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

STAT 212: BUSINESS STATISTICS II

Major Exam **II**
Tuesday April 3, 2007
6:00 pm – 7:15 pm

Please **circle** your instructor's name & section #:

Instructor's name	Section number
Rahimov I.	1 5
Anabosi R.	2 3 4
Al Sawi E.	6

Name: SOLUTION KEY ID#: **Serial:**

Question No	Full Points	Points Obtained
1	12	
2	12	
3	18	
4	18	
Total	**60**	

Q1. The following sample data have been collected from two independent random samples:

Population	Sample Size	Sample Mean	Sample variance
A	n_A=25	$\bar{x}_A$=40	s_A^2=5
B	n_B=25	$\bar{x}_B$=50	s_B^2=11

In a test for the difference between two population means, the statistical analyst is considering using a pooled estimate of the population variance based on the assumption the variances of the two populations are equal.
Do these data support the statistical analyst's assumption with 0.10 significance level ? WRITE YOUR ANSWERS IN THE APROPRIATE BOX.

Hypotheses	claim H_0: $\sigma_A^2 = \sigma_B^2$	H_a: $\sigma_A^2 \neq \sigma_B^2$ 2
Test Statistic	$F_0 = \frac{S_B^2}{S_A^2} = \frac{11}{5} = 2.2$ 3	
Critical Value(s)	$F_{\frac{\alpha}{2}, n_B-1, n_A-1} = F_{0.05, 24, 24} = 1.984$ 2	
Decision Rule	If $F_0 > F_{\frac{\alpha}{2}} \Rightarrow$ Reject H_0 2	
Decision	since $F_0 = 2.2 > 1.984 = F_\alpha$ $\Rightarrow$ Reject H_0 1	
Conclusion	NO. The data do NOT support the analysts's assumption. 2	

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Q2. A certain part must be machined to very close tolerances or it is not acceptable to customers. Production specifications call for a maximum standard deviation in the lengths of the parts of 0.02 inches. The sample variance for 30 parts turns out to be s^2=0.0005. Using α =0.05, ***test to see if the production specifications are being violated.*** **WRITE YOUR ANSWERS IN THE APROPRIATE BOX.**

Hypotheses	H_0: claim $\sigma^2 \le 0.0004$	H_a: $\sigma^2 > 0.0004$ (2)
Test Statistic	$\chi_0^2 = \frac{(n-1)s^2}{\sigma_0^2} = \frac{(29)(0.0005)}{0.0004} = 36.25$ (3)	
Critical Value(s)	$\chi^2_{\alpha,n-1} = \chi^2_{0.05,29} = 42.5569$ (2)	
Decision Rule	If $\chi_0^2 > \chi^2_{\alpha,n-1} \Rightarrow$ Reject H_0 (1)	
Decision	Since $\chi_0^2 = 36.25 \not> 42.5569 = \chi^2_\alpha$ $\Rightarrow$ Do NOT reject H_0 (2)	
Conclusion	The production specifications are NOT violated. (2)	

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Q3. The number of automobile accidents per day in a particular city is believed to have a Poisson distribution. A sample of 120 days during the past year gives the data listed below. Do these data support the belief that the number of accidents per day has a Poisson distribution with mean 1.3 and 5% of type one error? Use $P\{X = i\} = \lambda^i e^{-\lambda}/i!$ for the Poisson distribution.

Number of Accidents	0	1	2	3	4
Observed Frequency (days)	39	30	30	18	3

Hypotheses

H_0: Number of accidents/day has Poisson with $\lambda = 1.3$. (1)

H_A: " " " does NOT " " " " .

Test Statistic

$$\chi_0^2 = \sum \frac{(O_i - e_i)^2}{e_i}$$

x	0	1	2	3	≥ 4	Total
$p(x)$	0.2725	0.3543	0.2303	0.0998	0.0431	1
e_i	32.7	42.516	27.636	11.976	5.172	120
O_i	39	30	30	18	3	120
$\frac{(O-e)^2}{e}$	1.214	3.685	0.202	3.03	0.912	

(6)

$$\chi_0^2 = 1.214 + 3.685 + 0.202 + 3.03 + 0.912 \quad (5)$$
$$= 9.043 \quad (1)$$

Critical Value(s)

$\chi^2_{\alpha, k-1} = \chi^2_{0.05, 4} = 9.4877$ (2)

Decision Rule

If $\chi_0^2 > \chi^2_{\alpha, k-1} \Rightarrow$ Reject H_0 (1)

Decision

Since $\chi_0^2 = 9.043 \not> 9.4877 = \chi^2_{\alpha, k-1}$ (1)
$\Rightarrow$ Do NOT reject H_0

Conclusion

The number of accidents/day has the Poisson dist^n with mean 1.3. (1)

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Q4. One of questions on the *Business Week* 2006 Subscriber Study was "In the past 12 months, when traveling for business, what type of airline tickets did you purchase most often?" The data obtained are shown in the following contingency table.

Type of Ticket	*Type of Flight*				
	Domestic		**International**		
First class	29	35.589	22	15.411	51
Business class	95	150.730	121	65.27	216
Full fare economy class	518	455.681	135	197.319	653
	642		278		920

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a) Using 0.05 significance level, are type of flight and type of ticket independent?

b) What is the range of the significance level, for which you would conclude that the type of flight is independent of the type of ticket?

Hypotheses	H_0: Type of flight & Type of ticket are INDEP. 1 H_A: " " " " " " NOT indep.
Test Statistic	O_i : Printed in cells. e_i : Typed by hand in cells. $e_{ij} = \frac{(i\text{th row total})(j\text{th column total})}{\text{sample size}}$ $\chi_0^2 = \sum_i \sum_j \frac{(O_{ij}-e_{ij})^2}{e_{ij}}$ $= 1.2199 + 20.6053 + 8.5228 +$ 6 $2.8171 + 47.5844 + 19.6821$ $= 100.4316$ 1
Critical Value(s)	$\chi^2_{\alpha,(r-1)(c-1)} = \chi^2_{0.05,2} = 5.9915$ 2
Decision Rule	If $\chi_0^2 > \chi^2_{\alpha,(r-1)(c-1)} \Rightarrow$ Reject H_0 1
Decision	Since $\chi_0^2 = 100.4316 > 5.9915 = \chi^2_\alpha \Rightarrow$ Reject H_0 1
Conclusion	a) No. Type of flight & Type of ticket are <u>NOT</u> independant. 1 b) Nothing, because $\chi_0^2 \gg \chi_\alpha^2 \ \forall \alpha > 0$. 1

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