PROBABILITY & STATISTICAL DATA ANALYSIS

SEC12143-10

SEM 2 2019/2020

ASSIGNMENT 4

LECTURER : DR AZURAH BTE A SAMAH

NAME	MATRIC NO.
LOKESSH A/L PATHMANATAN	A19EC0077
PRASANT A/L KARUNAMURTHI	A19EC0148

PSDA (Assignment 4)

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Question 1

(a) i) $\hat{p} = \frac{990}{1100}$

$= 0.9$

ii) confidence interval $= p \pm 2.575\ (SE)$

$SE = \sqrt{\frac{(0.9)(0.1)}{1100}}$

$= 9.045 \times 10^{-3}$

$ci = (0.9) \pm (2.575)(9.045 \times 10^{-3})$

$= 0.9 \pm (0.023)$

$= (0.877, 0.923)$

(b) $n = 16$, mean $= 18.6$, s.d $= 9.486$

$\bar{x} + (1.341)(s/\sqrt{n})$

$= 18.6 \pm (1.341)(9.486/\sqrt{16})$

$= 18.6 \pm (1.341)(2.372)$

$= 18.6 \pm 3.18$

$= (15.42, 21.78)$

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Question 2

(a) A type I error is the rejection of the null hypothesis when it is true. So, the allergist could commit a type I error if he concludes that less than 30% of the public is allergic to some cheese products, but in fact it is true that 30% of the public is allergic to some cheese products.

(b) mean = 35 , s.d = 4.3

i) $H_0 : \mu = 35$, $H_1 : \mu < 35$

ii) $\alpha = 0.05$

Test statistic, $t = \dfrac{\bar{x} - \mu}{s/\sqrt{n}}$

$$= \frac{33.1 - 35}{4.3/\sqrt{20}}$$

$$t = -1.976$$

P-value = $P(z < -1.98) = 0.0239$

* Conclusion = Since $0.0239 > -1.976$, fail to reject H_0. There is sufficient evidence to support that the mean is less than 35 minutes.

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(c) i) $H_0 : \sigma = 0.470$, $H_1 : \sigma < 0.470$

ii) $\chi^2 = \frac{(n-1)s^2}{\sigma^2}$

mean = 3.675

$s = \sqrt{6.481}$

$= 2.55$

$\chi^2 = \frac{(16-1)(2.55)^2}{(0.470)^2}$

$\chi^2 = 441.55$

$\chi^2 = 21.01$

iii) Critical value = $t_{0.05, 15} = 7.261$

iv) Conclusion = Since $7.261 < 21.01$, reject H_0. The vitamin supplement does appear to affect the variation among birth weights.

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Question 3

(a) $\hat{p} = \frac{130}{350} = 0.371$

$$95\%\ CI = 0.371 \pm 1.960\left(\sqrt{\frac{(0.371)(0.629)}{350}}\right)$$

$$= 0.371 \pm 0.05$$

$$= (0.321,\ 0.421)$$

∴ I am 95% confident that the population of all food shops with special offers is between 0.321 and 0.421.

(b) $$\text{Margin of error} = 1.960\left(\sqrt{\frac{(0.371)(0.629)}{n}}\right)$$

$$1.960\left(\sqrt{\frac{(0.371)(0.629)}{n}}\right) = 0.04$$

$$\left(\sqrt{\frac{(0.371)(0.629)}{n}}\right) = \frac{1}{49}$$

$$\frac{(0.371)(0.629)}{n} = \frac{1}{2401}$$

$$n = 560.29$$

$$n \approx 561$$

∴ The new size, n of the random sample is 561.

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Question 4

(a) mean = 58392, $\sigma = 648$, $n=6$, $\alpha = 0.05$, $z = \dfrac{58392-58000}{648/\sqrt{6}}$

$z = 1.48$

$H_0 : \mu = 58000$

$H_1 : \mu \neq 58000$

$P(z > 1.48) = 1 - P(z < 1.48)$

$= 1 - 0.9306$

$= 0.0694$

* Fail to reject Ho. There is sufficient evidence that shows $\mu = 58000$, since P value $0.0694 > 0.025$

(b) $\sigma^2 = 0.18$, $n = 101$, $s^2 = 0.13$, $\alpha = 0.05$, $x^2 = \dfrac{(n-1)s^2}{\sigma^2}$

$H_0 : \sigma^2 = 0.18$

$H_1 : \sigma^2 \neq 0.18$

$= \dfrac{(101-1)(0.13)}{0.18}$

$x^2 = 72.22$

Critical value $\Rightarrow$ $x^2_{0.025, 100} = 124.342$

$x^2_{0.975, 100} = 74.22$

* Since $72.22 < 74.22$, reject Ho. There is sufficient evidence that support the variance of measurement that is not equal to $0.18 (\text{inch})^2$.

No:

Question 5

a) $\hat{p} = \frac{y}{n} = \frac{\cancel{218}\ 280}{418}$ $n = 418$

$y = 280$

$\hat{p} = 0.67$

$\hat{p} \pm (z)\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = 0.67 \pm (1.96)\sqrt{\frac{0.67(1-0.67)}{418}}$

$= 0.67 \pm (0.045) = (0.625, 0.715)$

95% confident that the true proportion of all insured patients who blame rising insurance rates on large courte settlements against doctors is between 0.625 and 0.715

b) $n = 126$

$\bar{x} = 29.2$

$\sigma = 7.5$

$CI = 90\% = 1.645$

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

$= 29.2 \pm (1.645)\left(\frac{7.5}{\sqrt{126}}\right)$

$= 29.2 \pm 1.1 = (28.1, 30.3)$

90% confident that the blood lead level is between 28.1 and 30.3

No:

Question 6

a) $n = 64$ $\quad H_0 : \mu = 40$ months

$\bar{x} = 38$ $\quad H_1 : \mu < 40$ months

$\sigma = 5.8$

$\alpha = 0.05$

$\mu = 40$

$$z = \frac{\bar{x} - \mu}{(\sigma / \sqrt{n})} = \frac{38 - 40}{(5.8 / \sqrt{64})}$$

$$z = -2.76$$

$$P(z < -2.76) = 0.0029$$

H_0 is rejected. $\mu < 40$ months is proven with evidence. advise given in manual is not good.

b) $\mu = 10$

$n = 10$

$\alpha = 0.01$

$$\bar{x} = \frac{10.2 + 9.7 + 10.1 + 10.3 + 10.1 + 9.8 + 9.9 + 10.4 + 10.3 + 9.8}{10}$$

$\bar{x} = 10.06$

$$s = \sqrt{\frac{[(10.2-10.06)^2 + (9.7-10.06)^2 + (10.1-10.06)^2 + (10.3-10.06)^2 + (10.1-10.06)^2 + (9.8-10.06)^2 + (9.9-10.06)^2 + (10.4-10.06)^2 + (10.3-10.06)^2 + (9.8-10.06)^2]}{9}}$$

$s = 0.246$

$$t = \frac{10.06 - 10}{0.246 / \sqrt{10}} = 0.77(2) = 1.54$$

Fail to reject H_0. Evidence that the mean content of container containing particular lubricant is 10 l.

Question 7

a) $SE = \frac{52.7 - 50.3}{2} = 1.2$

$\hat{p} = (upper - SE)$

$\hat{p} = 52.7 - 1.2$

$\hat{p} = 51.5$

$q = 100 - 51.5$

$q = 48.5$

$n = \sqrt{\frac{51.5(\cancel{48}\ 43.5)}{1.2}}$

$n = 45.6$

$SE = \frac{50.6 - 49.8}{2} = 0.4$

$\hat{p} = upper - SE$

$\hat{p} = 50.6 - 0.4$

$\hat{p} = 50.2$

$q = 100 - 50.2$

$q = 49.8$

$n = \sqrt{\frac{(50.2)(49.8)}{(0.4)}}$

$n = 79$

$(50.3, 52.7) = 45.6$, $(49.8, 50.6) = 79$. $(49.8, 50.6)$ has larger sample.

b) Statistic 2 is recommended due to it being unbiased. Distribution is centered at true value and it has a smaller std. deviation. Value dosent deviate much, making it accurate.

c) $\hat{p} \pm (z)\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = 0.15 \pm 1.645\sqrt{\frac{0.15(1-0.15)}{500}}$

$= 0.15 \pm (0.03) = (0.12, 0.18)$

90% confident that the true propotions of the market share for the new brand is between 0.12 and 0.18.

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