KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICAL SCIENCES
DHAHRAN, SAUDI ARABIA

STAT 212: BUSINESS STATISTICS II

Semester 163
First Major Exam
Tuesday July 25, 2017
5:00 pm – 6:15 pm

Name: KEY ID#: 0000 Section: 00 Serial: 0

Question No	Full Marks	Marks Obtained
1	8	
2	8	
3	9	
4	8	
5	7	
6	10	
Total	**50**	

8 **1.** A tourism and traveling agency claims that the average of a one-day travel expenses in Moscow exceeds \$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 $\alpha = 10\%$.

1	The hypotheses are: H_0: $\mu \leq 500$ H_1: $\mu > 500$ 1 — $\bar{x} = 528$, $n = 35$, $s = 41$, $\alpha = 0.1$
1	The assumption is: LARGE sample $\Rightarrow Z_0$ 1
1	The test statistic: $Z_0 = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{538 - 500}{\frac{41}{\sqrt{35}}} = 5.483$ 1
1	The critical value: $Z_\alpha = Z_{0.1} = 1.28$ 1
2	The decision rule & decision: If 1 $Z_0 > Z_\alpha \Rightarrow$ Reject H_0 Since $5.483 > 1.28$ 1 $\Rightarrow$ Reject H_0
2	The conclusion: There is enough 1 evidence that the claim of the company is TRUE 1 at 10% level of Significance.

8 **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.

1	The hypotheses are: H_0: $\pi \leq 0.6$ H_1: $\pi > 0.6$ (1)	$n = 1000$ $x = 640$ $\alpha = 0.05$
1	The assumptions are: a. $n\pi_0 = 1000(0.6) = 600 \geq 5$ ✓ (1) b. $n(1-\pi_0) = 1000(0.4) = 400 \geq 5$ ✓	$p = \frac{640}{1000} = 0.64$ $q = 1-p = 0.36$
2	The test statistic value: $Z_0 = \frac{x - n\pi_0}{\sqrt{n\pi_0(1-\pi_0)}} = \frac{640-600}{\sqrt{600(0.4)}} = 2.582$ (1) (1)	
2	The p-value = $P(Z > Z_0) = P(Z > 2.58)$ (1) $= P(Z < -2.58)$ (1) $= 0.0049 \approx 0.005$	
2	The decision rule & decision: If p-value $< \alpha \Rightarrow$ Reject H_0 (1) Since $0.005 < 0.05 \Rightarrow$ Reject H_0 (1)	

9 **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**
$n_1 = 25$	$n_2 = 61$
$\bar{x}_1 = \$45,000$	$\bar{x}_2 = \$35,000$
$s_1 = \$3,500$	$s_2 = \$4,000$

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.

1 The hypotheses are: H_0: $\mu_1 - \mu_2 = 0$ H_1: $\mu_1 - \mu_2 \neq 0$ 1

2 The assumptions are: a. Indep. samples b. Small samples 1

c. ASSUME normal pops d. Unknown σ's (Assumed Equal)

1

3 The test statistic value:

$$t_0 = \frac{(\bar{x}_1 - \bar{x}_2) - D_0}{S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \quad 1$$

$$S_p = \sqrt{\frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1+n_2-2}}$$

$$= \sqrt{\frac{24(3500)^2 + 60(4000)^2}{25+61-2}}$$

$$= \boxed{3863.751} \quad 1$$

$$t_0 = \frac{45000 - 35000}{3863.751\sqrt{\frac{1}{25} + \frac{1}{61}}}$$

$$= \boxed{10.8987} \quad 1$$

2 The p-value:

$= 2P(t_{n_1+n_2-2} > |t_0|)$ 1 $= 2P(t_{84} > 10.8987) = 2(p < 0.005)$

$\Rightarrow$ p-value $<< 0.01$ 1

1 The decision rule & decision:

If p-value $< \alpha \Rightarrow$ Reject H_0

Since p-value $<< 0.01 < 0.05 \Rightarrow$ Reject H_0.

1

8 **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 (1)

$\bar{D} = -6.1667$

$S_D = 6.5853$

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

(1)

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

1	The hypotheses are: H_0: $\mu_D \geq 0$ H_1: $\mu_D < 0$ (1) | $D = \text{After} - \text{Before}$
1	The assumptions are: a. Two related pop. b. Differences are Normally dist. (1)
3	The test statistic value: $t_0 = \dfrac{\bar{D} - \mu_D}{\frac{S_D}{\sqrt{n}}} = \dfrac{-6.1667 - 0}{\frac{6.5853}{\sqrt{6}}} = \boxed{-2.2938}$ (1)
1	The critical value: $t_{\alpha, n-1} = t_{0.01, 5} = 3.365$ (1)
1	The Decision rule & decision: If $t_0 < -t_\alpha \Rightarrow$ Reject H_0. (1) Since $-2.2938 \not< -3.365 \Rightarrow$ Do NOT reject H_0
1	The Conclusion: (1) There is NO enough evidence that the program provides significant loss in weight at 1% level of significance.

7 **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?

1	The hypotheses are: H_0: $\sigma_1^2 = \sigma_2^2$ H_1: $\sigma_1^2 \neq \sigma_2^2$ ① | $\alpha = 0.1$
1	The assumptions are: a. Two populations are Indep. b. " " " Normally dist. ①
2	The test statistic value: $F_0 = \frac{S^2_{Higher}}{S^2_{Lower}} = \frac{S_1^2}{S_2^2}$ ① $= \left(\frac{4000}{3500}\right)^2 = 1.3061$ ①
1	The critical value: $F_{\frac{\alpha}{2}, df_1, df_2} = F_{0.05, 60, 24} = 1.842$ ①
2	The decision rule & decision: ① If $F_0 > F_{\frac{\alpha}{2}, df_1, df_2} \Rightarrow$ Reject H_0. Since $1.3061 \not> 1.842 \Rightarrow$ Do NOT reject H_0 ①

10 **6.** A book marketing research study about the relationship between delivery time and computer-assisted ordering was conducted. A sample of 40 firms shows that 16 use computer-assisted ordering, while 24 do not. Furthermore, past data are used to categorize each firm's delivery times as below the industry average, equal to the industry average, or above the industry average as given in the table below:

	Delivery time			
Computer Ordering	Below average	Equal to average	Above average	Total
No	4 (1) 8.4	12 (1) 9.6	8 6	24
Yes	10 5.6	4 6.4	2 4	16
Total	14	16	10	$\boxed{40}$

Using the above table what do you conclude about the relationship between delivery time and computer-assisted ordering? Use 5% significance level.

1 The hypotheses are: H_0: No relationship between Delivery time & Computer Ordering

(1) H_1: There is a sig- relationship bet. Delivery & Ordering.

2 The assumption is: (1) $E_i \geq 5$ ✗ | Yes & Above average has $E_i < 5$ (1)

4 The test statistic value:

$$\chi^2_0 = \sum \frac{(O-E)^2}{E} = \frac{(4-8.4)^2}{8.4} + \frac{(12-9.6)^2}{9.6} + \cdots + \frac{(2-4)^2}{4}$$

$$= 2.3048 + 0.6 + 0.6667 + 3.4571 + 0.9 + 1$$

$$= 8.9286$$ (1)

1 The critical value:

$$\chi^2_{\alpha,(r-1)(c-1)} = \chi^2_{0.05,(2-1)(3-1)} = \chi^2_{0.05,2} = 5.9915$$ (1)

2 The decision rule & decision & decision:

If $\chi^2_0 > \chi^2_\alpha$ (1) $\Rightarrow$ Reject H_0

Since $8.9286 > 5.9915 \Rightarrow$ Reject H_0 (1)

With My Best Wishes