【本科可使用一般計算機】

壹、選擇題

1. 以下每題有五個答案，請選出正確答案。每題 3 分；答錯者倒扣 1 分。請小心作答。
2. 請於答案卷上，標示選擇題，並以「直」式方式寫出 1 至 20 之題號後，於每題之題號後寫出所選擇的答案。
3.「計算過程不計分」，請於他處計算，答案不可混於計算過程中。未寫題號或將計算與答案混一起者，不給分。

1. Which one of the following is not a legitimate reason for sampling?
(a) economy (b) timeliness (c) avoidance of nonsampling error (d) destructive observations (e) none of the above

2. The following are population of the student body in a particular university system: ages, majors, sexes, names, incomes, and heights. Which are the qualitative populations?
(a) ages, incomes, heights (b) sexes, ages (c) majors, incomes (d) majors, sexes (e) none of the above

3. The bias of nonresponse may be minimized by
(a) more accurate observations (b) improved interview technique (c) statistical analysis (d) all of the above
(e) none of the above

4. Statisticians regard a population census as
(a) usually unnecessary (b) often a waste of resources (c) often not accessible (d) all of the above
(e) none of the above

5. A population is positively skewed when which one of the following is true?
(a) Its mean is less than its median (b) Its mean is less than its mode (c) It median is less than its mode
(d) Its mean is greater than its median (e) None of the above

6. A and B are complementary events. All ***but*** which one of the following statements must apply?
(a) Pr[A]=Pr[B] (b) Pr[A and B]=0 (c) Pr[A or B]=1 (d) Pr[A]=1-Pr[not A] (e) Pr[A]=1-Pr[B]

7. A and B are independent. Which one of the following statements cannot occur?
(a) Pr[A]+Pr[B]>1 (b) Pr[A]=1/2; Pr[B]=1/2; Pr[A and B]=1/4 (c) Pr[A]=Pr[B] (d) Pr[A]+Pr[B]<1
(e) The above are all possible to occur.

8. 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. What is the probability that an item is good and is accepted?
(a) 0.89 (b) 0.81 (c) 0.79 (d) 0.009 (e) 0.0005

9. A population of size N=10,000 has a proportion of 0.01 of occurrence of an event. What is the standard error of the proportion when a sample of size n=100 is taken randomly from the population?
(a) 0.010 (b) 0.021 (c) 0.031 (d) 0.041 (e) 0.100

10. A fair coin is tossed 100 times. Which one is the approximately estimated proportion of heads when the coin has a proportion ≤ 0.42 in obtaining a head?
(a) 0.050 (b) 0.2268 (c) 0.3821 (d) 0.4780 (e) 0.5938

11. Which one of the following is true of a consistent estimator?
(a) It will not be more reliable when it is applied to large samples than when it is applied to small samples.
(b) It has a standard error that becomes larger as n become larger.
(c) It is impossible to obtain without a census. (d) It can never be unbiased. (e) None of the above

(背面仍有題目,請繼續作答)

12. Which one of the following doesn't involve sampling error?
(a) census　(b) stratified sample　(c) simple random sample　(d) cluster sample　(e) all of the above

13. Which one of the following statements is true?
(a) The population standard deviation is the same value as the standard deviation of a future observed value for a randomly chosen unit
(b) The expected value of an observation is always equal to the population median
(c) 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
(d) The sample standard deviation must be equal to the standard deviation of a random observation made of the population
(e) non of the above

14. The 95% confidence interval estimate of the mean time taken to process a new insurance policy is $11 \le \mu \le 12$ days. Which one of the following statement is true?
(a) Only 5% of all policies take less than 11 days or more than 12 days to process.
(b) Only 5% of all policies take between 11 and 12 days to process.
(c) About 95 out of every 100 intervals similarly constructed from samples of same size will contain the true mean value.
(d) The probability is 0.95 that μ lies between 11 and 12 days.
(e) All of the above

15. 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. The probability that the machine will be shut down when it overfills each jar by an average of 0.4 ounce is
(a) 0.01　(b) 0.02　(c) 0.98　(d) 0.99　(e) none of the above

16. 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 n=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. The probability that 65% or more of the persons queried will favor the new package is,
(a) 0.0262　(b) 0.1026　(c) 0.1433　(d) 0.1788　(e) 0.2177

17. The following decision rule has been established for testing the mean under the null hypothesis $\mu \le 100$. Accept H_0 if $\bar{x} \le 101.2$. What is the type I error probability assuming that $\mu=100$, $\sigma=5$ and n=100,
(a) 0.082　(b) 0.0548　(c) 0.1056　(d) 0.1379　(e) 0.1736

18. In testing the null hypothesis $\mu_A \le \mu_B$, the critical value of the normal deviate is $z_{.05}=1.64$. The null hypothesis H_0 must be rejected for all but one of the following outcomes?
(a) z= 2.03　(b) z= 3.41　(c) z= 1.75　(d) z=1.64　(e) z= -1.68

19. In its objective, analysis of variance is most similar to
(a) a two-sided test of the population mean.　(b) a two-sample test for the equality of two sample proportions.
(c) a chi-square test for independence.　(d) a two-sample test for the equality of two population means.
(e) none of the above.

20. Which one of the following statements is false?
(a) Multiple regression is always better than simple regression, providing a sufficient number of data points available
(b) Least squares method minimizes the collective squared vertical deviations of data points about the regression line.
(c) Normal equations are used to find the multiple regression coefficients.
(d) The coefficient of determination equals the square of the correlation coefficient.　(e) none of the above.

貳、是非題

1. 每題 2 分；答錯者倒扣 2 分。請小心作答。
2. 於答案卷上標示是非題，並以「直」式方式寫出 A.1~10 及 B.1~10 題號後，於每題號後寫出「O」或「×」。
3.「計算過程不計分」，請於他處計算，答案不可混於計算過程中。未寫題號或將計算與答案混一起者，不給分。

A. A behavioral scientist is interested in determining whether group discussion tends to decrease or increase the appraisal of house price. She obtained the cooperation of 11 real estate appraisers. Randomly, she selected 5 and asked them to make individual appraisals of a parcel of commercial property after all 5 had participated in a group discussion of relevant appraisal factors. The other 6 appraisers were also asked to make individual appraisals of the same property but without any prior group discussion. The measurement data obtained from the experiment are:

With group discussion ($00000)	Without group discussion ($00000)
97	118
111	110
102	84
99	85
91	100
	109

Questions:

1. The scientist should use a test for variance difference to test her study?
2. The null hypothesis could be「there is no appraisal difference between having and having no group discussion」?
3. The Within SS is 10.28 ?
4. The Between SS is 0.53 ?
5. The DF of Within SS is larger than 10 ?
6. The Within MS is 1.028 ?
7. The Total SS is 10.81 ?
8. T-test is always better than F-test in this problem ?
9. The experiment suggests that group discussion would increase the appraisal of house price at 0.05 significant level?
10. This is a two-sample test for testing the equality between two population means ?

B. The following is the results of a regression test, in which the dependent variable is number of employees, and the independent variables include firm age, annual sales, market share and productivity of firm, and speed change of the industrial technology.

Dependent Variable: Y=Number of employees.					
	Unstandardized coefficient		Standardized Coefficients coefficient	T-stat.	P-value.
X: Independent Variables	B	Std. Error			
(Constant)	2.241	0.922		2.429	0.017
Firm age	0.003	0.071	0.003	0.042	0.967
Annual sales	0.743	0.104	0.563	7.128	0.000
Market share	0.287	0.148	0.166	1.932	0.056
Productivity	0.159	0.144	0.097	1.105	0.272
Technological change	-0.178	0.107	-0.133	-1.660	0.100

Questions from the table:

1. The correlation between number of employees and firm age is definitely positive ?
2. The correlation between number of employees and technology change is significant negative at 0.100 level?
3. In analysis, standardized coefficient is better than un-standardized coefficient ?
4. Y-intercept is 0 because there is no intercept in the standardized model ?
5. As a predictor of number of employees, annual sales is about 2.6 to 3.4 times more important than market share?
6. Using multiple regression may not be better than using simple regression in analyzing this problem?
7. A one-unit increase in market share raises the predicted level of Y by 0.166 if standardized model is used?
8. When all X variables are 0, the predicted level of Y is 2.241 if unstandardized model is used?
9. The above results are not good enough to analyzing this problem. R^2 and F-test are also needed?
10. T-statistics and P-value may result in different conclusion?

(背面仍有題目,請繼續作答)

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 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	24.7230	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 degree 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
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