逢甲大學106學年度碩士班考試入學試題

編號：006　　科目代碼：104

科目	統計學	適用系所	統計學系統計與精算碩士班應用統計暨計量財務組、精算組	時間	90分鐘

※請務必在答案卷作答區內作答。　　

1. **(10%)** More than 50 million guests stay at bed and breakfasts (B&Bs) each year. The website for the Bed and Breakfast Inns of North America, which averages seven visitors per minute, enables many B&Bs to attract guests.
   (a) What is the probability of no website visitors in a one-minute period? (5分)
   (b) What is the probability of one or more website visitors in a 30-second period? (5分)

2. **(10%)** A university found that 20% of its students withdraw without completing the introductory statistics course. Assume that 20 students registered for the course.
   (a) Compute the probability that exactly four students will withdraw. (3 分)
   (b) Compute the probability that more than three students will withdraw. (3 分)
   (c) Compute the expected value and variance of withdraws. (4 分)

3. **(15%)** The NCAA estimates that the yearly value of a full athletic scholarship at in-state public universities is $19,000. Assume the scholarship value is normally distributed with a standard deviation of $2100.
   (a) Write the probability density function for the scholarship value. (5分)
   (b) For the 10% of athletic scholarships of least value, how much are they worth? (5分)
   (c) What percentage of athletic scholarships are valued at $22,000 or more? (5分)

4. **(15%)** A department store has determined that 25% of all their sales are credit sales. A random sample of 60 sales is selected.
   (a) What is the sampling distribution of $\bar{p}$? (5 分)
   (b) What is the probability that the sample proportion will be within ± 0.05 of the population proportion? (5 分)
   (c) In a random sample of 60 sales, 18 indicated they are credit sales. Determine a 95% confidence interval for the population proportion of all customers who did credit sales. (5 分)

5. **(18%)** Four brands of canned soups were examined for quality. The numbers of cans passed/failed the assessment are shown below.

	Brands of the canned soups			
	A	B	C	D
Failed	10	15	10	25
Passed	90	85	90	75

   (a) Estimate with 95% confidence the difference of passed proportions between brand A and B. State your conclusion for the quality between brand A and B. (8分)
   (b) At the 5% level of significance, can we conclude that the qualities of 4 brands are the same? State the decision rule and your conclusion. (10分)

6. **(10%)** The least squares prediction line for the response Y and independent variable X is $\hat{Y}=110+4X$ .The following results are also given:

$$n=5,\ \bar{x}=528,\ \sum_{i=1}^{n}\left(x_i-\bar{x}\right)^2=3,\ \sum_{i=1}^{n}\left(y_i-\bar{y}\right)^2=75$$

Please find a 95% prediction interval of Y when x=531.

7. **(12%)** Two independent samples are selected from the normally distributed population 1 and 2. The mean and standard deviation of population i are denoted as μ_i and σ_i, i=1,2. The data information is summarized as follows.

	Sample size	Sample mean	Sample variance
Population 1	17	310	445
Population 2	10	302	320

(a) Test the null hypothesis H_0: $\sigma_1=\sigma_2$ versus the alternative hypothesis H_a: $\sigma_1\neq\sigma_2$ by setting the level of significance α=0.05. State the decision rule and your conclusion. (5分)

(b) Based on the result of (a), test the null hypothesis H_0: $\mu_1\leqq\mu_2$ versus the alternative hypothesis H_a: $\mu_1>\mu_2$ by setting the level of significance α=0.05. Calculate the p-value and state your conclusion. (7分)

8. **(10%)** A marketing organization wants to know the effects of 4 sales methods on daily sales of a product. The organization employs a randomized block design in which 3 salesman use each sales method. The data and an ANOVA table are given.

		Sales method				
		1	2	3	4	Total
Salesman	1	220	210	215	215	860
	2	230	220	215	225	890
	3	225	220	220	225	890
	Total	675	650	650	665	2640

Source of Variation	Sum of Squares	DF	Mean Squares	F
Sales method	150	(b2)	(b6)	(b9)
Salesman	(a)	(b3)	(b7)	(b10)
Error	(b1)	(b4)	(b8)	
Total	350	(b5)		

(a) Please calculate the block (salesman) sum of squares. (3分)

(b) Answer (b1) to (b10). (5分)

(c) Test the null hypothesis that no differences exist between the effects of the sales methods. Set the level of significance α=0.05? State your conclusion. (2分)

Note: In the following, we show the z_α, $t_{df,\alpha}$, $\chi^2_{df,\alpha}$, and $F^{df_1}_{df_2,\alpha}$ values, where α is the area or probability in the upper tail of the standard normal, t, chi-square, and F distributions, respectively.

z_α	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014

$t_{3,0.05} = 2.35$, $t_{4,0.05} = 2.13$, $t_{5,0.05} = 2.02$, $t_{3,0.025} = 3.18$, $t_{4,0.025} = 2.78$, $t_{5,0.025} = 2.57$, $t_{25,0.16} = 1$

$\chi^2_{3,0.05} = 7.81$, $\chi^2_{4,0.25} = 9.49$, $\chi^2_{8,0.05} = 15.51$, $\chi^2_{3,0.025} = 9.35$, $\chi^2_{4,0.025} = 11.14$, $\chi^2_{8,0.025} = 17.53$

$F^{16}_{9,0.05} = 2.99$, $F^{9}_{16,0.05} = 2.54$, $F^{2}_{6,0.05} = 5.14$, $F^{3}_{6,0.05} = 4.76$, $F^{16}_{9,0.025} = 3.74$, $F^{9}_{16,0.025} = 3.05$, $F^{2}_{6,0.025} = 7.26$, $F^{3}_{6,0.025} = 6.60$