

系所組別 統計學系

考試科目 統計學

考試日期：0306，節次：3

※ 考生請注意：本試題 可 不可 使用計算機

一、計算題 共20分

1. Twenty mutual funds specializing in technology-intensive stocks were randomly selected for a study involving the effect of fund manager's experience on fund performance. Summary data from the random sample are as follows:

Variable	Average	SS
Experience (X)	19.5	2,845
Performance (Y)	10.5	6,583
X*Y		-2,913

- a. What are the least squares estimates for β_0 and β_1 in this situation? 8分
- b. What is estimate for the population correlation coefficient between experience and performance? 6分
2. The vice president of customer relations of a national rent-a-car agency is trying to determine the average time it takes a customer to be served. Rather than sample all agencies in every city in the United States, she constructs a sampling frame of 20 car agencies. From these she chooses 3 agencies (clusters). The time it takes to serve each customer is then recorded for these three agencies and the results are given below. (Total number of customers served by the 20 car agencies = 5344.)

Cluster Data

	Agency 1	Agency 2	Agency 3
Number of Customers	302	230	295
Total Service time	1510	1280	2655

Find the estimated average customer service time. 6分

二、選擇題：(每題5分，共80分)

1. What is the difference between R^2 and the adjusted R^2 ?
- A) the adjusted R^2 always increases as more independent variables are added to the model
- B) the adjusted R^2 is smaller in this case because the constant term is negative
- C) the adjusted R^2 adjusts explanatory power by the degrees of freedom
- D) the adjusted R^2 is always smaller than R^2
- E) the adjusted R^2 adjusts explanatory power by division by the standard error of each coefficient
2. An aspiring politician decided to sample 300 citizens from each of two major cities to find out whether the two populations were homogenous with regard to their opinion on gun control. The following data were obtained. What is the p -value for this test?

(背面仍有題目,請繼續作答)

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- | City | Favor Gun Control | Against Gun Control |
|------|-------------------|---------------------|
| A | 126 | 174 |
| B | 148 | 152 |
- A) $< .005$ B) between .01 and .025 C) between .025 and .05
D) between .05 and .10 E) $> .10$
3. Statistical significance is a measure of what?
A) The chance of making a type-I error.
B) The chance of making a type-II error.
C) The chance you are willing to take of making a type-I error.
D) The chance you are willing to take of making a type-II error.
E) A and C above. F) B and D above.
4. A study is being made of the relationship between family annual income (X), and annual expenditures on food (Y) in a native American community. Both variables are in \$1,000s. Below is the summary of the data $SS_x = 791.5$, $SS_y = 14$, $SP_{Cxy} = 100$, $n = 8$, $\bar{X} = 19.75$, $\bar{Y} = 3.5$
Calculate the standard error of the slope of the regression line.
A) .0170 B) .0211 C) .3750 D) .0982 E) .1132
5. The requirement(s) for a randomized block design is (are):
A) The populations within each factor/level combination are normally distributed and the sample observations within each factor level/block combination are randomly selected.
B) The replicates are obtained independently and randomly from each of the populations.
C) The normal populations have a common variance.
D) Both A and C. E) A, B, and C.
6. Consider the hypotheses about a binomial population: $H_0: p \leq .10$ v.s. $H_a: p > .10$
Suppose the decision rule based on a random sample of size 20, is to reject H_0 if a sample proportion is greater than .20. If p is really .20, what is the probability of making Type II error?
A) .630 B) .950 C) .412 D) .867 E) .805
7. A manager of a fleet of cars was investigating differences in maintenance and repair costs for two makes of automobiles in his fleet. He selected a sample of 15 cars of each make and calculated the maintenance and repair costs per mile over the past year for each car. The results are:

	Make 1	Make 2
Mean	\$.018	\$.025
Std. Dev.	\$.015	\$.021
Sample size	15	15

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Does the evidence from this data set suggest that the two makes differ significantly in average maintenance and repair costs per mile? Test at the .05 level (There is no reasons to believe that the variances of repair and maintenance costs are equal.) Construct a 95% confidence interval for the mean difference between the maintenance and repair costs of the two makes of car.

- A) -.025 to .011 B) -.007 to .007 C) -.021 to .021 D) .007 to .021
E) -.021 to -.007
8. If we want to construct a confidence interval half as wide as the current one, then the sample needs to be:
- A) twice as large B) half as large C) four times as large
D) eight times as large E) one-fourth as large
9. Given the following probabilities $P(A)=.2$, $P(B)=.3$, $P(C)=.5$, $P(E|A)=.15$, $P(E|B)=.02$, $P(E|C)=.06$, compute $P(C|E^c) =$
- A).45 B).50 C).36 D).51 E).41
10. HDC produces microcomputer hard drives at four different production facilities (F1, F2, F3, and F4). Hard drive production at F1, F2, F3, and F4 is 20%, 25%, 15%, and 40%, respectively. Quality control records indicate that 1.5%, 2%, 1%, and 3% of the hard drives are defective at F1, F2, F3, and F4, respectively. What is the probability that a defective part is produced at F1 or F3?
- A) .0215 B) .5581 C) .3990 D) .2330 E) .2093
11. Suppose the following frequency distribution represents the rent paid by 44 tenants in apartments located on the West side of a city.
- | CLASS
NUMBER | CLASS
(RENT IN DOLLARS) | FREQUENCY |
|-----------------|----------------------------|-----------|
| 1 | 400 to 500 | 7 |
| 2 | 500 to 600 | 10 |
| 3 | 600 to 700 | 18 |
| 4 | 700 to 800 | 9 |
- What is the approximate variance of this data sample?
- A) 9741.0 B) 9519.6 C) 97.6 D) 98.7 E) 8621.5
12. The advantage(s) of a convenience sample is (are)
- A) data are easily obtained
B) may provide you with enough information to make a decision
C) can be used as an informal base of knowledge
D) all of the above E) A & B only

(背面仍有題目,請繼續作答)

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13. 下列何者敘述是正確的？

- (i) For mutually exclusive events E, F or G, $P(E \text{ or } F \text{ or } G) = P(E) + P(F) + P(G)$.
- (ii) The midrange is not affected by outliers.
- (iii) The distribution of X, the number of cars sold per day, where X can be 0, 1, 2, 3, 4, or 5, is never a normal distribution.
- (iv) An estimator that contains all the information about the parameter it estimates is said to be efficient.

A) i B) i & ii & iii C) iii D) i & iii E) i & iii & iv

14. 下列何者敘述是正確的？

- (i) The adjusted multiple coefficient of determination always increases as new variables are added to the model, just as R^2 does.
- (ii) In an ANOVA, if: $n = 130$, $r = 3$ groups, $SSE = 12,490$, $SSTR = 13,000$, and using $\alpha = 0.05$, the decision should be to reject the null hypothesis.
- (iii) Two events which are mutually exclusive events, are also complements of each other.
- (iv) A two-tailed hypothesis test is always more powerful than a one tailed test.

A) i B) ii C) ii & iii D) ii & iv E) iii & iv

15. 下列何者敘述是正確的？

- (i) The F -distribution is not very sensitive to the assumption of normal populations.
- (ii) A powerful test has a low probability of Type II error.
- (iii) The variance of a chi-square distribution is equal to the degrees of freedom.
- (iv) Taking a census means taking a large sample with replacement.
- (v) The exponential distribution deals either with units of time or units of space.

A) i B) i & ii C) ii & v D) iii E) i & vi & v

16. 下列何者敘述是正確的？

- (i) The correlation coefficient, r , measures the degree of any relationship between two variables.
- (ii) The Durbin-Watson statistic is used for testing the assumption of normality.
- (iii) In testing for a significant difference in two population proportions, at $\alpha = .01$, if the test statistic is 4.20, then the null hypothesis will not be rejected.
- (iv) Increasing the sample size will increase the power of a test.

A) i B) i & ii C) iii D) i & iv E) iv

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
考試科目： 統計學

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附表一

Normal Probability




背熟分配

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.1	0.5398	0.5406	0.5413	0.5420	0.5427	0.5434	0.5441	0.5448	0.5455	0.5462
0.2	0.5793	0.5808	0.5823	0.5838	0.5854	0.5869	0.5884	0.5899	0.5914	0.5928
0.3	0.6179	0.6193	0.6207	0.6222	0.6236	0.6251	0.6265	0.6280	0.6294	0.6309
0.4	0.6496	0.6508	0.6520	0.6532	0.6544	0.6556	0.6568	0.6580	0.6592	0.6604
0.5	0.6915	0.6925	0.6935	0.6945	0.6955	0.6965	0.6975	0.6985	0.6995	0.7005
0.6	0.7257	0.7267	0.7277	0.7287	0.7297	0.7307	0.7317	0.7327	0.7337	0.7347
0.7	0.7643	0.7654	0.7664	0.7675	0.7685	0.7695	0.7705	0.7715	0.7725	0.7735
0.8	0.7881	0.7891	0.7901	0.7911	0.7921	0.7931	0.7941	0.7951	0.7961	0.7971
0.9	0.7981	0.7991	0.8001	0.8011	0.8021	0.8031	0.8041	0.8051	0.8061	0.8071
1.0	0.8081	0.8091	0.8101	0.8111	0.8121	0.8131	0.8141	0.8151	0.8161	0.8171
1.1	0.8181	0.8191	0.8201	0.8211	0.8221	0.8231	0.8241	0.8251	0.8261	0.8271
1.2	0.8281	0.8291	0.8301	0.8311	0.8321	0.8331	0.8341	0.8351	0.8361	0.8371
1.3	0.8381	0.8391	0.8401	0.8411	0.8421	0.8431	0.8441	0.8451	0.8461	0.8471
1.4	0.8481	0.8491	0.8501	0.8511	0.8521	0.8531	0.8541	0.8551	0.8561	0.8571
1.5	0.8581	0.8591	0.8601	0.8611	0.8621	0.8631	0.8641	0.8651	0.8661	0.8671
1.6	0.8681	0.8691	0.8701	0.8711	0.8721	0.8731	0.8741	0.8751	0.8761	0.8771
1.7	0.8781	0.8791	0.8801	0.8811	0.8821	0.8831	0.8841	0.8851	0.8861	0.8871
1.8	0.8881	0.8891	0.8901	0.8911	0.8921	0.8931	0.8941	0.8951	0.8961	0.8971
1.9	0.8981	0.8991	0.9001	0.9011	0.9021	0.9031	0.9041	0.9051	0.9061	0.9071
2.0	0.9081	0.9091	0.9101	0.9111	0.9121	0.9131	0.9141	0.9151	0.9161	0.9171
2.1	0.9181	0.9191	0.9201	0.9211	0.9221	0.9231	0.9241	0.9251	0.9261	0.9271
2.2	0.9281	0.9291	0.9301	0.9311	0.9321	0.9331	0.9341	0.9351	0.9361	0.9371
2.3	0.9381	0.9391	0.9401	0.9411	0.9421	0.9431	0.9441	0.9451	0.9461	0.9471
2.4	0.9481	0.9491	0.9501	0.9511	0.9521	0.9531	0.9541	0.9551	0.9561	0.9571
2.5	0.9581	0.9591	0.9601	0.9611	0.9621	0.9631	0.9641	0.9651	0.9661	0.9671
2.6	0.9681	0.9691	0.9701	0.9711	0.9721	0.9731	0.9741	0.9751	0.9761	0.9771
2.7	0.9781	0.9791	0.9801	0.9811	0.9821	0.9831	0.9841	0.9851	0.9861	0.9871
2.8	0.9881	0.9891	0.9901	0.9911	0.9921	0.9931	0.9941	0.9951	0.9961	0.9971
2.9	0.9981	0.9991	1.0001	1.0011	1.0021	1.0031	1.0041	1.0051	1.0061	1.0071
3.0	1.0081	1.0091	1.0101	1.0111	1.0121	1.0131	1.0141	1.0151	1.0161	1.0171

附表二

Critical Values of:




t-分配

degrees of freedom	degrees of confidence					degrees of freedom	degrees of confidence				
	99%	95%	90%	85%	80%		99%	95%	90%	85%	80%
1	6.314	3.078	1.963	1.638	1.375	1	6.314	3.078	1.963	1.638	1.375
2	2.920	1.886	1.533	1.375	1.123	2	2.920	1.886	1.533	1.375	1.123
3	2.344	1.638	1.375	1.250	1.088	3	2.344	1.638	1.375	1.250	1.088
4	2.015	1.533	1.250	1.176	1.033	4	2.015	1.533	1.250	1.176	1.033
5	1.753	1.476	1.211	1.135	1.000	5	1.753	1.476	1.211	1.135	1.000
6	1.638	1.433	1.176	1.101	0.965	6	1.638	1.433	1.176	1.101	0.965
7	1.533	1.399	1.143	1.066	0.935	7	1.533	1.399	1.143	1.066	0.935
8	1.476	1.375	1.118	1.039	0.908	8	1.476	1.375	1.118	1.039	0.908
9	1.433	1.353	1.094	1.015	0.881	9	1.433	1.353	1.094	1.015	0.881
10	1.399	1.333	1.069	0.989	0.854	10	1.399	1.333	1.069	0.989	0.854
11	1.375	1.311	1.045	0.965	0.829	11	1.375	1.311	1.045	0.965	0.829
12	1.353	1.289	1.021	0.941	0.803	12	1.353	1.289	1.021	0.941	0.803
13	1.333	1.267	1.000	0.919	0.781	13	1.333	1.267	1.000	0.919	0.781
14	1.311	1.246	0.979	0.897	0.759	14	1.311	1.246	0.979	0.897	0.759
15	1.289	1.225	0.958	0.876	0.737	15	1.289	1.225	0.958	0.876	0.737
16	1.267	1.204	0.937	0.855	0.716	16	1.267	1.204	0.937	0.855	0.716
17	1.246	1.183	0.916	0.834	0.695	17	1.246	1.183	0.916	0.834	0.695
18	1.225	1.162	0.895	0.813	0.674	18	1.225	1.162	0.895	0.813	0.674
19	1.204	1.141	0.874	0.792	0.653	19	1.204	1.141	0.874	0.792	0.653
20	1.183	1.120	0.853	0.771	0.632	20	1.183	1.120	0.853	0.771	0.632
25	1.156	1.095	0.826	0.744	0.603	25	1.156	1.095	0.826	0.744	0.603
30	1.131	1.070	0.805	0.723	0.582	30	1.131	1.070	0.805	0.723	0.582
40	1.103	1.043	0.785	0.703	0.561	40	1.103	1.043	0.785	0.703	0.561
50	1.078	1.018	0.766	0.684	0.540	50	1.078	1.018	0.766	0.684	0.540
60	1.059	1.000	0.748	0.666	0.520	60	1.059	1.000	0.748	0.666	0.520
70	1.045	0.986	0.731	0.649	0.500	70	1.045	0.986	0.731	0.649	0.500
80	1.033	0.973	0.716	0.634	0.480	80	1.033	0.973	0.716	0.634	0.480
90	1.023	0.962	0.701	0.619	0.460	90	1.023	0.962	0.701	0.619	0.460
100	1.015	0.953	0.688	0.606	0.440	100	1.015	0.953	0.688	0.606	0.440

附表三

Critical Values of F^2



卡方分配

degrees of freedom	degrees of freedom					degrees of freedom	degrees of freedom				
	99%	95%	90%	85%	80%		99%	95%	90%	85%	80%
1	161.448	102.583	63.685	48.381	38.912	1	161.448	102.583	63.685	48.381	38.912
2	18.513	9.000	5.991	4.605	3.599	2	18.513	9.000	5.991	4.605	3.599
3	10.128	5.991	4.103	3.158	2.353	3	10.128	5.991	4.103	3.158	2.353
4	7.709	4.542	3.008	2.270	1.628	4	7.709	4.542	3.008	2.270	1.628
5	6.591	3.838	2.557	1.928	1.385	5	6.591	3.838	2.557	1.928	1.385
6	5.965	3.357	2.246	1.676	1.193	6	5.965	3.357	2.246	1.676	1.193
7	5.591	3.054	2.033	1.514	1.064	7	5.591	3.054	2.033	1.514	1.064
8	5.341	2.819	1.863	1.385	0.973	8	5.341	2.819	1.863	1.385	0.973
9	5.141	2.639	1.730	1.286	0.907	9	5.141	2.639	1.730	1.286	0.907
10	4.979	2.500	1.629	1.207	0.851	10	4.979	2.500	1.629	1.207	0.851
11	4.841	2.396	1.544	1.142	0.804	11	4.841	2.396	1.544	1.142	0.804
12	4.723	2.311	1.478	1.086	0.764	12	4.723	2.311	1.478	1.086	0.764
13	4.619	2.241	1.426	1.038	0.729	13	4.619	2.241	1.426	1.038	0.729
14	4.525	2.181	1.383	0.995	0.697	14	4.525	2.181	1.383	0.995	0.697
15	4.441	2.130	1.346	0.957	0.668	15	4.441	2.130	1.346	0.957	0.668
16	4.365	2.086	1.314	0.923	0.642	16	4.365	2.086	1.314	0.923	0.642
17	4.296	2.048	1.286	0.892	0.618	17	4.296	2.048	1.286	0.892	0.618
18	4.233	2.014	1.261	0.864	0.596	18	4.233	2.014	1.261	0.864	0.596
19	4.174	1.983	1.238	0.839	0.575	19	4.174	1.983	1.238	0.839	0.575
20	4.119	1.955	1.217	0.816	0.556	20	4.119	1.955	1.217	0.816	0.556
25	3.858	1.812	1.099	0.716	0.479	25	3.858	1.812	1.099	0.716	0.479
30	3.686	1.699	1.000	0.646	0.424	30	3.686	1.699	1.000	0.646	0.424
40	3.443	1.541	0.891	0.562	0.364	40	3.443	1.541	0.891	0.562	0.364
50	3.287	1.437	0.809	0.496	0.312	50	3.287	1.437	0.809	0.496	0.312
60	3.174	1.353	0.746	0.441	0.270	60	3.174	1.353	0.746	0.441	0.270
70	3.084	1.286	0.696	0.396	0.236	70	3.084	1.286	0.696	0.396	0.236
80	3.011	1.231	0.655	0.359	0.208	80	3.011	1.231	0.655	0.359	0.208
90	2.948	1.185	0.621	0.327	0.184	90	2.948	1.185	0.621	0.327	0.184
100	2.893	1.146	0.592	0.298	0.163	100	2.893	1.146	0.592	0.298	0.163

$P(F_{n_1, n_2, \alpha} > F_{n_1, n_2, \alpha}) = \alpha$
 $F_{2, 120, 0.05} = 3.07$
 $F_{3, \infty, 0.05} = 2.6$
 $F_{120, 2, 0.05} = 17.99$
 $F_{\infty, 3, 0.05} = 8.63$