所別：資訊管理學系碩士班 甲組 科目：統計學
乙組

請注意：答案請橫式書寫，並依題號順序依序作答，違者各扣總分 3 分。

1. (8 分) An increasing number of employees are exploring the Internet for savings in business travel. A recent survey of 400 corporate travel managers reported the following results.

	BOOK AIRPLIN TICKETS ON THE INTERNET		
RESEARCH AIRLINE TICKET PRICES ON THE INTERNET	YES	NO	TOTAL
YES	88	124	212
NO	20	168	188
TOTAL	108	292	400

If a corporate travel manager is selected at random, what is the probability that he or she
   a. （2 分）researches airline ticket prices on the internet and books airline tickets on the Internet?
   b. （2 分）researches airline ticket prices on the internet or books airline tickets on the Internet?
   c. （4 分）Are researching airline tickets on the Internet statistically independent? Explain.

2. （4 分）The probability that a person has a certain disease is 0.03. Medical diagnostic tests are available to determine whether the person actually has the disease. If the disease is actually present, the probability that the medical diagnostic test will give a positive result (indicating that the disease is present) is 0.90. If the disease is not actually present, the probability of a positive test result (indicating that the disease is present) is 0.02. Suppose that the medical diagnostic test has given a positive result. What is the probability that the disease is actually present?

3. （2 分）When the relationship between variables X and Y is curvelinear, using Pearson *r* will
   a. overestimate the true degree of association.
   b. underestimate the true degree of association.
   c. truly reflect the degree of association.

4. （2 分）Regarding the Pearson coefficient of correlation between variables X and Y, the greater the restriction of range in either variable X or variable Y will result in a(n)
   a. higher correlation coefficient between X and Y.
   b. lower correlation coefficient between X and Y.
   c. unchanged correlation coefficient between X and Y.

5.（2 分）If we transform each score of one variable (or both variables) from one set of units to another by adding, subtracting, or multiplying, or dividing each score by a constant value, the Pearson *r* will become
   a. larger.
   b. smaller.
   c. unaffected.

6. （2 分）The probability, given that H_0 is false, of obtaining sample results that will lead to its rejection is called
   a. power
   b. Type I error.
   c. 1- Type II error.

7.（10 分）The U.S. Department of Transportation requires tire manufacturers to provide tire performance information on the sidewall of the tire so that a prospective customer can be better informed when making a purchasing decision. One measure of tire performance is the tread wear index, which indicates the tire's resistance to tread wear compared with a tire graded with a base of 100. This means that a tire with a grade of 200 should last twice as long, on average, as a tire graded with a base of 100. Suppose a random sample of 16 tires graded 200 produced by a brand name manufacturer indicates a sample mean tread wear index of 195.3 and a sample standard deviation of 21.6.
   a. （7 分）Assuming that the population of tread wear indices is normally distributed, set up a 95% confidence interval estimate of the population mean tread wear index for tires produced by this manufacturer under this brand name.
   b. （3 分）Do you think that the consumer organization should accuse the manufacturer of producing tires that do not meet the performance information provided on the sidewall of the tire? Why or why not?

8.（15 分）何謂假說檢定的 型 I 錯誤 及 型 II 錯誤? 什麼情況下降低其中一型錯誤發生的機率時會導致另一型錯誤發生的可能性增加? 什麼情況可以同時降低這兩類型錯誤發生的機率?

9.（10 分）一項研究廣告次數與銷售量的調查顯示以下資料，則銷售量與廣告次數的關係爲正或是負? 銷售量對廣告次數的迴歸方程式爲何? $\Sigma X = 55$, $\Sigma Y = 2613$, $\Sigma XY = 14060$, $\Sigma X^2 = 299$

廣告次數	銷售量
4	197
6	272
2	100
5	228
7	327
6	279
3	148
8	377
5	238
3	142
1	66
5	239

注意：背面有試題

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10.（10分）有 A, B, C 三個品牌的產品在北區、中區、南區、東區營業所三天的銷售量如下表，在 0.05 顯著水準下如何檢定品牌是否影響銷售量？各區域銷售情形是否有顯著差異？品牌與區域是否有交互作用？ 只須列出所有虛無假說及對立假說，檢定之統計量公式，ANOVA 表及決策準則即可

品牌	營業所區域	銷售量		
A	北區	14	18	11
	中區	16	9	12
	南區	8	11	5
	東區	13	7	10
B	北區	19	23	17
	中區	23	17	21
	南區	11	14	9
	東區	20	15	13
C	北區	21	16	13
	中區	25	18	20
	南區	9	4	7
	東區	18	14	11

11.（10分）The data set in a population has a size of 11, including 5,4,3,1,5,2,6,15,8,7,2. The descriptive statistics of the average and standard deviation are 5.27 and 3.72 respectively.

a.（5分）Draw a Box-Whisker Plot to illustrate if the distribution of the data set is normal.

b.（5分）Check if the data set exists any outlier.

12.（15分）Answer the following subproblems with a brief statement. It won't be graded if there is no statement.

a.（5分）An α represents the probability of upper right tail for the statistic of a standard normal distribution, Z_α, and the statistic of a student distribution with the degree of freedom, df, $t_{\alpha,df}$. Compare the magnitude of the following statistics in ascending order: $A=t_{0.05,20}$; $B=t_{0.05,10}$; $C=t_{0.10,20}$; $D=Z_{0.10}$. Show your result with the capitals A, B,C, D.

b.（5分）If we use simple random sampling without replacement to collect data for a sample, what is the variance of sampling distribution of the proportion, given that np and n(1-p) greater than or equal to 5, the ratio of n/N greater than 0.05, where n is the sample size, N is the size of a finite population, p is the proportion of success in a population?

c.（5分）What is the sampling distribution of the mean for a normally distributed population if we use random sampling to collect data with a sample size of 15 without giving the variance of the population?

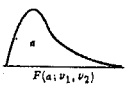
13.（10分）The department of information management surveys if the relationship of the preference on the given seven courses between male and female is correlated statistically. The result of course ranking by gender is summarized as the following table.

course	male	female
A	1	3
B	3	2
C	5	5
D	6	7
E	7	6
F	4	1
G	2	4

Compute the correlation coefficient for the above data set by using one of the formulas below. You will have to state why you choose the formula. [hint: formula 1: $SSXY / (SSX)^{0.5} / (SSY)^{0.5}$; formula 2: $1 - (6 * \Sigma d_i^2) / (n^3-n)$]

Appendix:

Critical Values of F



$\alpha = .95$

denominator *df*	numerator *df* 1	2	3	4	5	6	7	8	9
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88

$\alpha = .95$

denominator *df*	numerator *df* 10	12	15	20	24	30	40	60	120	∞
1	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3
2	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36
6	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
26	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69
27	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67
28	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65
29	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64
30	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51
60	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25
∞	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00

Critical Values of t

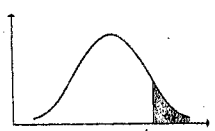


TABLE 8 Cutoff Points for the Student's t Distribution

ν	α 0.100	0.050	0.025	0.010	0.005
1	3.078	6.314	12.706	31.821	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
30	1.310	1.697	2.042	2.457	2.750
40	1.303	1.684	2.021	2.423	2.704
60	1.296	1.671	2.000	2.390	2.660
∞	1.282	1.645	1.960	2.326	2.576