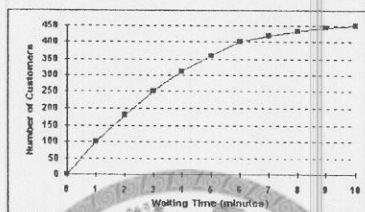


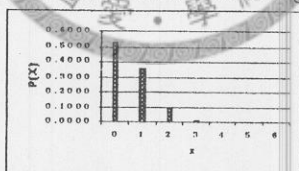
本份統計考題總分爲 100 分，總共分爲是非題、單選題與簡答題三大部份。

一、是非題(共 20 分，每題 2 分)：請按照題號順序作答

1. Abel Alonzo, Director of Human Resources, is exploring the causes of employee absenteeism at Batesville Bottling during the last operating year (January 1, 1999 through December 31, 1999). The average number of absences per employee, computed from the personnel data of all employees, is a statistic.
2. How many inventories do Christmas tree sales lots keep? A researcher goes from location to location around the city counting the number of trees in each lot. These numbers most likely represent ratio level of data.
3. The staff of Mr. Wayne Wertz, VP of Operations at Portland Peoples Bank, prepared a cumulative frequency ogive of waiting time for walk-in customers. The percentage of walk-in customers waiting one minute or less was 22%.



4. In its Industry Norms and Key Business Ratios, Dun & Bradstreet reported that Q1, Q2, and Q3 for 577 motorcycle dealers' current ratios were 1.3, 1.6 and 2.9, respectively. From this we can conclude that 68% of these dealers had current ratios between 1.3 and 2.9.
5. Let A be the event that a student is enrolled in an accounting course, and let S be the event that a student is enrolled in a statistics course. It is known that 30% of all students are enrolled in an accounting course and 40% of all students are enrolled in statistics. Included in these numbers are 15% who are enrolled in both statistics and accounting. From this information, it can be concluded that A and S are mutually exclusive.
6. The following graph is a binomial distribution with $n = 6$. This graph reveals that $p < 0.5$.



7. The average time between phone calls is 30 seconds. Assuming that the time between calls is exponentially distributed, the probability that more than a minute elapses between calls is 0.368.
8. Financial analyst Larry Potts needs a sample of 100 securities listed on either the New York Stock Exchange (NYSE) or the American Stock Exchange (AMEX). According to the Wall Street Journal's "Stock Market Data Bank," 2,531 NYSE securities and AMEX 746 securities were traded on the previous business day. Larry directs his staff to randomly select 77 NYSE and 23 AMEX securities. His sample is a proportionate stratified sample.
9. A bank officer wishes to estimate the amount of the average total deposits per customer at the bank. She wishes the estimate to be within \$200 of the actual average with 95% confidence. She assumes the standard deviation for this should be \$1000. The sample size should be at least 96.
10. You wish to determine the proportion of all secretaries who are familiar with a particular word processing package. You will conduct a random survey. The sample size should be at least 277 if you want to be 95% confident of the results and within 0.05 of the true population proportion.

二、單選題(共 60 分，每題 3 分)：請按照題號順序作答

1. The United States Postal Service (USPS) offers a service called Priority Mail that promises 2-day delivery. It costs about \$3.00 to send a letter by Priority Mail within the United States. A spoken person for the USPS claims that it has a success rate of more than 95% in delivering letters within 2-day

deadline. An experiment was conducted by sending letters from New York City to Cleveland, Ohio: 275 through priority mail and 378 through ordinary mail. The result was that 97.14% of the priority mails and 91.01% of the ordinary mails arrived on time. At 95% confidence level, which of the following conclusions is correct?

- Reject the null hypothesis. The spokesperson's claim is true.
 - Don't reject the null hypothesis. The spokesperson's claim is not true.
 - Reject the null hypothesis. The spokesperson's claim is not true.
 - Don't reject the null hypothesis. The spokesperson's claim is true.
 - None of above
2. Continue from the above example and given the following excel output. Which of the following conclusions is correct?

Test of Hypothesis About P1-P2

Test of $P1-P2 = 0$ Vs $P1-P2$ greater than 0

Priority Mail proportion (P1) = 0.9714

Ordinary Mail proportion (P2) = 0.9101

Test Statistic = 3.018

P-Value = 0.0013

- At $\alpha = 1\%$, Do not reject the null hypothesis.
- There is no evidence to infer that Priority Mail delivers letters within two days more frequently than does ordinary mail at 95% confidence level.
- At $\alpha = 5\%$, reject the null hypothesis.
- There is significant evidence to infer that Priority Mail delivers letters within two days more frequently than does ordinary mail at 99% confidence level.
- None of above

Questions 3 through 7 are based on the following information:

In an effort to explain to customers why their electricity bills have been so high lately, and how, specifically, they could save money by reducing the thermostat settings on both space heaters and water heaters, an electric utility company has collected total kilowatt consumption figures for last year's winter months, as well as thermostat settings on space and water heaters, for 100 homes.

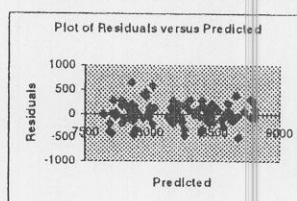
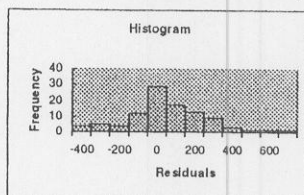
Regression Statistics

Multiple R	0.8415
R Square	0.7081
Adjusted R Square	0.7021
Standard Error	213.7
Observations	100

ANOVA

	df	SS	MS	F	Significance F
Regression	2	10744454	5372227	117.64	0.0000
Residual	97	4429664	45667		
Total	99	15174118			

	Coefficients	Standard Error	t Stat	P-value
Intercept	576.8	514.0	1.12	0.2646
Space	90.61	6.48	13.99	0.0000
Water	9.66	2.41	4.00	0.0001



	Coefficient of Correlation	
	Space	Water
Space	1	
Water	0.1578	1

3. Which of the following statement is correct?
- The regression equation is $\hat{y} = 576.8 + 90.61\text{Space} + 9.66\text{Water}$
 - The standard error of estimate is = 213.7.
 - 70.81% of the variation in sales is explained by the model.

- D. The model fits reasonably well.
E. All of the above.
4. Test the validity of the model.
A. Since $F = 117.64$, there is no evidence to conclude that the model is valid.
B. Since $p\text{-value} = 0$, there is no evidence to conclude that the model is valid.
C. At $\alpha = 5\%$, there is enough evidence to conclude that the model is valid.
D. Since $R^2 = .7081$, there is no evidence to conclude that the model is valid.
E. None of the above.
5. About the coefficients of Space, which of the following statement is correct?
A. At $\alpha = 1\%$, "Space" should be retained in the model.
B. At $\alpha = 5\%$, "Space" should not be retained in the model.
C. At $\alpha = 10\%$, "Space" should not be retained in the model.
D. At $\alpha = 5\%$, "Space" should not be retained in the model.
E. None of the above.
6. At 5% significant level, given Space = 70 and Water = 130 for a house, point estimate the electricity consumption.
A. In the range of [5000, 6000)
B. In the range of [6000, 7000)
C. In the range of [7000, 8000)
D. In the range of [8000, 9000)
E. In the range of [9000, 10000)
7. Determine whether the required conditions are satisfied.
A. The error variable's variance appears to be constant.
B. The histogram is slightly skewed and the errors are not normally distributed.
C. There is a strong correlation between the two independent variables.
D. Multicollinearity is a problem in this study.
E. None of the above.

Questions 8 through 13 are based on the following information.

The revenues (in millions of dollars) of a chain of ice cream stores are listed for each quarter during the years 1997-2001 as shown in the following table. Four-period centered moving average is given in column 4-p center MA. The ratio between y and 4-p center MA is also given in column y/MA .

Year	Quarter	# of Visitors (y)	4-p center MA	y/MA	Year	Quarter	# of Visitors (y)	4-p center MA	y/MA
1997	1	16			2000	1	18	29.125	0.6180
	2	25				2	29	29.375	0.9870
	3	31	23.750	1.3050		3	45	29.375	1.5320
	4	24	23.750	1.0110		4	24	29.875	0.8030
1998	1	14	24.125	0.5800	2001	1	21	30.875	0.6800
	2	27	24.125	1.1190		2	30	32.750	0.9160
	3	32	24.375	1.3130		3	52		
	4	23	25.250	0.9110		4	32		
1999	1	17	26.750	0.6360					
	2	31	28.250	1.0970					
	3	40	28.875	1.3850					
	4	27	28.750	0.9390					

After the seasonal effect is removed, a regression model is built: $\hat{y} = 20.2 + 0.732t$ where t starts from 1.

8. Which range does the seasonal index of the third quarter fall into?
A. In the range of [0.60, 0.90)
B. In the range of [0.90, 1.20)
C. In the range of [1.20, 1.50)
D. In the range of [1.50, 1.80)
E. In the range of [1.80, 2.10)
9. Use the seasonal indexes computed question 8 to deseasonalized the original time series data of the third quarter, 2000. Which range does it fall into?
A. In the range of [13, 19)
B. In the range of [19, 23)
C. In the range of [23, 28)
D. In the range of [28, 32)

- E. In the range of [32, 36)
10. Which range does the seasonal index of the second quarter fall into?
- A. In the range of [0.60, 0.90) B. In the range of [0.90, 1.20)
- C. In the range of [1.20, 1.50) D. In the range of [1.50, 1.80)
- E. In the range of [1.80, 2.10)
11. Use the seasonal indexes computed question 10 to deseasonalized the original time series data of the second quarter, 2001. Which range does it fall into?
- A. In the range of [13, 19) B. In the range of [19, 23)
- C. In the range of [23, 28) D. In the range of [28, 32)
- E. In the range of [32, 36)
12. Use the seasonal indexes computed question 8 and the linear trend model given above to forecast the revenue in the third quarter, 2002. Which range does it fall into?
- A. In the range of [27, 32) B. In the range of [32, 37)
- C. In the range of [37, 42) D. In the range of [42, 47)
- E. In the range of [47, 52)
13. Use the seasonal indexes computed question 10 and the linear trend model given above to forecast the revenue in the second quarter, 2002. Which range does it fall into?
- A. In the range of [27, 32) B. In the range of [32, 37)
- C. In the range of [37, 42) D. In the range of [42, 47)
- E. In the range of [47, 52)

Questions 14 through 18 are based on the following information.

Pay equity for men and women has been an ongoing source of conflict for a number of years in North America. Suppose that a statistician is investigating the factors that affect salary differences between male and female university professors. The following variables are included in the study: Annual salary, number of years since first degree, highest degree (1 with a PhD and 0 else), Mean score on teaching evaluation, number of articles published, and gender (1 if male and 0 else). The result of the regression analysis is listed as follows.

Regression Statistics	
Multiple R	0.9737
R Square	0.9482
Adjusted R Square	0.9454
Standard Error	3015
Observations	100

ANOVA					
Sources	df	SS	MS	F	Significance F
Regression	5	15636303318	3127260664	344.04	0.0000
Residual	94	854451113	9089905		
Total	99	16490754431			

	Coefficients	Standard Error	t Stat	P-value
Intercept	-5916	3141	-1.88	0.0627
Years	1022	48.93	20.88	0.0000
PhD	725.7	961.5	0.75	0.4523
Evaluation	3729	619.8	6.02	0.0000
Articles	439.1	80.69	5.44	0.0000
Gender	1090	632.0	1.72	0.0879

14. In this problem, how many indicator variables are used?
- A. 2 B. 3
- C. 4 D. 5
- E. None of the above.
15. Which of the following statement is correct?
- A. Since $F = 344.04$, there is no evidence to infer that the model is valid.
- B. Since $p\text{-value} = 0$, there is enough evidence to infer that the model is valid.

- C. Since $R^2 = 0.9482$, there is no evidence to infer that the model is valid.
 D. Since Standard Error = 3015, there is enough evidence to infer that the model is not valid.
 E. None of the above.
16. Which of the following statement is correct?
 A. There is no evidence that the professors with PhD are better paid than the professors without PhD are at 10% significant level.
 B. There is enough evidence that the professors with PhD are better paid than the professors without PhD are at 5% significant level.
 C. There is no evidence that male professors are better paid than female professors are with the same qualifications at 10% significant level.
 D. There is enough evidence that male professors are better paid than female professors are with the same qualifications at 5% significant level.
 E. None of the above.
17. Point estimate the annual salary of a male professor with 20 years since first degree, PhD, 5 mean score on teaching evaluation, and 13 articles published.
 A. In the range of [25000, 30000) B. In the range of [30000, 35000)
 C. In the range of [35000, 40000) D. In the range of [40000, 45000)
 E. In the range of [45000, 50000)
18. Point estimate the annual salary of a female professor with 20 years since first degree, PhD, 5 mean score on teaching evaluation, and 13 articles published.
 A. In the range of [25000, 30000) B. In the range of [30000, 35000)
 C. In the range of [35000, 40000) D. In the range of [40000, 45000)
 E. In the range of [45000, 50000)
19. Suppose that the sample regression equation of a model is $\hat{y} = 10 + 4x_1 + 3x_2 - x_1x_2$. If we examine the relationship between x_1 and y for three different values of x_2 , which of the following statement is correct?
 A. Three equations produced differ only in the intercept.
 B. Three equations produced differ not only in the intercept term but the coefficient of x_1 , also varies.
 C. The coefficient of x_1 varies.
 D. The coefficient of x_2 remains unchanged.
 E. None of the above.
20. Which of the following statements is correct in testing for normality?
 A. The chi-squared test requires us to compute the mean and the standard deviation from the data.
 B. The Kolmogorov-Smirnov test assumes that we can compute the mean and the standard deviation from the data.
 C. The Lilliefors test requires relatively large samples to ensure its validity.
 D. A Wilcoxon rank sum test can be used to test for normality but require very large samples.
 E. None of the above.

三、簡答題(共 20 分)：請按照題號順序作答

1. A major insurance firm interviewed a random sample of 1200 college students to find out the type of life insurance preferred, if any. The results follow:

Gender	Insurance Preference		
	Term	Whole Life	No Insurance
Female	100	80	325
Male	160	60	475

The firm tries to answer the question of "is there evidence that life insurance preference of male students is different than that of female students?"

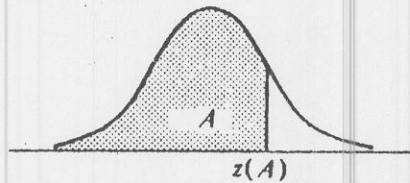
- (1) (1 分) Please write down the testing hypotheses.
 (2) (4 分) Please choose the testing method, compute the test statistics, and make conclusion.

2. A professor of statistics is trying to determine which of three statistical software's is the best for his students. He believes that the time (in hours) it takes a student to master a particular software may be influenced by gender. The ANOVA analysis result is as follows. (Please write down hypotheses, testing procedure, and conclusion in the following tests.)

SOURCE OF VARIATION	SS	DF	MS	F	P-VALUE	F-CRITICAL
Software	25.333	2	12.667	1.194	.3367	3.885
Gender	107.556	1	107.556	10.136	.0079	4.747
Interaction	61.778	2	30.889	2.911	.0932	3.885
Errors	127.333	12	10.611			
Total	322.000	17				

- (1) (3 分) Is there sufficient evidence at the 5% significance level to infer that different software results in different time for a student to master?
- (2) (3 分) Is there sufficient evidence at the 5% significance level to infer that different gender causes different time for a student to master a software?
- (3) (3 分) Is there sufficient evidence at the 5% significance level to infer that the time it takes a student to master a software and the gender of the student interact?
3. (1) (2 分) What is the nonparametric method to compare two populations, when the samples are matched pairs and the data are quantitative where the normality requirement necessary to perform the parametric test is unsatisfied?
- (2) (2 分) What is the nonparametric method to compare two populations, when the samples are matched pairs and the data are ranked?
- (3) (2 分) What is the nonparametric method to compare two or more populations, when the samples are matched pairs and the data are either ranked or quantitative but not normal?

Cumulative Probabilities of the Standard Normal Distribution

Entry is area A under the standard normal curve from $-\infty$ to $z(A)$ 

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

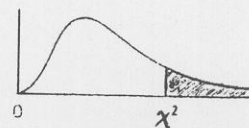
Selected Percentiles

Cumulative probability A :	.90	.95	.975	.98	.99	.995	.999
$z(A)$:	1.282	1.645	1.960	2.054	2.326	2.576	3.090

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CHI-SQUARE DISTRIBUTION TABLE

The entries in the table give the critical values of χ^2 for the specified number of degrees of freedom and areas in the right tail.



df	Area in the Right Tail under the Chi-square Distribution Curve									
	.995	.990	.975	.950	.900	.100	.050	.025	.010	.005
1	0.000	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169