1. A tourism and traveling agency claims that the average of a one-day travel expenses in Moscow exceed $500. If a random sample of 35 one-day travel expenses in Moscow has a mean of $538 and a standard deviation of $41, is the claim of the company true? Use the critical value approach and $\alpha = 10\%$.

The hypotheses are: H_0: $\mu \leq 500$ H_A: $\mu > 500$	} ① point
The assumption is: Large Sample size, $n \geq 30$	} ① point
The test statistic: $n = 35$, $\bar{X} = 538$, $S = 41$ $Z_c = \frac{\bar{X} - \mu_0}{S/\sqrt{n}} = \frac{538 - 500}{41/\sqrt{35}} = 5.48$ } ② points $\bar{x}_{\alpha U} = \mu_0 + Z_\alpha \frac{S}{\sqrt{n}} = 500 + (1.28)\frac{41}{\sqrt{35}} = \boxed{508.87}$	
The critical value: $\alpha = .10 \Rightarrow Z_\alpha = Z_{.10} = 1.28$	} ① point
Decision Rule: Reject Ho if $Z_c > Z_\alpha$ $\Rightarrow 5.48 > 1.28$ $\therefore$ Reject Ho If $\bar{x} > \bar{x}_{\alpha U} \Rightarrow$ Reject H_0. So, since $\bar{x} = 538 > 508.87 = \bar{x}_{\alpha U} \Rightarrow$ Rej. H_0	} ② points
Conclusion: A tourism and traveling agency claims based on the sample data is true, that means the average of a one-day travel expenses in Moscow exceeds $500. ① point	

2. Assume that the UK insurance survey is based on 1,000 randomly selected United Kingdom households and that 640 of these households spent on life insurance in 1993. Using the p-value approach test the claim that no more than 60% of UK households spent on life insurance in 1993. Use 5% level of significance.

The hypotheses are: H_0: $p \leq 0.60$ H_A: $p > 0.60$ 1 point
The assumptions are: a. Large Sample Size b. $np \geq 5$ c. $n(1-p) \geq 5$ 2 points
The test statistic value: $\bar{p} = \frac{x}{n} = \frac{640}{1000} = 0.64$ 1 point $Z_c = \frac{\bar{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{0.64 - 0.60}{\sqrt{\frac{(.6)(1-.6)}{1000}}} = 2.58$ 1 point
The p-value = $p(Z > Z_c)$ $= p(Z > 2.58)$ $= 0.5 - p(0 < Z < 2.58)$ $= 0.5 - .4951$ $= 0.0049$ 2 points
Decision Rule: Reject H_0 if p-value $< \alpha$ $\Rightarrow 0.0049 < .05$ $\therefore$ Reject H_0 2
Conclusion: Based on the sample data there are more than 60% of UK households spent on life insurance in 1993. 1 point

3. Starting annual salaries for individuals with master's and bachelor's degrees were collected in two different samples. The data are given as follows

Master's Degree	**Bachelor's Degree**
$n_1 = 25$	$n_2 = 25$
$\bar{x}_1 = \$45{,}000$	$\bar{x}_2 = \$35{,}000$
$s_1 = \$4{,}000$	$s_2 = \$3500$

Do the data provide sufficient evidence to conclude that there is no difference between the average annual salaries of the two degrees? Use a significance level of 0.05.

The hypotheses are: H_0: $\mu_1 - \mu_2 = 0$ H_A: $\mu_1 - \mu_2 \neq 0$ (1)

The assumptions are: a. Each pop. has a normal dist. b. σ_1^2, σ_2^2 are unknown but equal

(2) points c. Samples are indep. d. Small samples size ($n_1 < 30$ or $n_2 < 30$

The test statistic value:

$$t_c = \frac{\bar{x}_1 - \bar{x}_2 - 0}{S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}, \quad S_p = \sqrt{\frac{(25-1)(4000)^2 + (25-1)(3500)^2}{25+25-2}}$$

$$= 3758.32 \quad (1)$$

$$\therefore t_c = \frac{45000 - 35000 - 0}{3758.32\sqrt{\frac{1}{25} + \frac{1}{25}}} = 9.407 \quad \Big\} \quad (1) \text{ point}$$

The critical value: $\alpha = .05 \Rightarrow t_{\alpha/2, n_1+n_2-2} = t_{.025, 48} \approx 2.0086$ (1)

with $df = 50$

Decision Rule: Reject H_0 if $|t_c| > t_{\alpha/2, n_1+n_2-2}$

$\Rightarrow 9.407 > 2.0086 \Rightarrow$ Reject H_0. (1) point.

Conclusion:

The data ~~provide~~ do not provide a sufficient evidence to conclude that there is no difference between the average annual salaries of the two degrees. (1) point

4. Figure perfect incorporation is a women's figure salon that specializes in weight reduction programs. Weights of a sample of 6 clients before and after a 6-week introductory program are shown below

Weight	**Before**	140	160	210	148	190	170
	After	132	158	195	152	180	164
	D_i	8	2	15	-4	10	6

Test to determine whether the introductory program provides a statistically significant weight loss at 1% significance level.

The hypotheses are: H_0: $\mu_d = \mu_1 - \mu_2 \leq 0$ H_A: $\mu_d = \mu_1 - \mu_2 > 0$ (1) point

The assumptions are: a. Samples are dependent b. Small Sample - pairs size (1) points

The test statistic value: μ_1: Before μ_2: After

$$t_c = \frac{\bar{d} - d_o}{S_d / \sqrt{n}}, \quad \bar{d} = \frac{\sum d_i}{n} = \frac{37}{6} = 6.167 \quad \text{(1) point}$$

$$S_d = \sqrt{\frac{\sum (d_i - \bar{d})^2}{n-1}} = 6.5853 \quad \text{(1) point}$$

$$t_c = \frac{6.167 - 0}{6.5853 / \sqrt{6}} = 2.293 \quad (1)$$

The critical value: $\alpha = .01 \Rightarrow t_{\alpha, n-1} = t_{.01, 5} = 3.3649$ (1) point

The Decision Rule: Reject H_0 if $t_c > t_{\alpha, n-1}$

$\Rightarrow 2.293 \ngtr 3.3649$ $\therefore$ Do not reject H_0. (1)

The Conclusion:

Based on the sample data, the introductory program does not provide a statistically significant weight loss. (1) point

5. Consider question 3 above, do you think that the standard deviations of the annual salaries of both the Bachelor's degree and the Master's degree should be equal at 10% significance level?

The hypotheses are: H_0: $\sigma_1^2 = \sigma_2^2$ H_A: $\sigma_1^2 \neq \sigma_2^2$	1 point
The assumption is: 1. populations are normally distributed 2. Sample variances are indep.	2 points
The test statistic value: $F_c = \frac{S_1^2}{S_2^2} = \frac{(4000)^2}{(3500)^2} = 1.3061$	2 points
The critical value: $F_{\alpha/2, n_1-1, n_2-1} = F_{.05, 24, 24} = 1.984$	1 point
The Decision Rule: Reject H_0 if $F_c > F_{\alpha/2, n_1-1, n_2-1}$ $\Rightarrow 1.3061 \not> 1.984 \Rightarrow$ Do not reject H_0.	1 points.
The Conclusion: Based on the sample data, the standard deviations of the annual salaries of both degrees are equal.	1 point

6. The filling variance for boxes of cereal is designed to be no more than 0.02. A sample of ~~41~~ 31 boxes of cereal shows a standard deviation of 0.16 ounces. Determine whether the filling specifications were violated. Use $\alpha = 0.05$

The hypotheses are: H_0: $\sigma^2 \le .02$	H_A: $\sigma^2 > .02$ ① point
The assumption is: Population is normally distributed. ① point	
The test statistic value: $\chi^2_c = \frac{(n-1)S^2}{\sigma_0^2} = \frac{(31-1)(.16)^2}{0.02} = 38.4$ } ② points	
The critical value $\chi^2_{\alpha, n-1} = \chi^2_{.05, 30} = (43.7730 \rightarrow df = 30)$ ① point	
The Decision Rule: Reject H_0 if $\chi^2_c > \chi^2_{\alpha, n-1}$ $\Rightarrow$ $38.4 \not> 43.7730$ $\therefore$ Do Not Reject ~~rejeced~~ H_0 } ② points	
The Conclusion: Based on the sample data, The filling variance for boxes is NO more than 0.02. ① point NOT violated	

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