銘傳大學 94 學年度 ✓財務金融學系 ✓國際企業學系 ✓經濟學系 觀光研究所 風險管理與保險學系 應用統計資訊學系 資訊管理學系 資訊工程學系 碩士班招生考試

第二節

統計學 試題 （限用答案本作答）

可使用計算機

第一部分：選擇題，每題 2 分(答案請依題號順序，5 題一組整齊排列)

1. A survey of 158,612 job discrimination cases yielded that 33.5% of the cases were based on the race of the employees. From this data, a researcher has predicted that if 100,000 cases of job discrimination are reported next year, approximately 33,000 to 34,000 of them will be based on race. This prediction would be an example of a(n)
   (A) measurement process. (B) qualitative variable. (C) statistical inference.
   (D) observational study.

2. A researcher modified a prediction for the proportion of job discrimination cases based on race to include an estimate of the error. The researcher has predicted that from 100,000 cases of job discrimination, 33,500 ± 1,500 will be based on race. This estimation of error is an example of a
   (A) controlled variable. (B) measure of reliability. (C) random sample.
   (D) designed experiment.

3. When a researcher exercises strict control over the people, objects, or events in the study, then he/she is conducting a(n)
   (A) observational study. (B) survey. (C) designed experiment.
   (D) unethical statistical practice.

4. A group of researchers want to ensure that they have a representative sample of the population being studied. To do this, they assign a number to every member of the population and then use a randomly generated number to choose the subjects to be included in their sample. What type of sample is this?
   (A) biased (B) population subset (C) measurement (D) random

5. Give the principal that accounts for the phenomenon of a "vital few" errors causing most of the defects produced in a given manufacturing process.
   (A) Empirical Rule (B) rare-event approach (C) Pareto principle (D) Chebyshev's rule

6. A quality control engineer at a manufacturing plant monitors the products coming off the assembly line over time. What type of chart should he/she use to present the data?
   (A) histogram (B) stem-and-leaf display (C) pie chart (D) time series plot

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7. Calculate the standard deviation for the following grades given that a class has 120 students and the data is only a sample of the entire class.

72	90	91	84	85	57	90	84	77	84	69	77
66	87	55	95	86	78	86	85	87	92	73	82

(A) 10.33 (B) 84.75 (C) 10.55 (D) 160.39

8. Which of the following statements is true?
   (A) If events A and B are independent, then the complement events A^c and B^c are independent.

   (B) $P(A \cup B) = P(A) + P(B) - P(A)P(B)$

   (C) $P(A \cup B \cup C) = P(A)P(B \mid A)P(C \mid A \cup B)$

   (D) If $P(A \mid B) = P(B)$, then A and B are independent.

9. Assume events A, B and C are mutually exclusive, and $P(A) = 0.5$, $P(B) = 0.2$ and $P(C) = 0.3$. Let $P(D \mid A) = 0.4$ and $P(D \mid B) = P(D \mid C) = 0.6$. Then $P(A \mid D) =$ ____.

   (A) 0.3 (B) 0.4 (C) 0.5 (D) 0.6

10. If X is a discrete random variable with probability measure function $f(x) = \frac{1}{11}, x = 1, 2, \cdots, 11$.

    Then σ_X^2 is ____.

    (A) 10 (B) 12 (C) 100 (D) 120

11. If $X \sim N(\mu, \sigma^2)$, then the interquartile range (IQR) of X is ____.

    (A) 1.35σ (B) $1.35\sigma^2$ (C) 2σ (D) $2\sigma^2$

12. If the sampling distribution of a sample statistic has a mean equal to the population parameter the statistic is intended to estimate, the statistic is said to be
    (A) a point estimation of the parameter.
    (B) a biased estimate of the parameter.
    (C) a low standard error of the statistic.
    (D) an unbiased estimate of the parameter.

13. The amount of time that it takes to complete a statistic exam has a skewed left distribution with a mean of 60 minutes and a standard deviation of 6 minutes. If 25 students are randomly sampled, determine the probability that the sample mean of the sampled students is less than 70 minutes.
(A) 0.3345 (B) approximately 1 (C) 0.1252 (D) approximately 0

14. A polling agency found that 387 people who planned to vote in the upcoming election said that they would vote for the democratic party, 360 people planned to vote republican, and 253 are undecided. Use a 90% confidence interval to estimate the proportion of voters who plan to vote for a democrat in the next election.
(A) (0.341, 0.432) (B) (0.357, 0.417) (C) (0.376, 0.398) (D) (0.362, 0.412)

15. The _____ hypothesis will be accepted only if the data provide convincing evidence of truth.
(A) alternative (B) rejection (C) null (D) one-tailed

16. If a researcher finds the null hypothesis to be true when it is actually false, a(n) _____ error is occurring?
(A) type I (B) type II (C) alternative (D) critical

17. If a researcher conducted a hypothesis test and rejected the null hypothesis at $\alpha = 0.05$, would the null hypothesis be rejected again at $\alpha = 0.01$?
(A) No, because the confidence interval has changed.
(B) It may be rejected again, but it is not definite.
(C) Yes, because the confidence interval is lower.
(D) Yes, because the confidence interval is higher.

18. Which of the following is not an assumption that must be made when performing a small-sample test for hypothesis $(\mu_1 - \mu_2)$ independent samples?
(A) The samples are randomly and independently selected from the population.
(B) Both sampled populations have relative frequency distributions that are approximately normal.
(C) The mean of each of the samples is approximately equal to the mean of the populations from which they are taken.
(D) The population variances are equal.

19. The probability that a test will correctly lead to the rejection of the null hypothesis for a particular value of in the alternative hypothesis is the
(A) significance level. (B) power of a test. (C) p-value. (D) reliability.

20. A researcher performed a one-tailed Z test to test $H_0 : \mu = 43$ against the alternative hypothesis $H_a : \mu < 43$. If the observed Z score was $z = -3.12$, what is the p-value of the test.
(A) 0.0009 (B) 0.01 (C) 0.05 (D) 0.4991

21. A sample of 16 items provides a sample standard deviation of 8. Test $H_0 : \sigma^2 \le 50$ against $H_a : \sigma^2 > 50$ using $\alpha = 0.05$. What is your conclusion?
(A) Since p-value < 0.05, the conclusion is to reject H_0.
(B) Since the 95% confidence interval for σ^2 do not contain 50, we reject H_0.
(C) Since the $\chi^2 = 19.2$ does not fall in the rejection region, we are not able to reject H_0.
(D) Since the $\chi^2 = 2.4 < \chi^2_{0.05;15} = 24.996$, we are not able to reject H_0.

22. Consider the following results for two independent samples random taken from two normal populations.
$n_1 = 25, \quad s_1^2 = 4.0, \quad n_2 = 21, \quad s_2^2 = 8.2$
Then the 90% confidence interval for $(\sigma_1^2 / \sigma_2^2)$ is _____.
(A) (2.35, 5.89) (B) (0.01, 3.05) (C) (2.35, 3.05) (D) (0.23, 0.99)

23. A researcher using a random sample of size $n = 24$ fits the following regression model
$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 + \varepsilon$
If he/she finds that the coefficient of determination R^2 is 0.7, then the adjusted coefficient of determination is _____.
(A) 0.640 (B) 0.655 (C) 0.671 (D) 0.712

24. Three different brands of golf balls are hit by a mechanical device, and the distance each ball travels is recorded. The experiment is performed 10 times and yields the following information: $\bar{Y}_1 = 200$ yards, $\bar{Y}_2 = 204$ yards, $\bar{Y}_3 = 220$ yards, and SSE=200.

Then SSB and SST are _____ respectively.
(A) 2240 and 2440 (B) 1800 and 2000 (C) 1680 and 1880 (D) 2000 and 2200

25. Using the data in problem 24, then MSB, MSE and F are _____ respectively.
(A) 746.667, 10 and 74.667 (B) 1120, 7.407, and 151.2 (C) 100, 10 and 10
(D) 500, 2.5 and 200

第二部分：計算題

(一) 以下資料是隨機選取二十位受試者並測量其手指靈活度分數(X)與肌肉協調度分數(Y)：

受試者	X	Y	受試者	X	Y
1	75	95	11	73	91
2	77	97	12	77	97
3	71	88	13	71	86
4	76	98	14	74	92
5	72	91	15	73	91
6	76	99	16	72	87
7	73	89	17	76	96
8	75	95	18	74	93
9	74	94	19	75	95
10	75	94	20	74	93

已知：

$\sum X = 1483$

$\sum Y = 1861$

$\sum XY = 138112$

$\sum X^2 = 110027$

$\sum Y^2 = 173421$

(a) 考慮簡單直線迴歸模型 $Y = \beta_0 + \beta_1 X + \varepsilon$。試利用最小平方法估計此迴歸直線。

(b) 以 5%的顯著水準檢定此迴歸直線之斜率是否大於 1.5。(已知：SSE = 29.1255)

(c) 假使某受試者之手指靈活度爲 78 分，試估計該受試者肌肉協調度分數之 95%預測區間。

(d) 以 5%的顯著水準檢定此直線迴歸模型是否適合。(已知：SSPE = $20.08\overline{3}$)

(以上每小題 5 分)

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(二) 某食品公司為瞭解廣告量與定價方式對於該公司某項新產品銷售量之影響，執行了一項二因子的隨機實驗得到以下資料：

廣告量	低價位	中價位	高價位	
低	620	475	413	
	774	544	556	
	623	579	395	
	776	706	382	
	$\bar{Y}_{11.}=698.25$	$\bar{Y}_{12.}=576.00$	$\bar{Y}_{13.}=436.50$	$\bar{Y}_{1..}=570.25$
高	955	472	294	
	669	701	378	
	596	482	355	
	1208	388	373	
	$\bar{Y}_{21.}=857.00$	$\bar{Y}_{22.}=510.75$	$\bar{Y}_{23.}=350.00$	$\bar{Y}_{2..}=572.58\bar{3}$
	$\bar{Y}_{.1.}=777.625$	$\bar{Y}_{.2.}=543.385$	$\bar{Y}_{.3.}=393.25$	$\bar{Y}_{...}=571.41\bar{6}$

(a) 已知 SST = 1039857.83 、 SSE = 365562.5 ，試建立 ANOVA 表。(10 分)

(b) 以 5% 顯著水準分別檢定兩因子之主要效果與兩因子之交互作用。(6 分)

(三) 某項研究隨機調查 200 對夫妻，依其身高之高、中、矮交叉分類如下列聯表：

丈夫 \ 太太	高	中	矮	
高	40	8	4	52
中	6	82	14	102
矮	2	10	34	46
	48	100	52	200

(a) 試以 5% 顯著水準檢定夫妻身高是否有關聯。(9 分)

(b) 試計算 Goodman-Kruskal λ 相關係數，並說明其意義。(5 分)

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附表

標準常態分配 $P(0 \le Z \le z)$

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.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
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.49865	.49869	.49874	.49878	.49882	.49886	.49889	.49893	.49896	.49900
3.1	.49903	.49906	.49910	.49913	.49916	.49918	.49921	.49924	.49926	.49929
3.2	.49931	.49934	.49936	.49938	.49940	.49942	.49944	.49946	.49948	.49950
3.3	.49952	.49953	.49955	.49957	.49958	.49960	.49961	.49962	.49964	.49965
3.4	.49966	.49968	.49969	.49970	.49971	.49972	.49973	.49974	.49975	.49976
3.5	.49977	.49978	.49978	.49979	.49980	.49981	.49981	.49982	.49983	.49983
3.6	.49984	.49985	.49985	.49986	.49986	.49987	.49987	.49988	.49988	.49989
3.7	.49989	.49990	.49990	.49990	.49991	.49991	.49992	.49992	.49992	.49992
3.8	.49993	.49993	.49993	.49994	.49994	.49994	.49994	.49995	.49995	.49995
3.9	.49995	.49995	.49996	.49996	.49996	.49996	.49996	.49996	.49997	.49997

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T 分配的臨界值

自由度	$t_{0.05}$	$t_{0.025}$
6	1.943	2.447
12	1.782	2.179
18	1.734	2.101
24	1.711	2.064
∞	1.645	1.960

卡方分配的臨界值

自由度	$\chi^2_{0.975}$	$\chi^2_{0.05}$	$\chi^2_{0.025}$
2	0.051	5.991	7.378
4	0.484	9.488	11.143
5	0.831	11.070	12.832
15	6.262	24.996	27.488
20	9.591	31.410	34.170

F 分配的臨界值 $F_{0.05}$

分母自由度 \ 分子自由度	1	2	3	5	20	21	24	25
11	4.84	3.98	3.59	3.20	2.65	2.64	2.61	2.60
13	4.67	3.81	3.41	3.03	2.46	2.45	2.42	2.41
15	4.54	3.68	3.29	2.90	2.33	2.32	2.29	2.28
18	4.41	3.55	3.16	2.77	2.19	2.18	2.15	2.14
20	4.35	3.49	3.10	2.71	2.12	2.11	2.08	2.07
21	4.32	3.47	3.07	2.68	2.10	2.08	2.05	2.05
24	4.26	3.40	3.01	2.62	2.03	2.01	1.98	1.97
25	4.24	3.39	2.99	2.60	2.01	2.00	1.96	1.96

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