.99$ → The area is left

0.99 is equal to (2.326)

$$EBM = (2.326)\frac{0.337}{\sqrt{30}}$$

$EBM = (2.326)(0.0615)$

$\boxed{EBM = 0.1430}$

$\bar{x} \pm EBM$

$\bar{x} + EBM \rightarrow 1.024 + 0.1430 = 1.167$

$\bar{x} - EBM \rightarrow 1.024 - 0.1430 = 0.881$

Try It 8.3

Total amount of phones $1.48+0.8+1.15+\cdots+0.869=18.$

Total number of phones $=20$

$\sigma = 0.337$, Find CI 93%

Solution:

$$\bar{x} = \frac{18.801}{20}$$

$$\bar{x} = 0.9401$$

$$n = 20$$

$$EBM = (Z_{1-\alpha/2})\left(\frac{\sigma}{\sqrt{n}}\right)$$

$CI = 93\%$

$$CI = 0.93$$

$$1-\alpha = 1-0.93$$

$$1-\alpha = 0.07$$

$$1-\alpha/2 = \frac{0.07}{2}$$

$$1-\alpha/2 = 0.035$$

$$1-\alpha/2 = 1-0.035$$

$$1-\alpha/2 = 0.965$$

$$Z_{1-\alpha/2} = 1.82$$

$$EBM = (1.82)\left(\frac{0.337}{\sqrt{20}}\right)$$

$$EBM = (1.82)(0.0754)$$

$$EBM = 0.1372$$

$$\bar{x} \pm EBM$$

$$\bar{x} + EBM \rightarrow 0.9401 + 0.1372 = 1.0773$$

$$\bar{x} - EBM \rightarrow 0.9401 - 0.1372 = 0.8029$$

Example 8.7

$\sigma = 15$, $EBM = 2$, $CI = 95\%$

$n = ?$

Solution

$$n = (Z_{1-\alpha/2})(\sigma/\sqrt{n})$$

$$n = \frac{Z^2_{1-\alpha/2} \cdot \sigma^2}{EBM^2}$$

$CI = 95\%$

$CI = 0.95$

$1-\alpha = 1-0.95$

$1-\alpha = 0.05$

$1-\alpha/2 = \frac{0.05}{2}$

$1-\alpha/2 = 0.025$

$1-\alpha/2 = 1-0.025$

$1-\alpha/2 = 0.975$

$Z_{1-\alpha/2} = 1.96$

$$n = \frac{(1.96)^2(15)^2}{(2)^2}$$

$$n = \frac{(3.8416)(225)}{4}$$

$$n = \frac{864.36}{4}$$

$n = 216.09$

$\boxed{n = 217}$

Try It 8.7

$\sigma = 3$, $EBM = 1$, $CI = 95\%$

$n = ?$

Solution:

$$n = \frac{Z^2_{1-\alpha/2} \cdot \sigma^2}{EBM^2}$$

95% is equal to 1.96

$Z_{1-\alpha/2} = 1.96$

$$n = \frac{(1.96)^2 (13)^2}{(1)^2}$$

$$n = \frac{(3.8416)(9)}{1}$$

$$\boxed{n = 34.5744}$$

Example 8.8

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{8.6 + 9.4 + 7.9 + 6.8 + 8.3 + 7.3 + 9.2 + 9.6 + 8.7 + 11.4 + \cdots + 6.9}{15}$$

$$\bar{x} = \frac{123.4}{15}$$

$$\bar{x} = 8.2267$$

$n = 15$ $\quad S = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$

$$S = \sqrt{\frac{(x-\bar{x})^2 + (x-\bar{x})^2 - \cdots + (x-\bar{x})^2}{n-1}}$$

$$S = \sqrt{\frac{(8.6 - 8.2267)^2 + (9.4 - 8.2267)^2 + \cdots + (6.9 - 8.2267)^2}{15-1}}$$

$S = 1.6722$

$CI = 95\%$

$CI = 0.95$

$1 - \alpha = 1 - 0.95$

$1 - \alpha = 0.05$

$1 - \alpha/2 = \frac{0.05}{2}$

$1 - \alpha/2 = 0.025$

$1 - \alpha/2 = 1 - 0.025$

$1 - \alpha/2 = 0.975$

$t_{1-\alpha/2} = 0.975(14)$

$EBM = (t_{1-\alpha/2}^{(n-1)})\left(\frac{S}{\sqrt{n}}\right)$

$t_{1-\alpha/2} = 2.14$

$EBM = (2.14)\frac{1.6722}{\sqrt{15}}$

$EBM = (2.14)\left(\frac{1.6722}{3.8729}\right)$

$EBM = (2.14)(0.4318)$

$EBM = 0.9241$

$\bar{x} \pm EBM$

$\bar{x} + EBM \rightarrow 8.2267 + 0.9241 = 9.1508$

$\bar{x} - EBM \rightarrow 8.2267 - 0.9241 = 7.3026$

y 8.8

8.2, 9.1, 7.7, 8.6, 6.9, 11.2, 10.1, 9.9, 8.9, 9.2, 7.5, 10.5

$n = 12$

$$\bar{x} = \frac{\Sigma x}{n}$$

$$\bar{x} = \frac{8.2+9.1+7.7+8.6+6.9+11.2+10.1+9.9+8.9+9.2+7.5+10.5}{12}$$

$$\bar{x} = \frac{107.8}{12}$$

$$\bar{x} = 8.98$$

$$S = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

$$S = \sqrt{\frac{(x-\bar{x})^2+(x-\bar{x})^2+---+(x-\bar{x})^2}{n-1}}$$

$$S = \sqrt{\frac{(8.2-8.98)^2+(9.1-8.98)^2+(7.7-8.98)^2+---+(10.5-8.98)^2}{12-1}}$$

Example 8.9

$n = 20$

$\bar{x} = \frac{\Sigma x}{n}$

$\bar{x} = \frac{79 + 145 + 147 + 160 + \cdots + 99}{20}$

$\bar{x} = \frac{2549}{20}$

$\bar{x} = 127.45$

$S = \sqrt{\frac{\Sigma (x - \bar{x})^2}{n - 1}}$

$S = \sqrt{\frac{(79 - 127.45)^2 + (145 - 127.45)^2 + \cdots + (99 - 127.45)^2}{20 - 1}}$

$S = \sqrt{\frac{12808.95}{19}}$

$S = \sqrt{674.1553}$

$S = 25.965$

$EBM = (t_{1-\alpha/2\,(n-1)})\left(\frac{S}{\sqrt{n}}\right)$

$CI = 90\%$

$CI = 0.90$

$1 - \alpha = 1 - 0.90$

$1 - \alpha = 0.10$

$1 - \alpha/2 = \frac{0.10}{2}$

$1 - \alpha/2 = 0.05$

$1 - \alpha/2 = 1 - 0.05$

$1 - \alpha/2 = 0.95$

$EBM = (0.95\,(20-1))\left(\frac{25.965}{\sqrt{20}}\right)$

$EBM = (0.95(19))\left(\frac{25.965}{4.4721}\right)$

$EBM = (1.729)(5.8054)$

$EBM = 10.0384$

$\bar{x} \pm EBM$

$\bar{x} + EBM$

$127.45 + 10.0384 = 137.4884$

$\bar{x} - EBM$

$127.45 - 10.0384 = 117.412$

Try It 8-9

$n = 15$, $CI = 98\%$

$$\bar{x} = \frac{\Sigma x}{n}$$

$$\bar{x} = \frac{0+3+1+20+9+\cdots+5}{15}$$

$$\bar{x} = \frac{92}{15}$$

$$\bar{x} = 6.1333 \rightarrow EBM = (t_{1-\alpha/2}(n-1))\left(\frac{s}{\sqrt{n}}\right)$$

$$s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

$$s = \sqrt{\frac{(0-6.1333)^2+(3-6.1333)+\cdots+(5-6.1333)^2}{15-1}}$$

$$s = \sqrt{\frac{\begin{array}{l}(-6.1333)^2+(-3.1333)^2+(-5.1333)^2+(13.8667)^2 \\ +(2.8667)^2+(-1.1333)^2+(3.8667)^2+(-5.1333)^2+ \\ (3.8667)^2+(-2.1333)^2+(7.8667)^2+(-4.1333)^2+ \\ (-2.1333)^2+(-2.1333)^2+(-1.1333)^2\end{array}}{15-1}}$$

$$s = \sqrt{\frac{\begin{array}{l}37.6174+9.8176+26.3508+192.2854+8.21797 \\ +1.2844+14.9514+26.3508+14.9514+4.55097+ \\ 61.88497+17.0842+4.55097+4.55097+1.2844\end{array}}{14}}$$

$$s = \sqrt{\frac{425.7337}{14}}$$

$$s = \sqrt{30.4096}$$

$$s = 5.5145$$

$$CI = 0.98$$

$$1-\alpha = 1-0.98$$

$$1-\alpha = 0.02$$

$$1-\alpha/2 = \frac{0.02}{2}$$

$1-\alpha/2 = 0.01$

$1-\alpha/2 = 1-0.01$

$t_{1-\alpha/2} = 0.99$

$EBM = (0.99)(15-1)\left(\frac{5.5145}{\sqrt{15}}\right)$

$EBM = (0.99)(14)\left(\frac{5.5145}{3.8729}\right)$

$EBM = (2.624)(1.4239)$

$EBM = 3.7363$

$\bar{X} \pm EBM$

$\bar{X} + EBM$

$6.1333 + 3.7363 = 9.8696$

$\bar{X} - EBM$

$6.1333 - 3.7363 = 2.397$

Practice

Question. 17

$\sigma = 0.2$, $n = 20$, $CI = 90\%$, $EBM = ?$

$EBM = (z_{1-\alpha/2})\left(\frac{\sigma}{\sqrt{n}}\right)$

$CI = 90\%$

$CI = 0.90$

$1-\alpha = 1-0.90$

$1-\alpha = 0.10$

$1-\alpha/2 = \frac{0.10}{2}$

$1-\alpha/2 = 0.05$

$1-\alpha/2 = 1-0.05$

$1-\alpha/2 = 0.95$

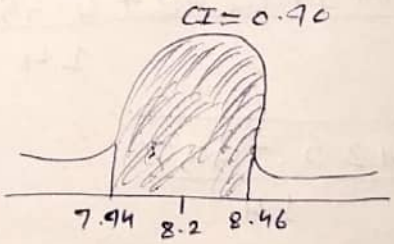
$z_{1-\alpha/2} = 1.65$

$EBM = (1.65)\left(\frac{0.2}{\sqrt{20}}\right)$

$EBM = (1.65)\left(\frac{0.2}{4.4721}\right)$

$EBM = (1.65)(0.0447)$

Graph



$EBM = 0.07$

Question. 18

$\sigma = 0.2, n = 20$ CI = 95%, EBM = ?

$EBM = (Z_{1-\alpha/2})\left(\frac{\sigma}{\sqrt{n}}\right)$

CI = 0.95
$1-\alpha = 1-0.95$
$1-\alpha = 0.05$
$1-\alpha/2 = \frac{0.05}{2}$
$1-\alpha/2 = 0.025$
$1-\alpha/2 = 1-0.025$
$1-\alpha/2 = 0.975$
$Z_{1-\alpha/2} = 1.96$

$EBM = (1.96)\left(\frac{0.2}{\sqrt{20}}\right)$
$EBM = (1.96)\left(\frac{0.2}{4.4721}\right)$
$EBM = (1.96)(0.0447)$
$\boxed{EBM = 0.08}$

Question. 19

The interval is greater because the level of confidence increased. If the only changed in the analysis is a change in confidence level then all we are doing is changing how much area is being calculated for the normal distribution. Therefore a large result areas and larger intervals.

Question. 20

The confidence interval denotes the range of possibilities for the population parameter. we are 95% convinced that the population parameter is between x and x is the accurate reading of a 95% confidence intervals.

Question. 21

The conifdence level would increase.

Question. 22

If 40 heads of lettuce were sampled instead of 20, It means the sample size has increased. Also the confidence interval is the same

Question.44

A random variable is defined as the value of the given variable which represented the outcome of a statistical experiment.
It is usually represented by X.

Question.45

$\bar{X}$ is the mean number of hours spent watching television per month from a sample of 108 Americans.

Question.46

The distribution required for this problem is 't' distribution with parameters t_{n-1}.

Question.47

$\bar{X} = 151, S = 32, n = 108, CI = 99\%$

$CI = 99\%$ $\quad EBM = (t_{1-\alpha/2}) \frac{S}{\sqrt{n}}$

$CI = 0.99$

$1 - \alpha = 1 - 0.99$

$1 - \alpha = 0.01$

$1 - \alpha/2 = \frac{0.01}{2}$

$1 - \alpha/2 = 5 \times 10^{-3}$

$1 - \alpha/2 = 0.005$

$1 - \alpha/2 = 1 - 0.005$

$1 - \alpha/2 = 0.995$

$t_{1-\alpha/2} = 2.575$

$EBM = (2.575) \frac{32}{\sqrt{108}}$

$EBM = (2.575)\left(\frac{32}{10.3923}\right)$

$EBM = (2.575)(3.0792)$

$EBM = 7.9289$

$\bar{X} \pm EBM$

$\bar{X} + EBM$

$151 + 7.9289 = 158.9289$

$\bar{X} - EBM$

$151 - 7.9289 = 143.0711$