國立暨南國際大學九十二學年度碩士班研究生入學考試試題

第 2 節統計學 適用:(資管所 332)

考生注意: 1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分，並限以藍黑色筆作答。
3. 試題隨卷繳回。(餘請詳閱試場規則)

1. A professor of epidemiology reported that, based on currently available evidence, close contact with an infected person is needed for the infective agent of SARS (Severe Acute Respiratory Syndrome) to spread from one person to another. He then concluded that people need not to wear a facemask all day long; unless when in close contact with the patients or the suspect cases. As of 24th March, six suspect cases are found due to local transmission. Among them, two are hospital workers who have cared for SARS patients and two are close family members of the patients. The investigation on the remaining two suspect cases is still on going.
   (1) Do the data present sufficient evidence to support the professor's claim? Please explain. (7 points)
   (2) As of 1st April, 327 suspect cases are reported due to local transmission. Among these, 226 are health care workers and 94 are close family members or friends of the patients. The remaining cases are still being investigated. Do the new data sufficient to support the professor's statement? (8 points)

2. (1) Show that if $x \geq 0$ and $E[x]=n$, then $\Pr(x \geq \sqrt{n}) \leq \sqrt{n}$. (8 points)
   (2) Consider a sample of sample size $n=100$. If the maximum and minimum values of this sample are 285 and 205, respectively, please provide an estimate to its standard deviation? (7 points)

3. A process engineer conducts an experiment to determine the effect of slurry flow rate on the uniformity of the chemical-mechanical polishing (CMP) process on a silicon wafer used in integrated circuit manufacturing. Three flow rates are used in the experiment, and the non-uniformity (in percent) for six replicates is shown below.

Slurry	Non-Uniformity (%)					
Flow Rate	1	2	3	4	5	6
100	2.5	2.7	3.0	3.2	3.8	4.2
125	3.7	4.2	4.3	4.6	4.9	5.0
150	3.8	4.2	4.6	5.0	5.1	5.1

   (1) Does slurry flow rate affect CMP uniformity? Construct box plots to compare the factor levels and perform the analysis of variance. Use $\alpha=0.05$. (10 points)
   (2) Do the residuals indicate any problem with the underling assumptions. (5 points)

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4. The Distance Learning Center (DLC) of NCNU wishes to evaluate a new method of teaching elementary statistics. At the end of the course, the evaluation will be made on the basis of scores of participating students on a standard test. There is a particular interest in estimating the mean score, μ, for students learning with the new method. As the method is new and some of the staffs question the value of this approach, DLC does not want to expose every student to this new method. There is a desire to determine the minimum number of students (sample size), n, who are to be selected at random to take the new method. From past experience, it is believed that the standard deviation associated with this type of test is about 16.5. Please find the sample size n such that DLC is fairly confident that the 95% confidence interval is 2. (15 points)

5. The recent two month average utilization rates of 10 computer servers in Puli Wine Company are tabulated as below.

March	April	March	April
67	73	70	87
70	83	74	79
64	88	80	79
84	91	74	98
82	94	80	96

(1) Calculate the least-squares regression line for these data. (10 points)
(2) Find the maximum likelihood estimate of the variance. (10 points)

6. Two studies on the average duration of computer users spending on the Internet are reported. Study *A* was conducted in the country area with the following 11 observations (in hours):

0.1 0.5 0.8 0.9 0.9 1.0 1.0 1.2 1.4 1.7 1.8

Study *B* was conducted in the metropolitan area with the following 13 observations (in hours):

0.8 1.0 1.1 1.2 1.3 1.4 1.6 1.8 1.9 2.0 2.4 2.5 2.6

We are interested in testing whether the distributions of these two areas are the same.
(1) Please test the equality of the two means at a significance level of 0.05. (7 points)
(2) What is the approximate *p*-value of the test above. (6 points)
(3) Please test the equality of the two variances at a significance level of 0.05. (7 points)

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Remark: The following data may be useful in answering your questions:

$F_{0.025}(10,12)=3.37$ $F_{0.025}(12,10)=3.62$

$t_{0.05}(22)=1.717$ $t_{0.005}(22)=2.819$

$z_{0.05}=1.64$ $z_{0.025}=1.96$

Table of Calculations of Average Utilization Rates of Recent Two Months

	x	y	x^2	xy	y^2	$\hat{y}$	$y-\hat{y}$	$(y-\hat{y})^2$
	67	73	4489	4891	5329	83.0575	-10.0575	101.1533
	70	83	4900	5810	6889	84.5545	-1.5545	2.41647
	64	88	4096	5632	7744	81.5605	6.4395	41.46716
	84	91	7056	7644	8281	91.5405	-0.5405	0.29214
	82	94	6724	7708	8836	90.5425	3.4575	11.95431
	70	87	4900	6090	7569	84.5545	2.4455	5.98047
	74	79	5476	5846	6241	86.5505	-7.5505	57.01005
	80	79	6400	6320	6241	89.5445	-10.5445	111.1865
	74	98	5476	7252	9604	86.5505	11.4495	131.0911
	80	96	6400	7680	9216	89.5445	6.4555	41.67348
Sum	745	868	55917	64873	75950			504.2249