CIMT Further Statistics p26 Ex2A

1. X = temperature lubricant ceases to be effective.

from sample of $n = 8$

$\bar{x} = 237.375$

$s_{n-1} = 2.77424$

now, if we assume $X \sim N(\mu, \sigma^2)$

then $\bar{X} \sim N(\mu, \frac{\sigma^2}{8})$ where X = mean temperature of 8 samples

so $\dfrac{\bar{X} - \mu}{\sqrt{\frac{\sigma^2}{8}}} \sim N(0, 1^2)$

we estimate σ^2 with s_{n-1}^2 and n is small so

$$\frac{\bar{X} - \mu}{\sqrt{\frac{s^2}{8}}} \sim t_7$$

so 95% CI for μ is $\bar{x} \pm t_{7, 0.975} \times \sqrt{\frac{s^2}{8}}$

$= 237.375 \pm 2.36462 \times \sqrt{\frac{2.77424^2}{8}}$ $t_{7, 0.975}$ from invt(0.975, 7)

$= (235.05, 239.694)$

$\approx \underline{\underline{(235.1, 239.7)}}$ to 1dp.

TINspire Check

MENU

Statistics

Confidence Intervals

t Interval

2. X = functional arm reach, in mm.

$n = 8$

$\bar{x} = 668.125$

$s_{n-1} = 22.7874$

we assume that X is normally distributed

so $X \sim N(\mu, \sigma^2)$

$\bar{X} \sim N(\mu, \frac{\sigma^2}{8})$ where $\bar{X}$ = mean arm reach of 8 arms

$$\frac{\bar{X} - \mu}{\sqrt{\frac{\sigma^2}{8}}} \sim N(0, 1^2)$$

we estimate σ with s_{n-1}, and n is small, so we have t_7 distribution

$$\frac{\bar{X} - \mu}{\sqrt{\frac{s^2}{8}}} \sim t_7$$

so 95% CI for $\mu = \bar{x} \pm t_{7,0.975} \times \sqrt{\frac{s^2}{8}}$

$= 668.125 \pm 2.36462 \times \sqrt{\frac{22.7874^2}{8}}$

$= (649.074, 687.176)$

$\approx \underline{\underline{(649.07, 687.18)}}$ to 2dp)

3 X = time in seconds to recognise word

$n = 9$

$\bar{x} = 59 \cdot 1111$

$s_{n-1} = 18 \cdot 4421$

we assume X is normally distributed

so $X \sim N(\mu, \sigma^2)$

so $\bar{X} \sim N(\mu, \frac{\sigma^2}{9})$ where $\bar{X}$ = mean of 9 student's times.

so $\dfrac{\bar{X} - \mu}{\sqrt{\frac{\sigma^2}{9}}} \sim N(0, 1^2)$

we estimate σ with s_{n-1}, and n is small, so we use t_8 distribution

$\dfrac{\bar{X} - \mu}{\sqrt{\frac{s^2}{9}}} \sim t_8$

so 95% CI for μ is $\bar{x} \pm t_{8, 0.975} \times \sqrt{\frac{s^2}{9}}$

$= 59 \cdot 1111 \pm 2 \cdot 306 \times \sqrt{\frac{18 \cdot 4421^2}{9}}$

$= (44 \cdot 9353, 73 \cdot 287)$

$\approx \underline{\underline{(44 \cdot 94, 73 \cdot 29)}}$ to 2dp)

and 99% CI for μ is $\bar{x} \pm t_{8, 0.995} \sqrt{\frac{s^2}{9}}$

$= 59 \cdot 1111 \pm 3 \cdot 35539 \sqrt{\frac{18 \cdot 4421^2}{9}}$

$= (38 \cdot 4843, 79 \cdot 7379)$

$\approx \underline{\underline{(38 \cdot 48, 79 \cdot 74)}}$ to 2dp)