

中國醫藥大學九十七學年度研究所碩士班暨碩士在職專班入學招生考試試題

所別：生物統計研究所

科目：統計學



考生注意：答案必須寫在答案卷上，否則不予計分。

1. (10 points)

- What is the distinction between a normal distribution and the standard normal distribution? (5pts)
- Why do statisticians prefer to work with the standard normal distribution rather than the normal distribution? (5pts)

2. (10 points)

What are the degrees of freedom for between, within, and total treatments for a one-way ANOVA with five treatments and 10 subjects in each treatment?

3. (10 points)

Complete the following ANOVA table:

Source	SS	df	MS	F	<i>p</i>
Between	140				
Within	455	35			
Total		39			

Is the *F* ratio significant at the $\alpha = 0.05$ level?

Note:

	Numerator Degree of Freedom (df)					
		3	4	5	35	39
Denominator Degree of Freedom (df)	3	9.277	9.117	9.013	8.604	8.596
	4	6.591	6.388	6.256	5.729	5.719
	5	5.409	5.192	5.050	4.478	4.466
	35	2.874	2.641	2.485	1.757	1.739
	39	2.845	2.612	2.456	1.723	1.704

4. (10 points)

A simple linear regression analysis was performed with infant's length (unit: cm) as response variable and gestational age (unit: week) as explanatory variable. The results are shown as the follows:

	df	SS	MS	F	<i>p</i>
Model	1	575.7	575.7	82.1	<0.001
Residual	98	687.0	7.0		
Total	99	1262.8			

	Coefficient Estimate	Std. Error	t	<i>p</i>
Intercept	9.328	3.045	3.063	0.003
gestage	0.952	0.105	9.062	<0.001

- What is the coefficient of determination (R^2)? (4pts)
- At the $\alpha = 0.01$, test the null hypothesis that the true population slope β is equal to 0. (3pts)
- What is the estimated mean length for infants whose gestational age is 30 weeks? (3pts)

5. (10 points)

Super-Duper Cee Pills were advertised as having 750 mg of vitamin C per pill. A consumers' group believed the amount of vitamin C was less than advertised. A one-sided test will

be suggested to be conducted at the $\alpha = 0.01$ level of significance. A sample of $n=16$ subjects has mean $\bar{x}=730$ mg and standard deviation $s=24$. Assume the distribution of the amount of vitamin C is normally distributed.

- State the null hypothesis. (2pts)
- State the alternative hypothesis. (2pts)
- Perform the appropriate test and calculate the p value. (4pts)
- What do you conclude? (2pts)

Note:

Percentiles of the t distribution for area in the upper tail					
df	area in the upper tail				
	0.05	0.025	0.01	0.005	0.0005
13	1.771	2.16	2.65	3.012	4.221
14	1.761	2.145	2.624	2.977	4.14
15	1.753	2.131	2.602	2.947	4.073
16	1.746	2.12	2.583	2.921	4.015

6. (10 points)

- What are the differences between the standard deviation and the standard error? (5pts)
- When would we want to use the standard deviation, and when the standard error? (5pts)

7. (10 points)

The following table presents data on 100 pregnant women and their smoking status before and after pregnancy. Determine whether there is a relationship between pregnancy and smoking status at the $\alpha = 0.05$ level.

A 2x2 Table of Smoking Status Before and After Pregnancy

Pregnancy	After Pregnancy		Total
	Smoker	Nonsmoker	
Nonsmoker	5	55	60
Smoker	20	20	40
Total	25	75	100

Note:

Percentiles of the chi-square distribution			
df	Area in Upper Tail		
	0.1	0.05	0.025
1	2.71	3.84	5.02
2	4.61	5.99	7.38
3	6.25	7.81	9.35
4	7.78	9.49	11.14

8. (10 points)

A survey of 200 women and 200 men indicated that 120 of the women and 80 of the men said they were trying to lose weight. (Note: π represents the population proportion)

- Perform a test of significance by using the method of confidence interval based on null hypothesis H_0 to determine whether this difference is significant at the $\alpha = 0.05$ level. Please state your computed confidence interval. (6pts)
- Does this interval contain the value 0? What do you conclude? (4pts)

Note :

Percentiles of the standard normal distribution for area in the upper tail					
	area in the upper tail				
0.1	0.05	0.025	0.01	0.005	0.0005
1.28	1.64	1.96	2.33	2.58	3.29

9. (10 points)

Let a random variable x be the number of successes in a binomial distribution with sample size n and probability π .

- What are the mean and the standard deviation of a random variable x ? (4pts)
- What are the mean and the standard deviation of the binomial sample proportion $p (=x/n)$? (4pts)
- Under what condition is the normal distribution a reasonable approximation to the binomial distribution? (2pts)

10. (10 points)

Two health inspectors rate 11 hospitals on cleanliness, as shown in the tabulation that follows. Determine whether their rankings are comparable. Assume that the differences of their rankings are not normally distributed.

	Hospital										
	1	2	3	4	5	6	7	8	9	10	11
Inspector 1	2	3	2	3	1	4	5	3	1	3	4
Inspector 2	1	3	3	2	2	5	4	2	1	4	3

- State the null hypothesis. (2pts)
- State the alternative hypothesis. (2pts)
- Perform the appropriate test and calculate the p value. What do you conclude? (6pts)

Note:

k	0	1	2	3	4	5	6	7	8	9	10	11
n= 9	0.002	0.018	0.070	0.164	0.246	0.246	0.164	0.070	0.018	0.002		
n= 10	0.001	0.010	0.044	0.117	0.205	0.246	0.205	0.117	0.044	0.010	0.001	
n= 11	0.000	0.005	0.027	0.081	0.161	0.226	0.226	0.161	0.081	0.027	0.005	0.000