Lab Statistics

1- $t_{0.025,15}=2.131$,

$t_{0.05,10}=1.812$,

$t_{0.10,20}=1.325$,

$t_{0.005,25}=2.787$,

and $t_{0.001,30}=3.385$

2- $\mathrm{CI} = 100(1-\sigma)\%,\ \alpha = 0.05$

a) $-t_{0.025,12}<T< t_{0.025,12}$

$-2.179<T<2.179$

b) $-t_{0.025,24}<T< t_{0.025,24}$

$-2.064<T<2.064$

$\mathrm{CI} = 100(1-\sigma)\%, \qquad \alpha = 0.01$

C) $-t_{0.005,13}<t<-t_{0.005,13}$

$-3.012<T<3.012$

$\mathrm{CI} = 100(1-\sigma)\%, \qquad \alpha = 0.001$

d) $-t_{0.001,15}<T<t_{0.001,15}$

$-4.073<T<4.073$

3- $\mathrm{CI} = 100(1-\sigma)\%,\ \alpha = 0.025$

a) $t_{0.025,14}= 2.145$

$\mathrm{CI} = 100(1-\sigma)\%, \qquad \alpha = 0.005$

b) $t_{0.005,19}= 2.861$

$\mathrm{CI} = 100(1-\sigma)\%, \qquad \alpha = 0.0005$

C) $t_{0.0005,24}= 3.764$

4- 95% confidence interval on mean tire life

$n = 16, \bar{x} = 60139.7, s = 3645.94, \mathrm{t}0.025{,}15 = 2.131$

$\bar{x} - t\alpha/2, n - 1s/\sqrt{n} \leq \mu \leq \bar{x} + t\alpha/2, n - 1s\ /\sqrt{n}$

$60139.7 - 2.131(3645.94/\sqrt{16}) \leq \mu$

$\leq 60139.7 + 2.131(3645.94/\sqrt{16})$

$58{,}197.33 \leq \mu \leq 62{,}082.07$

5- 99% lower confidence bound on mean Izod impact strength

$n = 20, \bar{x} = 1.25, s = 0.25, \mathrm{t}0.005{,}19 = 2.861$

$\bar{x} - t\alpha/2, n - 1s/\sqrt{n} \leq \mu$

$1.25 - 2.861(0.25/\sqrt{20}) \leq \mu$

$1.09 \leq \mu$

6- 99% confidence interval on mean current required

Assume that the data are a random sample from a normal distribution

$n = 10, \bar{x} = 317.2, s = 15.7, \mathrm{t}0.005{,}9 = 3.25$

$\bar{x} - t\alpha/2, n - 1s/\sqrt{n} \leq \mu \leq \bar{x} + t\alpha/2, n - 1s\ /\sqrt{n}$

$317.2 - 3.25(15.7/\sqrt{10}) \leq \mu$

$\leq 317.2 + 3.25(15.7/\sqrt{10})$

$301.06 \leq \mu \leq 333.34$

7- Mean $(\bar{x}) = \frac{\Sigma x}{n} = \frac{101.9}{6} = 16.9833$

standard deviation (s) = 0.291

99% CI on the mean level of polyunsaturated fatty acid.

For α = 0.01, $t\alpha/2, n - 1$= t0.005,5 = 4.032

$\bar{x} - t\alpha/2, n - 1s/\sqrt{n} \leq \mu \leq \bar{x} + t\alpha/2, n - 1s\ /\sqrt{n}$

$16.98 - 4.032(0.291/\sqrt{6}) \leq \mu$

$\leq 16.98 + 4.032(0.291/\sqrt{6})$

$16.505 \leq \mu \leq 17.462$

8- Mean $(\bar{x}) = \frac{\Sigma x}{n} = \frac{27119}{12}$ =2259.917 , std. deviation = 34.055 , n =12

a) 95% two-sided confidence interval on mean comprehensive strength

For α = 0.01, $t\alpha/2, n - 1$= t0.025,11 = 2.20

$\bar{x} - t\alpha/2, n - 1s/\sqrt{n} \leq \mu \leq \bar{x} + t\alpha/2, n - 1s\ /\sqrt{n}$

$2259.917 - 2.20(34.055/\sqrt{12}) \leq \mu$

$\leq 2259.917 + 2.20(34.055/\sqrt{12})$

$2237.3 \leq \mu \leq\ 2282.5$

b) 95% lower-confidence bound on mean strength

t0.05,11=2.23

$\bar{x} - t\alpha/2, n - 1s/\sqrt{n} \leq \mu$

$2259.917 - 2.23(34.055/\sqrt{12}) \leq \mu$

$2241.4 \leq \mu$

Test of Hypothesis

1- a) Population mean μ = 12, Standard deviation, σ = 0.5, Sample size, n = 4 and $\bar{x}$= 11.5

H0 : μ = 12

H1 : μ < 12

The test statistic = ($\bar{x}$– μ) ÷ (σ/$\sqrt{n}$)

Test statistic = (11.5 – 12) ÷ (0.5/$\sqrt{4}$)

Test statistic = – 0.5 ÷ 0.5/2

Teat statistic = – 0.5 / 0.25 = – 2

P(x < – 2) = 0.02275 (from Z-table)

P-value = 0.02275

b) β = P($\bar{x} \geq$ 11.5| μ =11.25)

= $P(Z \geq \frac{\bar{x}-\mu}{\sigma/\sqrt{n}} = \frac{11.5-11.25}{0.5/\sqrt{4}}$)= 1

P(Z ≥1) = 0.5

β = 0.5

2- a) μ = 12, Standard deviation, σ = 0.5, Sample size, n = 16 and $\bar{x}$= 11.5

H0 : μ = 12

H1 : μ < 12

The test statistic = ($\bar{x}$– μ) ÷ (σ/$\sqrt{n}$)

Test statistic = (11.5 – 12) ÷ (0.5/$\sqrt{16}$) = –4

P(X ≤ 11.5) = P(Z ≤ -4) = 0.00003167

type I error = 0.00003167

b) type II error is ß = P(x̄ ≥ 11.5 given that μ = 11.25)

$P(Z \geq \frac{\bar{x}-\mu}{\sigma/\sqrt{n}} = \frac{11.5-11.25}{0.5/\sqrt{16}})$

=P(Z > (11.5 - 11.25) / 0.125)

= P (Z > 2.000) = 0.0228

β = 0.0228

3- α=0.01 and n= 16

boundaries:

$11.7087 \leq \bar{x}_c \leq 11.71$

4- α=0.05 and n = 16

boundaries:

$11. .7937 \leq \bar{x}_c \leq 11.84$

5- a) σ = 0.25, $H0$: μ = 5, $H1$: μ ≠ 5, n = 8

$\alpha = P\ (Z < \bar{x} - \mu/\sigma/\sqrt{n}) + P\ (Z > \bar{x} - \mu/\sigma/\sqrt{n})$

$\alpha = P\ (Z < 4.85 - 5/0.25/\sqrt{8}) + P\ (Z > 5.15 - 5/0.25/\sqrt{8})$

$\alpha = P(Z < -1.697) + P(Z > 1.697)$

$\alpha = 2 * 0.0446 = 0.0892$

b) $\beta = P(4.85 \leq \bar{x} \leq 5.15),\ when\ \mu = 5.1$

$\beta = P\ (Z < \bar{x} - \mu/\sigma/\sqrt{n}) + P\ (Z > \bar{x} - \mu/\sigma/\sqrt{n})$

$= P\ (Z < 5.15 - 5.1/0.25/\sqrt{8}) + P\ (Z > 4.85 - 5.1/0.25/\sqrt{8})$

$= P(0.565) - P(-2.83) = 0.714 - 0.0023 = 0.7117$

The power of the test is 1 – β = 1 – 0.7117 = 0.2883