(12.5 points) 1. The weights of 39 boxes of cereal are measured. The **sample standard deviation** is 0.37 ounces. The **sample mean** is 15.9 ounces. We are concerned that the mean weight of all boxes may be **under 16** ounces.

(a) **State** the null and alternative hypotheses.

$H_0: \mu = 16, \quad H_1: \mu < 16$

(b) **Test** the null hypothesis at the 5% level, using either p-value or classical approach, showing calculation of the test statistic.

$n = 39, \quad s = 0.37, \quad \bar{x} = 15.9, \quad df = 38, \quad \alpha = 0.05$

$$t^* = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{15.9 - 16}{0.37/\sqrt{39}} = \frac{-0.1(\sqrt{39})}{0.37} = -1.687837297$$

p-value = tcdf$(-E99, t^*, 38) = 0.0498174749 \le 0.05 = \alpha$

Reject H_0.

$\boxed{\text{There is enough evidence at the 5\% level to say the mean weight of the boxes is under 16 oz.}}$

(12.5 points) 2. The weights of 21 loaves of bread are measured. The **sample standard deviation** is 0.6 ounces. We are concerned that the weights of the loaves may have a standard deviation greater than 0.5 ounces.

(a) State the null and alternative hypotheses.

$H_0: \sigma = 0.5, \quad H_1: \sigma > 0.5$

(b) Test the null hypothesis at the 10% level, using either p-value or classical approach, showing calculation of the test statistic.

$n = 21, \quad df = 20, \quad s = 0.6, \quad \sigma = 0.5$

$$\chi^{2*} = \frac{(n-1)s^2}{\sigma^2} = \frac{20(.6)^2}{(.5)^2} = 28.8$$

p-value = χ^2cdf$(28.8, E99, 20) = 0.0917727417 \le 0.10 = \alpha$

Reject H_0.

$\boxed{\text{There is sufficient evidence at the 10\% level to say the weight of the loaves has a standard deviation greater than 0.5 oz.}}$

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(12.5 points) 5. One class, of 35 students, averages 77 on a test with **variance**, $s_1^2 = 16$. Another class, of 31 students, averages 81 on the same test, with $s_2^2 = 25$.

(a) Compute the **estimated standard error** of the difference of sample means. (You have to identify exactly what this is, here.)

$$\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} = \sqrt{\frac{16}{35} + \frac{25}{31}} = \boxed{1.12409718}$$

(store this)

(b) Are the averages significantly **different** at the 2% level? Show calculation of the test statistic. May use TI test.

$H_0: \mu_1 = \mu_2$
$H_1: \mu_1 \neq \mu_2$

$$t^* = \frac{77 - 81}{1.12409718} = -3.55841204$$

use stored value or Ans on TI.

2-SampTTest gives df = 57.38205774

p-value = $2 \cdot \text{tcdf}(-E99, -3.55841204, df)$
$= 2(3.7841975E{-4}) = 7.56839\ldots \times 10^{-4}$
$= 0.000756839499 \leq 0.02 = \alpha$

Reject H_0. The averages differ significantly at the 2% level.

(12.5 points) 6. As in the previous problem, one class, of 35 students, averages 77 on a test with **variance**, $s_1^2 = 16$. Another class, of 31 students, averages 81 on the same test, with **variance**, $s_2^2 = 25$. Is the sample variance of the 2nd class significantly higher than that of the ~~second~~ first class, at the 10% level? Show calculation of the test statistic.

$H_0: \sigma_1 = \sigma_2$, $H_1: \sigma_1 < \sigma_2$

$F^* = \frac{16}{25} = 0.64$, p-value = Fcdf(0, 0.64, 34, 30)
$= 0.1041819866 > 0.10 = \alpha$

or $F^* = \frac{25}{16} = 1.5625$, p-value = Fcdf(1.5625, E99, 30, 34)
$= 0.1041819866 > 0.10 = \alpha$

Fail to reject H_0.

There is not enough evidence at the 10% level to say the variance of the 2nd population is greater than that of the 1st population.

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(12.5 points) 8. (a) Complete the table, and find

$n = 4$

x	y	x^2	y^2	xy
2	3	4	9	6
4	2	16	4	8
5	4	25	16	20
6	9	36	81	54
17	18	81	110	88

(b) SS(x) = $\Sigma x^2 - \frac{(\Sigma x)^2}{n}$

$= 81 - \frac{17^2}{4} = \boxed{8.75}$

(c) SS(y) = $\Sigma y^2 - \frac{(\Sigma y)^2}{n}$

$= 110 - \frac{18^2}{4} = \boxed{29}$

(d) SS(xy) = $\Sigma xy - \frac{(\Sigma x)(\Sigma y)}{n}$

$= 88 - \frac{17(18)}{4} = \boxed{11.5}$

(e) Find r, the **coefficient of linear correlation**.

$$r = \frac{SS(xy)}{\sqrt{SS(x) \cdot SS(y)}} = \frac{11.5}{\sqrt{(8.75)(29)}} = \boxed{0.7219295437}$$

(f) Find the **equation** of **line of best fit** in the form y = mx + b

$$\left.\begin{array}{l} \Sigma y = m \Sigma x + nb \\ \Sigma xy = m \Sigma x^2 + b \Sigma x \end{array}\right\} \rightarrow \left.\begin{array}{l} 17m + 4b = 18 \\ 81m + 17b = 88 \end{array}\right\} \rightarrow \begin{array}{l} m = 46/35 \\ b = -38/35 \end{array}$$

Also $m = \frac{SS(xy)}{SS(x)} = \frac{11.5}{8.75} = \frac{46}{35}$

$$\boxed{y = \frac{46}{35}x - \frac{38}{35}}$$

(g) Predict y if x = 3

$$\hat{y} = \frac{46}{35}(3) - \frac{38}{35} = \boxed{\frac{20}{7}} \text{ or } \boxed{2\frac{6}{7}} \text{ or } \boxed{2.\overline{857142}}$$

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