國立臺北科技大學 100 學年度碩士班招生考試

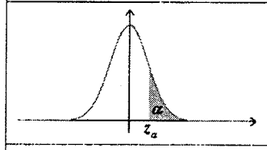
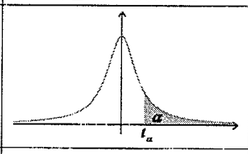
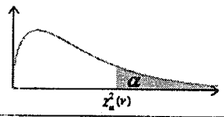
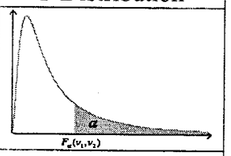
系所組別：4300 資訊與運籌管理研究所

第二節　統計學　試題

注意事項：

1. 本試題共六題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

Note:

Standard Normal	t Distribution	Chi-Square	F Distribution
			
$z_{0.025} = 1.960$	$t_{0.05}(5) = 2.015$	$\chi^2_{0.025}(4) = 11.143$	$F_{0.05}(1,9) = 5.12$
$z_{0.05} = 1.645$	$t_{0.05}(4) = 2.132$	$\chi^2_{0.025}(5) = 12.833$	$F_{0.05}(1,10) = 4.96$
$P(Z > 0.2) = 0.4207$	$t_{0.025}(5) = 2.571$	$\chi^2_{0.025}(6) = 14.449$	$F_{0.05}(1,11) = 4.84$
$P(Z > 0.77) = 0.2206$	$t_{0.025}(4) = 2.776$	$\chi^2_{0.05}(4) = 9.448$	
$P(Z > 1.0) = 0.1587$	$t_{0.05}(9) = 1.833$	$\chi^2_{0.05}(5) = 11.070$	
$P(Z > 1.414) = 0.0787$	$t_{0.05}(8) = 1.860$	$\chi^2_{0.05}(6) = 12.592$	
$P(Z > 1.5) = 0.0668$	$t_{0.025}(9) = 2.262$		
$P(Z > 2.0) = 0.0228$	$t_{0.025}(8) = 2.306$		
$P(Z > 3.0) = 0.0013$			

需計算者，請作必要計算過程，否則不予計分

1. A variable of a population has mean μ and standard deviation σ. For a large sample size n, fill in the blanks. Justify your answers. (12%)
   a. Approximately ____% of all possible samples have means within $\sigma/\sqrt{n}$ of the population mean, μ.
   b. Approximately ____% of all possible samples have means within $2\sigma/\sqrt{n}$ of the population mean, μ.
   c. Approximately ____% of all possible samples have means within $3\sigma/\sqrt{n}$ of the population mean, μ.
   d. Approximately ____% (expressed in term of α) of all possible samples have means within $Z_{\alpha/2}$ of the population mean, μ.

2. The US National Center for Education Statistics publishes information about school enrollment in the contingency table for public and private schools by level. Frequencies are in thousands of students. Explain your answer in terms of percentages. (15%)

	Public T1	Private T2	Total
Elementary L1	33,952	z	s
High school L2	13,736	1,322	15,058
College L3	x	3,695	t
Total	y	9,897	69,818

   a. Find P(T2).
   b. Find P(T2|L2).
   c. Are events L2 and T2 independent?
   d. Are events L2 and T2 mutually exclusive?
   e. As known P(T1|L1)= 87.43% and P(T1|L3)=76.8%, find P(L3|T1).

3. The manufacturer of a new model car, the Orion, claims that a typical car gets 26miles per gallon (mpg). A consumer advocacy group is skeptical (懷疑的) of this claim and thinks that the mean gas mileage, μ, of all Orions may be less than 26 mpg. The group plans to perform the hypothesis test. (25%)
   a. What are the proper null hypothesis and alternative hypothesis?
   b. At the 5% significance level, using a sample of 30 Orions with a standard deviation of 1.4 mpg, find the type II error if the true mean gas mileage is 25.8.
   c. How do you interpret the result of question b?
   d. What is the power of question b?
   e. What is the sample size if we like to increase the power of question b to 0.5 at least?

4. The following data set, which gives the additional sleep in hours obtained by 10 patients who used a kind of sleeping pills. (13%)
   a. Are the numbers in the table paired differences? (3%)
   b. What are the null hypothesis and alternative hypothesis? (5%)
   c. At the 5% significance level, do the data provide sufficient evidence to conclude that this sleeping pill is effective in increasing sleep? (note: $\bar{d} = 2.33$ and $S_d = 2.002$) (5%)

1.9	0.8	1.1	0.1	-0.1	4.4	5.5	1.6	4.6	3.4

5. A national survey was conducted to obtain information on the alcohol consumption patterns of US adults by marital status. A random sample of 1772 residents, 18 years old and older, yielded the data displayed in table below. Suppose we want to decide whether marital status and alcohol consumption are associated. (10%)

注意：背面尚有試題

a. Formulate the problem statistically by posing it as a hypothesis test. (4%)
b. At the 5% significance level, do the data provide sufficient evidence to conclude that an association exists between marital status and alcohol consumption? (6%)

Drinks per month

	Abstain (不喝)	**1-60**	**Over 60**	**Total**
Single	67(117.9)	213(191.2)	74(44.9)	354
Married	411(390.6)	633(633.5)	129(148.9)	1173
Widowed	85(47.6)	51(77.2)	7(18.2)	143
Divorced	27(34.0)	60	15	102
Total	590	957	225	1772

(Note: The expected frequency is parenthesized.上表部份括號內爲預期頻率)

6. The age and price data for a sample of 11 used cars are in the table.

Age(yr) x	Price($100) y
5	85
4	103
6	70
5	82
5	89
5	98
6	66
6	95
2	169
7	70
7	48

As known Σxy=4732, Σy^2 =96,129, Σx^2 =326, construct a ANOVA table using the data above. (25%)

ANOVA

Source	df	SS	MS	F
Regression	1	SSR	MSR	f
Error	a	SSE	MSE	
Total	b	SST		

a. SSR=_____
b. SST=_____
c. f=_____
d. What will you conclude this ANOVA at the 5% significance level? (Write down the hypotheses of this ANOVA and conclude it.)
e. What is the slope of this regression line?