PSDA Assignment 3 Q_1 & Q_2 & Q_3

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Q_1 ~~3.433g~~

a) $\bar{x} = 3.433$ kg $\quad \sigma = 495g \quad$ 0.495 kg

$n = 75 \quad$ 95% confidence level $\quad z = 1.96$

$$\bar{x} \pm (z \text{ critical value}) \left(\frac{\sigma}{\sqrt{n}}\right)$$

$$3.433 \pm 1.96 \left(\frac{0.495}{\sqrt{75}}\right)$$

$$3.433 \pm 0.112$$

$$(3.321, 3.545)$$

b) $n = 75000$

$$\bar{x} \pm (z \text{ critical value}) \left(\frac{\sigma}{\sqrt{n}}\right)$$

$$3.433 \pm 1.96 \left(\frac{0.495}{\sqrt{75000}}\right)$$

$$3.433 \pm 3.543 \times 10^{-3}$$

$$(3.429, \cancel{4.23}\ 3.437)$$

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c) Part a has a wider confidence level ($n=75$), since a smaller sample value will give a higher margin of error value.

Q2 $n = 36$, $\bar{x} = 92.8$ cm, $\sigma = 3.6$ cm

0.05 significance level

$H_0 = 91.4$ (μ)

$H_1 \neq 91.4$

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

$$Z = \frac{92.8 - 91.4}{(3.6/\sqrt{36})} = 2.33$$

* two tailed

$P(Z > 2.33) = (1 - 0.9901) = 9.9 \times 10^{-3}$

$P(Z < -2.33) = 9.9 \times 10^{-3}$

$2 \times 9.9 \times 10^{-3} = 0.0198$

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$0.0198 < 0.05$ (significance level 0.05)

$\therefore$ reject H_0

$\therefore$ there is sufficient evidence that the children from urban area have a mean height different from 91.4 cm

Q3 Significance level = 0.05

P_1 (Male) P_2 (Female)

$H_0 : P_1 = P_2$ $H_1 : P_1 > P_2$

$$\hat{p}_1 = \frac{51}{71} = 0.718$$

$$\hat{P}_2 = \frac{31}{53} = 0.585$$

$$\bar{P} = \frac{51+31}{71+53} = \cancel{0.6613}\ 0.6613$$

$$Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\frac{\bar{p}\bar{q}}{n_1} + \frac{\bar{p}\bar{q}}{n_2}}}$$

$$Z = \frac{0.718 - 0.585}{\sqrt{\frac{(0.6613)(0.3357)}{71} + \frac{(0.6613)(0.3387)}{53}}}$$

$Z = 1.553$ (right tailed

$P(Z > 1.55) = (1 - 0.9394) = 0.0606$

$\therefore$ p-value $= 0.0606$

$0.0606 > 0.05$

$\therefore$ fail to reject Ho

$\therefore$ there is insufficient evidence that male drivers are more Prone to go through zebra crossing compared to female drivers.

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4. $H_0 : \mu_1 - \mu_2 = 0$
$H_1 : \mu_1 - \mu_2 \neq 0$

$\bar{x}_1 = \frac{21.7 + 21.0 + 21.2 + 20.7 + 20.4 + 21.9 + 20.2 + 21.6 + 20.6}{9}$
$= \frac{189.3}{9}$
$= 21.0333$

$\bar{x}_2 = \frac{21.5 + 20.5 + 20.3 + 21.6 + 21.7 + 21.3 + 23 + 21.3 + 18.9 + 20 + 20.4 + 20.8 + 20.3}{13}$
$= \frac{271.6}{13}$
$= 20.8923$

$s_1^2 = 0.3675$ $\quad v = (9-1) + (13-1)$ $\quad \alpha = 0.05$
$s_2^2 = 1.0141$ $\quad = 20$

$t_{0.05,20} = 1.725$ $\quad -t_{0.05,20} = -1.725$

$s_p^2 = \frac{8(0.3675)^2 + 12(1.0141)^2}{9 + 13 - 2}$
$= 0.6711$

$t_0 = \frac{21.0333 - 20.8923}{0.6711\sqrt{\frac{1}{9} + \frac{1}{13}}}$
$= 0.4845$

$\therefore -1.725 < 0.4845 < 1.725$. So, there is no strong evidence to prove $\bar{x}_1$ is different to $\bar{x}_2$. So, H_0 is failed to reject.

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5. $H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 \neq \mu_2$

$\bar{x}_1 = 3924.0667$ $s_1^2 = 688300.78$ $\alpha = 0.05$

$\bar{x}_2 = 4069.2667$ $s_2^2 = 908010.5$

$$t_0 = \frac{3924.0667 - 4069.2667 - 0}{\sqrt{\frac{688300.78}{15} + \frac{908010.5}{15}}}$$

$= -0.4451$

$$v = \frac{(106420.752)^2}{\frac{(45886.7187)^2}{15} + \frac{(60534.0333)^2}{15}}$$

$= 29.4422$

≈ 29

$t_{0.05,29} = 1.699$ $-t_{0.05,29} = -1.699$

$\therefore -1.699 < -0.4451 < 1.699$. So, H_0 is rejected. There is evidence to conclude that $\bar{x}_1$ is different than $\bar{x}_2$.

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(6.)

Subject	After 1 hour (x_1)	After 24 hours (x_2)	$D = (X_1 - \bar{X}_2)$	$D^2 = (X - \bar{X}_2)^2$
1	14	10	4	16
2	12	4	8	64
3	18	14	4	16
4	7	6	1	1
5	11	9	2	4
6	9	6	3	9
7	16	12	4	16
8	15	12	3	9
			$\Sigma D = 29$	$\Sigma D^2 = 135$

$H_0 = \mu_D = 3$

$H_1 = \mu_D > 3$

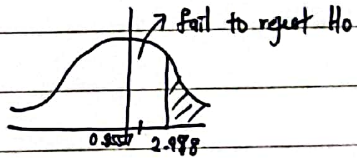
$\bar{D} = \frac{29}{8}$

$= 3.625$

$$s_D = \sqrt{\frac{135 - \left(\frac{29^2}{8}\right)}{7}}$$

$= 2.0659$

$$t = \frac{3.625 - 3}{2.0659/\sqrt{8}} = 0.8557$$



$t_{0.01, 8-1} = 2.998$

$\therefore$ Since $0.8557 < 2.998$ at $\alpha = 0.01$, the decision is not to reject the null hypothesis. There is not enough evidence to support that the mean number of words recalled after 1 hour exceeds the mean number of words recall after 24 hours by more than 3.

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(7)

Observed (O)	103	378	563	150
Expected (E)	298.5	298.5	298.5	298.5

$H_0 = p_1 = p_2 = p_3 = p_4$

H_1 : at least 1 of the 5 proportions is different from others.

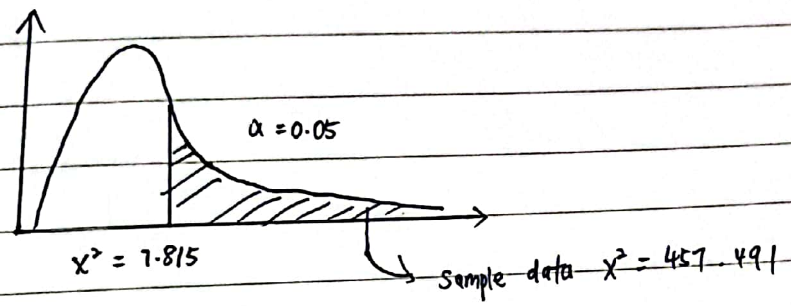
$(O-E)^2$ 38220.25 6320.25 69960.25 22052.25

$(O-E)^2/E$ 128.041 21.17 234.40 73.88

$\chi^2 = 128.041 + 21.17 + 234.40 + 73.88$

$= 457.491$

$\chi^2_{3,0.05} = 7.815$



∴ Since 457.491 > 7.815, reject Ho. There is sufficient evidence to conclude that at least 1 proportion of male smoker lung cancer deaths is not same for the four given tar level categories.

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	yellow and sweet	green and sweet	yellow and juicy	yellow and sour
f_o	124	30	43	11
f_e	$9 \times 13 = 117$	$3 \times 13 = 39$	$3 \times 13 = 39$	$1 \times 13 = 13$
$\frac{(O-E)^2}{E}$	0.42	2.08	0.41	0.31

$= 208$

$$\chi^2 = 0.42 + 2.08 + 0.41 + 0.31$$
$$= 3.22$$

$\chi^2_{k=3, \alpha=0.01} = 11.345$

$H_0: P_{yellow\ and\ sweet} = 9,\ P_{green\ and\ sweet} = 3,\ P_{yellow\ and\ juicy} = 3,\ P_{yellow\ and\ sour} = 1$
H_1: At least one of the proportions is different from the claimed value.

$\therefore$ Test statistic value ($\chi^2 = 3.22$) < critical value ($\chi^2_{k=3, \alpha=0.01} = 11.345$), that is it does not fall within critical region. Thus, we do not reject H_0. There is not sufficient evidence to warrant rejection of the claim that the categories are distributed with the given ratio.

9.

Group	27-29	29-31	31-33	33-35	35 and over	Total
1	6	11	16	14	13	60
2	5	9	8	6	2	30
Total	11	20	24	20	15	90
fe_1	7.33	13.33	16.00	13.33	10.00	
fe_2	3.67	6.67	8.00	6.67	5.00	

$\chi^2 = \frac{[O_{ij} - e_{ij}]^2}{e}$ $\chi^2 = 0.24 + 0.48 + 0.41 + 0.81 + 0 + 0 + 0.03 + 0.07 + 0.9 + 1.8$
$= 4.74$

$df = (2-1)(5-1) = 4$
$\chi^2_{k=4, \alpha=0.1} = 7.779$

H_0: variables are independent
H_1: variables are related (dependent)

$\therefore$ Since, $4.74 < 7.779$, thus do not reject H_0 at $\alpha = 0.1$. There is evidence that group and age preferences are independent.