編號：G 394　系所：國際企業研究所　　科目：統計學

本試題是否可以使用計算機：☑可使用 ，☐不可使用　（請命題老師勾選）

1. 本科可使用一般計算機.
2. 填答要求：
   1). 「壹」是非題與「貳」應用是非題：
      a. 於答案卷上，以「直」式方式標示「壹」及「貳」與題號後，於題號後寫 O 或 X，每題一列。
      b. 計算過程不可混於是非題之答案中。「計算過程不計分」，請於他處計算。
      c. 未寫題號或將計算與答案混一起者，不給分。
   2). 「參」應用題須列出計算過程。

壹、是非題（ O 或 X ）（每題 2 分）

1. Both economy and avoidance of nonsampling error are legitimate reason for sampling.
2. The bias of nonresponse can not be minimized by more accurate observations and statistical analysis.
3. Statisticians often regard a population census as a waste of resources.
4. A population is positively skewed when its mean is greater than its median.
5. A and B are complementary events. Therefore Pr[A and B] $\neq$ 0.
6. Pr[A] + Pr[B] may be larger than 1 when A and B are independent.
7. A quality control inspector only accept 5% of all bad items and rejects only 1% of all good items. Overall population is such that 90% of items to be inspected are good. The probability that an item is bed and accepted is larger than 0.01.
8. A population of size N=10,000 has a proportion of 0.01 of occurrence of an event. The standard error of the proportion when a sample of size n=100 is taken randomly from the population is about 0.01.
9. A coin is tossed 100 times. When the coin has a proportion $\leq$ 0.4 in obtaining a head, the proportion of the occurrence of heads by the tossing can not be larger than 0.5.
10. A consistent estimator is defined as that it will not be more reliable when it is applied to large samples than when it is applied to small samples.
11. The 95% confidence interval estimate of the mean time taken to process a new insurance policy is $11 \leq \mu \leq 12$ days. Therefore, only 5% of all policies take less than 11 days or more than 12 days to process.
12. A machine used to fill jars of instant coffee is shut down for adjustment whenever a mean of 25 sample jars is more than half an ounce under or over the intended mean of 32 ounces for a perfectly adjusted machine. The filling process has a standard deviation of 1 ounce per jar. Based on the data, the probability that the machine will be shut down when it overfills each jar by an average of 0.4 ounce is 0.90.
13. A marketing researcher for Big Sky Enterprises believes that the proportion of persons favoring a new package design is p=0.6. Suppose that a sample of 100 persons is selected at a random from the entire market, which numbers in millions. The sample proportion favoring the new design may be approximately by the normal distribution. Based on the data, the probability that 65% or more of the persons queried will favor the new package is approximately 16%.
14. The following decision rule has been established for testing the mean under the null hypothesis $\mu \leq 100$. Accept H_0 if $\bar{x} \leq 101.2$. The type I error probability assuming that μ=100, σ=5 and n=100 is approximately 0.1.

(背面仍有題目,請繼續作答)

15. In testing the null hypothesis $\mu_A \leq \mu_B$, the critical value of the normal deviate is $z_{.05} = 1.64$. The null hypothesis H_0 may be rejected when $z = -1.68$.

16. In its objective, analysis of variance is most similar to a two-sided test of the population mean.

17. Multiple regression is always better than simple regression, providing a sufficient number of data points available

18. Least squares method minimizes the collective squared vertical deviations of data points about the regression line.

19. The regression coefficient equals the square of the correlation coefficient in simple regression.

20. Except census, all sampling methods, including stratified sample, simple random sample and cluster sample, involve sampling error.

21. The population standard deviation is the same value as the standard deviation of a future observed value for a randomly chosen unit

22. The expected value of an observation may equal to the population median

23. The value of the variance and standard deviation of a random variable must always be different, since the latter is the square root of the former

24. Increasing the sample size is the only way to increase the precision of the interval while maintain the same confidence level.

貳、應用是非題　（ O 或 X ）（每題 2 分）

A. A toy company hires 4 production analysts to rate 3 groups of workers on their job performances. The ratings (see the table below) are then to be used by the company manager to determine whether or not there is any significant variation among the 4 analysts in the ratings. If no variation exists, then the manager needs not concern with which analyst is assigned to a particular group; but if the ratings do differ, the manager must consider this situation in the assigning.

The 4 analysts' ratings

Group of workers	A	B	C	D	Row mean
1	33	36	33	27	32.3
2	32	34	28	41	33.8
3	46	49	44	43	45.5
Column mean	37.0	39.7	35.0	37.0	Overall mean: 37.2

A test of the ANOVA model show that the R Square = 0.7917. Refer to the following blanks of the ANOVA table and answer O or X to each problem below (25~34).

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F-value	Critical value
Analysts' Rating	(1)	(5)	(9)	(12)	(14)
Worker group	(2)	(6)	(10)	(13)	(15)
Error	(3)	(7)	(11)		
Total	(4)	(8)			

25. The value of cell (1) is 2
26. The value of cell (3) is 2
27. The value of cell (5) is 33
28. The value of cell (6) is 421.2
29. The value of cell (7) is 119.5
30. The value of cell (9) is 19.9
31. The value of cell (10) is 19.9
32. The value of cell (12) is 0.55
33. The value of cell (14) is 0.55
34. Based on the ANOVA, we can not conclude "manager needs not concern with which analyst is assigned to a particular group at α=0.05 level of significance ".

B. A company, selling products to all cities in Taiwan, was told that its customers have an average earning less than $20,000 per month per person, and the distribution is normal. To confirm this information, a sample of 36 customers is randomly selected from Tainan. Each customer in the sample is asked how much money he or she is earning. The sample shows a mean earning of $19,975 and a variance of $10,000 per month per person. Answer O or X to each problem below (35~39).

35. Based on the data, we can conclude that the average earning of the customers of the company is less than $20,000 at a significant level of 0.05.
36. Based on the data, we can not conclude that the average earning of the customers of the company is less than $20,000 if a two tailed 95% confidence interval for the population mean is applied.
37. Refer to the above problem 36. We can conclude that the average earning of the customers of the company is less than $20,000 if the width of the confidence interval is increased because increasing the confidence level is one way to increase the sampling precision of this problem.
38. A sample with an average earning of $20,000 is better than a sample with an average earning of $19,990.
39. For this problem, it is better to assume H0:U<20,000 instead of assuming H0:U>=20,000.

C. Refer to problem **B**. If now the test is conducted in terms of asking the customers to answer:

Your personal earning per month is less than $20,000 per month?　Yes ☐　No ☐

Similarly, a sample of 36 customers is randomly selected. The sample shows 40% of the customers in the test answering "Yes" for the above question. Answer O or X to each problem below (40~45).

40. Refer to problems **B** and **C**. The alternative hypothesis for the current problem **C** can be assumed as "over half of the company's customers have an earning less than $20,000 per month per person".
41. Refer to problems **B** and **C**. The standard error used in testing the hypothesis of the current problem **C** is approximately 0.08.

(背面仍有題目,請繼續作答)

42. It the null hypothesis of the current problem **C** is accepted, we can conclude that the average earning of the customers of the company is less than $20,000 at a significant level of 0.05.
43. We may have a sample in which over 50% customers indicate their personal monthly earnings are under $20,000, whereas their average earnings is over $20,000 per month per person.
44. It is impossible to have a sample in which the average earning is less than $20,000 per month per person but over 50% customers indicate their personal monthly earnings are over $20,000.
45. If the company attempts to test the acceptance of a product for customers whose personal monthly earnings are over 20,000, we should suggest its manager to adopt an approach similar to problem **C**, rather than **B**, to search for the qualified customers.

參、應用題

A. Tainan Ltd. Co. provided the following data as an example of selection among 20 male and 20 female applicants for 15 open positions: (10%)

Applicant	Selected	No selected	Total
Male	10	10	20
Female	5	15	20

Using the above data to show and discuss whether Tainan Co. has a selection bias in favor of males for the 15 open positions at a statistical significance level of α=0.10. State clearly your hypothesis.

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Standard Normal Distribution:

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936

χ^2 - distribution:

degrees of freedom	Area in Upper Tail								
	.995	.99	.975	.95	.90	.10	.05	.025	.01	.005
1	$392,704 \times 10^{-10}$	$157,088 \times 10^{-9}$	$982,069 \times 10^{-9}$	$393,214 \times 10^{-8}$	.0157908	2.70554	3.84146	5.02389	6.63490	7.87944
2	.0100251	.0201007	.0506356	.102587	.210720	4.60517	5.99147	7.37776	9.21034	10.5966
3	.0717212	.114832	.215795	.351846	.584375	6.25139	7.81473	9.34840	11.3449	12.8381
4	.206990	.297110	.484419	.710721	1.063623	7.77944	9.48773	11.1433	13.2767	14.8602
5	.411740	.554300	.831211	1.145476	1.61031	9.23635	11.0705	12.8325	15.0863	16.7496
6	.675727	.872085	1.237347	1.63539	2.20413	10.6446	12.5916	14.4494	16.8119	18.5476
7	.989265	1.239043	1.68987	2.16735	2.83311	12.0170	14.0671	16.0128	18.4753	20.2777
8	1.344419	1.646482	2.17973	2.73264	3.48954	13.3616	15.5073	17.5346	20.0902	21.9550
9	1.734926	2.087912	2.70039	3.32511	4.16816	14.6837	16.9190	19.0228	21.6660	23.5893
10	2.15585	2.55821	3.24697	3.94030	4.86518	15.9871	18.3070	20.4831	23.2093	25.1882
11	2.60321	3.05347	3.81575	4.57481	5.57779	17.2750	19.6751	21.9200	24.7250	26.7569
12	3.07382	3.57056	4.40379	5.22603	6.30380	18.5494	21.0261	23.3367	26.2170	28.2995
13	3.56503	4.10691	5.00874	5.89186	7.04150	19.8119	22.3621	24.7356	27.6883	29.8194
14	4.07468	4.66043	5.62872	6.57063	7.78953	21.0642	23.6848	26.1190	29.1413	31.3193
15	4.60094	5.22935	6.26214	7.26094	8.54675	22.3072	24.9958	27.4884	30.5779	32.8013
16	5.14224	5.81221	6.90766	7.96164	9.31223	23.5418	26.2962	28.8454	31.9999	34.2672
17	5.69724	6.40776	7.56418	8.67176	10.0852	24.7690	27.5871	30.1910	33.4087	35.7185
18	6.26481	7.01491	8.23075	9.39046	10.8649	25.9894	28.8693	31.5264	34.8053	37.1564
19	6.84398	7.63273	8.90655	10.1170	11.6509	27.2036	30.1435	32.8523	36.1908	38.5822

F - distribution

Denominator degrees of freedom	Numerator Degrees of Freedom (Nominator)																		
	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88