T.C.

MERSİN ÜNİVERSİTESİ

İ.İ.B.F. İŞLETME BÖLÜMÜ

2015-2016 EĞİTİM-ÖĞRETİM YILI BAHAR DÖNEMİ

BUS294 STATISTICS II FİNAL

SINAV SORU-CEVAP KAĞIDI FORMU

K-Q TSE-ISO-EN 9000

Sınav Tarihi: 07 / 06 / 2016 Saati: 13 : 00

ÖĞRENCİNİN	ÖĞRETIM ELEMANIN	SINAV NOTU	
Adı Soyadı : Answer	Adı Soyadı : Doç.Dr. Tevfik AYTEMİZ	Rakamla	Yazıyla
Numarası : Sheet	İmzası		
İmzası			

Directives

Provide all the details of your answers, not just the solutions. You have **75 minutes and each question is 25 points.**
Good Luck!
Doç. Dr. Tevfik AYTEMİZ

Questions

1) A service station advertises a wait of no more than 30 minutes for an oil change. A sample of 28 oil changes has a mean of 20 minutes and a standard deviation of 5.2 minutes. Form a 92% confidence interval for the population variance of the times spent waiting for an oil change.

$n=28$

$\bar{X}=20$ minutes

$S=5.2$ minutes

$\chi^2_{n-1,\alpha/2}=\chi^2_{27,0.04}=40.113$

$\chi^2_{n-1,1-\alpha/2}=\chi^2_{27,0.96}=16.150$

$$\frac{(n-1)S^2}{\chi_{n-1,\alpha/2}} \le \sigma^2 \le \frac{(n-1)S^2}{\chi^2_{n-1,1-\alpha/2}}$$

$$\frac{27 \times 2.52^2}{40.113} \le \sigma^2 \le \frac{27 \times 2.52^2}{16.150}$$

$$18.2 \le \sigma^2 \le 45.2$$

2) A study conducted by the Mersin University on 250 students found that one in every five 19 and 20 years old students are smoker. To see how the smoking rate of the 19 and 20 years old students differs compared to Mersin University, Çukurova University also surveyed two hundred 19 and 20 years old students and found that 23% of them are smokers. Form a 99% confidence interval for the difference in the two population smoking rates.

Çukurova Univ. = Population X

Mersin Univ. = Population Y

$n_x=200$

$n_y=250$

$\hat{p}_x=0.23$

$\hat{p}_y=\frac{1}{5}=0.20$

$z_{1-\alpha/2}=z_{0.995}=2.57$ or 2.58

$$(\hat{p}_x-\hat{p}_y) \pm z_{1-\alpha/2}\sqrt{\frac{\hat{p}_x(1-\hat{p}_x)}{n_x}+\frac{\hat{p}_y(1-\hat{p}_y)}{n_y}}$$

$$(0.23-0.20) \pm 2.57 \underbrace{\sqrt{\frac{0.23 \times 0.77}{200}+\frac{0.20 \times 0.80}{250}}}_{0.039}$$

$$0.03 \pm 0.1$$

or $-0.07 \le P_x-P_y \le 0.13$

3) An educational study was designed to investigate the effectiveness of a reading program of elementary age children. Each child was given a pretest and posttest. Higher posttest scores would indicate reading improvement. From a very large population, a random sample of scores for the pretest and posttest are as follows:

Child	Pretest Score	Posttest Score
1	40	48
2	36	42
3	32	
4	38	36
5		43
6	33	38
7	35	45

improvement = Posttest − Pretest

d_i: 8, 6, −2, 5, 10

$\bar{d} = \frac{27}{5} = 5.4$

$S_d = \sqrt{\frac{(8-5.4)^2+(6-5.4)^2+(-2-5.4)^2+\dots+(10-5.4)^2}{4}}$

$S_d = \sqrt{\frac{83.2}{4}} = 4.56$

Child 3 moved from the school district and did not take the posttest. Child 5 moved into the district after the start of the study and did not take the pretest. Find a 95% confidence interval estimate of the mean improvement in the reading scores.

$\bar{d} = 5.4$

$n = 5$

$S_d = 4.56$

$t_{n-1,\alpha/2} = t_{4,0.025} = 2.776$

$\bar{d} \pm t_{n-1,\alpha/2} \frac{S_d}{\sqrt{n}}$

$5.4 \pm 2.776 \frac{4.56}{\sqrt{5}}$

5.4 ± 5.66 or $-0.26 \leq \mu_d \leq 11.06$

Mean improvement

4) An accounting firm conducts a random sample of the accounts payable for the east and the west offices of one of its clients. From these two independent samples, the company wants to estimate the difference between the population mean values of the payables. The sample statistics obtained are as follows:

	EAST OFFICE (POPULATION X)	WEST OFFICE (POPULATION Y)
Sample mean	\$290	\$250
Sample size	16	11
Sample standard deviation	15	50

We do not assume that the unknown population variances are equal. Estimate the difference between the mean values of the payables for the two offices. Use a 95% confidence level.

$$v = \frac{\left(\frac{S_x^2}{n_x} + \frac{S_y^2}{n_y}\right)^2}{\frac{\left(\frac{S_x^2}{n_x}\right)^2}{n_x-1} + \frac{\left(\frac{S_y^2}{n_y}\right)^2}{n_y-1}} = \frac{\left(\frac{225}{16} + \frac{2500}{11}\right)^2}{\frac{\left(\frac{225}{16}\right)^2}{15} + \frac{\left(\frac{2500}{11}\right)^2}{10}} \approx 11$$

$t_{v,\alpha/2} = t_{11,0.025} = 2.201$

$(\bar{X}_x - \bar{X}_y) \pm t_{v,\alpha/2}\sqrt{\frac{S_x^2}{n_x} + \frac{S_y^2}{n_y}}$

$(290-250) \pm 2.201 \underbrace{\sqrt{\frac{225}{16} + \frac{2500}{11}}}_{15.53}$

$\rightarrow 40 \pm 34.19$ or $5.81 \leq \mu_x - \mu_y \leq 74.19$

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2016-2017 EĞİTİM-ÖĞRETİM YILI BAHAR DÖNEMİ
BUS294 STATISTICS II FİNAL
SINAV SORU-CEVAP KAĞIDI FORMU

K-Q TSE-ISO-EN 9000

Sınav Tarihi: 18 / 05 / 2017 Saati: 13 : 00

ÖĞRENCİNİN	ÖĞRETIM ELEMANIN	SINAV NOTU	
Adı Soyadı : Answer Sheet	Adı Soyadı : Prof.Dr. Tevfik AYTEMİZ	Rakamla	Yazıyla
Numarası :	İmzası		
İmzası			

Directives

Provide all the details of your answers, not just the solutions. You have **75 minutes and each question is 25 points.**
Good Luck!
Prof. Dr. Tevfik AYTEMİZ

Questions

1) Consider the following random sample from a normal population. Find the 90% confidence interval for population variance.

12, 16, 8, 10, 9

$n=5$

$\bar{x} = \frac{12+16+8+10+9}{5} = \frac{55}{5} = 11$

$s^2 = \frac{(12-11)^2+(16-11)^2+\dots+(9-11)^2}{4} = \frac{40}{4} = 10$

$$\frac{(n-1)s^2}{\chi^2_{n-1,\alpha/2}} \le \sigma^2 \le \frac{(n-1)s^2}{\chi^2_{n-1,1-\alpha/2}}$$

9.488 $\rightarrow$ 0.711

$$\frac{4\times10}{9.488} < \sigma^2 < \frac{4\times10}{0.711}$$

$$4.22 < \sigma^2 < 56.26$$

2) It is important for airlines to follow the published scheduled departure times of flights. Suppose that one airline that recently sampled the records of 246 flights originating in Orlando found that 10 flights were delayed for severe weather, 4 flights were delayed for maintenance concerns, and all the other flights were on time. Estimate the percentage of on-time departures using a 98% confidence level.

$n=246$

$\hat{p} = \frac{246-14}{246} = 0.94$

$1-\alpha = 0.98$

$\frac{\alpha}{2} = 0.01$

$1-\frac{\alpha}{2} = 0.99$

$z_{0.99} = 2.33$

$$\hat{p} - z_{1-\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} < P < \hat{p} + z_{1-\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$0.94 - 2.33\sqrt{\frac{0.94\times0.06}{246}} < P < 0.94 + 2.33\sqrt{\frac{0.96\times0.06}{246}}$$

$$0.94 - 0.035 < P < 0.94 + 0.035$$

$$0.905 < P < 0.975$$

3) A college admissions officer for an MBA program has determined that historically all applicants (population) have undergraduate grade point averages that are normally distributed with standard deviation 0.45. From a random sample of 25 applications for the current year, the sample mean grade point average is 2.90 and the sample standard deviation is 0.60. Form an 88% confidence interval for the population mean.

$n = 25$

$\sigma = 0.45$

$\bar{X} = 2.90$

$S = 0.60$

$1-\alpha = 0.88$

$\alpha = 0.12$

$\frac{\alpha}{2} = 0.06$

$1-\frac{\alpha}{2} = 0.94$

$Z_{0.94} = 1.55$

$$\bar{X} - Z_{1-\alpha/2}\frac{\sigma}{\sqrt{n}} < \mu < \bar{X} + Z_{1-\alpha/2}\frac{\sigma}{\sqrt{n}}$$

$$2.90 - 1.55\frac{0.45}{\sqrt{25}} < \mu \leq 2.90 + 1.55\frac{0.45}{\sqrt{25}}$$

$$2.90 - 0.1395 < \mu < 2.90 + 0.1395$$

$$2.7605 < \mu < 3.0395$$

4) An accounting firm conducts a random sample of the accounts payable for the east and the west offices of one of its clients. From these two independent samples, the company wants to estimate the difference between the population mean values of the payables. The sample statistics obtained are as follows:

	EAST OFFICE (POPULATION X)	WEST OFFICE (POPULATION Y)
Sample mean	$290	$250
Sample size	16	11
Sample standard deviation	15	50

Assuming equal population variances, estimate the difference between the mean values of the payables for the two offices. Use a 90% confidence level.

$\bar{X} = 290$

$\bar{Y} = 250$

$n_x = 16$

$n_y = 11$

$S_x = 15$

$S_y = 50$

$1-\alpha = 0.90$

$\alpha = 0.10$

$\frac{\alpha}{2} = 0.05$

$n_x + n_y - 2 = 16 + 11 - 2 = 25$

$t_{25,0.05} = 1.708$

$$(\bar{x} - \bar{y}) \pm t_{n_x+n_y-2,\alpha/2}\sqrt{\frac{S_p^2}{n_x} + \frac{S_p^2}{n_y}}$$

$$S_p^2 = \frac{(n_x-1)S_x^2 + (n_y-1)S_y^2}{n_x+n_y-2}$$

$$= \frac{(15 \times 15^2) + (10 \times 50^2)}{25} = \frac{28375}{25} = 1135$$

$$\underbrace{(290-250) \pm 1.708 \underbrace{\sqrt{\frac{1135}{16} + \frac{1135}{11}}}_{13.195}}_{22.537}$$

$$40 \pm 22.537 \Rightarrow 17.463 < \mu_x - \mu_y < 62.537$$

T.C.

MERSİN ÜNİVERSİTESİ

İİBF İŞLETME BÖLÜMÜ

2017-2018 EĞİTİM-ÖĞRETİM YILI BAHAR DÖNEMİ

BUS294 STATISTICS II FİNAL

SINAV SORU-CEVAP KAĞIDI FORMU

K-Q TSE-ISO-EN 9000

Sınav Tarihi: 09 / 05 / 2018 Saati: 13 : 00

ÖĞRENCİNİN	ÖĞRETİM ELEMANIN	SINAV NOTU	
Adı Soyadı : Answer	Adı Soyadı : Prof.Dr.Tevfik AYTEMİZ	Rakamla	Yazıyla
Numarası : Sheet	İmzası		
İmzası			

Directives

* This is not a test exam. Therefore, you should provide all the details of your answers, not just the solutions.
* You have **65 minutes and each question is 25 points. Good Luck!**
Prof. Dr. Tevfik AYTEMİZ

Questions

1) A jar contains black and white balls. It is known that there are total of 1500 balls in the jar, although the proportions of black and white balls are unknown. To estimate these proportions, 35 of the randomly selected 100 balls are observed to be white. Using this sample, estimate the 85% confidence interval for the proportion (ratio) of the white balls in the jar.

$n=100$

$\hat{p} = \frac{35}{100} = 0.35$

$1-\alpha = 0.85$

$1-\frac{\alpha}{2} = 0.925$

$z_{0.925} = 1.44$

$$\hat{p} - z_{1-\frac{\alpha}{2}}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} < p < \hat{p} + z_{1-\frac{\alpha}{2}}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$0.35 - \underbrace{1.44\sqrt{\frac{0.35\times0.65}{100}}}_{0.069} < p < 0.35 + 1.44\sqrt{\frac{0.35\times0.65}{100}}$$

$$0.35 - 0.069 < p < 0.35 + 0.069$$

$$0.281 < p < 0.419$$

2) An insurance company finds that high-risk drivers will be involved in an accident every 2 months, on average, during a calendar year. What is the probability that a high-risk driver will be involved in an accident during the first 3 months of a calendar year?

$\lambda = \frac{1}{2}$ accidents/month (exponential distribution)

$$P(T<3) = 1 - e^{-\frac{1}{2}\times3} = 1 - e^{-\frac{3}{2}} = 1 - 0.2231$$

$$= 0.7769$$

3) It is known that 10% of all the items produced by a particular manufacturing process are defective. From the very large output of a single day, 400 items are selected at random.

a) What is the probability that at least 35 of the selected items are defective?
b) What is the probability that between 40 and 50 of the selected items are defective?

$X \sim \text{Binomial}(n=400,\ p=0.1) \Rightarrow \mu = np = 400 \times 0.1 = 40$

$\sigma^2 = np(1-p) = 400 \times 0.1 \times 0.9 = 36$

$X \approx \text{Normal}(\mu=40,\ \sigma^2=36)$

a) $P(X \geq 35) = P(Z \geq -0.83) = 1 - P(Z < -0.83)$

$= 1 - (1 - 0.7967)$

$= \underline{\underline{0.7967}}$ //

$Z = \dfrac{35-40}{6} = -0.83$

b) $P(40 \leq X \leq 50) = P(0 \leq Z \leq 1.67)$

$Z_1 = \dfrac{40-40}{6} = 0$

$= P(Z \leq 1.67) - P(Z \leq 0)$

$Z_2 = \dfrac{50-40}{6} = 1.67$

$= 0.9525 - 0.5$

$= \underline{\underline{0.4525}}$ //

4) A researcher wants to estimate the mean number of letters used in Turkish words. For this purpose, researcher randomly selects the following Turkish words. Form an 88% confidence interval for the population mean.

araba, televizyon, çarşı, sınav, ekmek, futbol

$\underbrace{\text{araba}}_{5}$, $\underbrace{\text{televizyon}}_{10}$, $\underbrace{\text{çarşı}}_{5}$, $\underbrace{\text{sınav}}_{5}$, $\underbrace{\text{ekmek}}_{5}$, $\underbrace{\text{futbol}}_{6}$

$\bar{X} = \dfrac{5+10+5+5+5+6}{6} = \dfrac{36}{6} = \underline{\underline{6}}$ //

$s^2 = \dfrac{(5-6)^2 + (10-6)^2 + \dots + (6-6)^2}{5} = \underline{\underline{4}}$ //

$n = 6$

$1 - \alpha = 0.88$

$\alpha = 0.12$

$\dfrac{\alpha}{2} = 0.06$

$t_{n-1,\alpha/2} = t_{5,0.06}$

$= 2.015$

$$\bar{X} - t_{n-1,\alpha/2}\frac{s}{\sqrt{n}} < \mu < \bar{X} + t_{n-1,\alpha/2}\frac{s}{\sqrt{n}}$$

$$\underbrace{6 - 2.015\frac{2}{\sqrt{6}}}_{1.65} < \mu < 6 + 2.015\frac{2}{\sqrt{6}}$$

$$4.35 < \mu < 7.65$$

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BUS294 STATISTICS II, 2021-2022 SPRING SEMESTER, MIDTERM EXAM ANSWER SHEET

07/04/2022 - 11:30

QUESTIONS AND ANSWERS

1) Management wants an estimate of the proportion of the corporation's employees who favor a modified bonus plan. From a random sample of 360 employees it was found that 270 were in favor of this particular plan. Find a 95% confidence interval estimate of the true population proportion that favors this modified bonus plan. **(35 Points)**

ANSWER

Given: $n = 360$, $p = \dfrac{270}{360} = 0.75$, $1\text{-}\alpha = 0.95$

Z value from the table: $1 - (\alpha/2) = 0.975$, $z_{1\text{-}(\alpha/2)} = 1.96$

Formula used: $\hat{p} \pm z_{1-(\alpha/2)}\sqrt{\dfrac{\hat{p}(1-\hat{p})}{n}}$ Confidence Interval: $0.75 \pm 1.96\sqrt{\dfrac{0.75*0.25}{360}} = 0.75 \pm 0.045$

Confidence Interval is $0.705 \leq P \leq 0.795$

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2) A college admissions officer for an MBA program has determined that historically all applicants (population) have undergraduate grade point averages that are normally distributed with standard deviation 0.5. From a random sample of 25 applications for the current year, the sample mean grade point average is 2.8 and the sample standard deviation is 0.7. Based on these sample results, admissions officer found for the population mean a confidence interval extending from 2.6 to 3. Find the confidence level of this interval. Use 4 decimal points when finding the confidence level. **(30 Points)**

ANSWER

Given: $\sigma = 0.5$, $n = 25$, $\bar{x} = 2.8$, $s = 0.7$, LCL=2.6, UCL=3

Interval Width $= 2*ME = 3 - 2.6 = 0.4$ then $ME = 0.4/2 = 0.2$

Formula used: Margin of Error $=$ $ME = z_{1-(\alpha/2)}\dfrac{\sigma}{\sqrt{n}}$

Since ME = 0.2 then using the formula above we can find that $z_{1-(\alpha/2)} = 2$

From the z table: $1 - (\alpha/2) = 0.9772$ and then $1 - \alpha = 0.9544$ and the **confidence level is 95.44%**

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3) A researcher wants to estimate the mean number of letters used in English words. For this purpose, researcher randomly selects the following English words. Form an 88% confidence interval for the population mean. **(35 Points)**
car, television, shopping, example, mail, milk

ANSWER

Number of letters in the sample: car: 3, television: 10, shopping: 8, example: 7, mail: 4, milk: 4

Mean number of letters in the sample: $\bar{x} = (3+10+8+7+4+4)/6 = 36/6 = 6$

Standard deviation of letters in the sample: $s = \sqrt{(3-6)^2+(10-6)^2+\ldots+(4-6)^2/5} = \sqrt{38/5} = \sqrt{7.6} = 2.76$

t value from the table: $1 - \alpha = 0.88$, $\alpha/2 = 0.06$, $n - 1 = 5$, $t_{5,\,0.06} = 2.015$

Formula used: $\bar{x} \pm t_{n\text{-}1,\,\alpha/2}\dfrac{s}{\sqrt{n}}$ Confidence Interval: $6 \pm 2.015\dfrac{2.76}{\sqrt{6}} = 6 \pm 2.27$

Confidence Interval is $3.73 \leq \mu \leq 8.27$

BUS294 STATISTICS II, 2021-2022 SPRING SEMESTER, FINAL EXAM

02/06/2022 - 11:30

QUESTIONS AND ANSWERS

1) Of a random sample of 300 marketing students, 225 rated a case of résumé inflation as unethical. Based on this information a statistician computed a confidence interval extending from 0.704 to 0.796 for the population proportion. What is the confidence level of this interval? **(30 Points)**

ANSWER

Given: n = 300, $\hat{p}$ = 225/300 = 0.75, LCL = 0.704, UCL = 0.796

Interval Width = 2*ME = 0.796 – 0.704 = 0.092 then ME = 0.092/2 = 0.046

Formula used: $\text{Margin of Error} = \text{ME} = z_{1-\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

Since ME = 0.046 then using the formula above we can find that $z_{1-\alpha/2} = \frac{\text{ME}}{\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}} = \frac{0.046}{\sqrt{\frac{0.75*0.25}{300}}} = 1.84$

From the z table: 1 - (α/2) = 0.9671 and then 1 - α = 0.9342 and the **confidence level is 93.42%**

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2) A researcher wants to estimate the difference between the mean score points of home and visitor teams in a basketball game. For this purpose, researcher randomly selects 25 basketball games and obtains their scores. In these games, home teams' mean score is 84 points with a standard deviation of 20 points while visitor teams' mean score is 75 points with a standard deviation of 30 points. Find the 99% confidence interval for the difference between the mean score points of home and visitor teams. **(35 Points)**

ANSWER

Let X be the home teams' scores and Y be the visitor teams' scores

Given: n_x = 25, n_y = 25, $\bar{x}$ = 84, $\bar{y}$ = 75, s_x = 20, s_y = 30, 1-α = 0.99

$$v = \frac{\left[\left(\frac{s_x^2}{n_x}\right) + \left(\frac{s_y^2}{n_y}\right)\right]^2}{\left(\frac{s_x^2}{n_x}\right)^2/(n_x-1) + \left(\frac{s_y^2}{n_y}\right)^2/(n_y-1)} = v = \frac{\left[\left(\frac{20^2}{25}\right)+\left(\frac{30^2}{25}\right)\right]^2}{\left(\frac{20^2}{25}\right)^2/(24)+\left(\frac{30^2}{25}\right)^2/(24)} = \frac{52^2}{10.67+54} = 41.81 \cong 42$$

t table value:
1 - α = 0.99
α = 0.01
α/2 = 0.005
$t_{v,\alpha/2} = t_{42,\,0.005} = 2.704$

Formula used: $(\bar{x} - \bar{y}) \pm t_{v,\alpha/2}\sqrt{\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}}$

Confidence Interval: $(84 - 75) \pm 2.704\sqrt{\frac{20^2}{25} + \frac{30^2}{25}} = 9 \pm 2.704 * 7.21 = 9 \pm 19.50$

Confidence Interval is $-10.5 \le \mu_x - \mu_y \le 28.5$

3) Six people sign up for a weight loss program. However, Person 2 and Person 5 quit the program before it ends. Find the 95% confidence interval for the mean weight loss from this program, based on the following data collected. **(35 Points)**

Person	Weight		d_i
	Before the Program	After the Program	
1	136	125	11
2	205	-	-
3	157	150	7
4	138	140	-2
5	175	-	-
6	166	160	6

ANSWER

$$\bar{d} = \frac{\sum_{i=1}^{n} d_i}{n} = \frac{22}{4} = 5.5 \qquad S_d = \sqrt{\frac{\sum_{i=1}^{n}(d_i - \bar{d})^2}{n-1}} = \sqrt{\frac{(11-5.5)^2+(7-5.5)^2+(-2-5.5)^2+(6-5.5)^2}{3}} = \sqrt{\frac{89}{3}} = 5.45$$

Given: $n = 4$, $\bar{d} = 5.5$, $s_d = 4.45$, $1-\alpha = 0.95$

t table value $= t_{n-1,\,\alpha/2} = t_{3,\,0,025} = 3.182$

Formula used: $\bar{d} \pm t_{n-1,\alpha/2} \frac{S_d}{\sqrt{n}}$ Confidence Interval: $5.5 \pm 3.182 \frac{5.45}{\sqrt{4}} = 5.5 \pm 8.67$

Confidence Interval is $-3.17 \leq \mu_d \leq 14.17$