國立成功大學104學年度碩士班招生考試試題

系所組別：統計學系

考試科目：統計學

考試日期：0212，節次：3

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

一、選擇題(每題 2 分，共計 30 分)

1. The scale of measurement that has an inherent zero value defined is the
   (a) interval scale (b)ratio scale (c)nominal scale (d)ordinal scale
2. Cumulative frequencies are usually represented graphically by
   (a)ogives (b)pie charts (c)histograms (d)frequency polygons
3. The interquartile range is used as a measure of variability to overcome what difficulty of the range?
   (a) the sum of the range variances is zero (b) the range is difficult to compute (c) the range is influenced too much by extreme values (d)the range is positive
4. A property of a point estimator that occurs whenever large sample sizes tend to provide point estimates closer to the population parameter is known as
   (a) efficiency (b) unbiased sampling (c) consistency (d) sufficiency
5. When a 95% confidence interval is calculated instead of a 99% confidence interval with n being the same, the maximum error of estimate will be
   (a)smaller (b) larger (c) constant (d) the same
6. For a given sample size, if the level of significance α is decreased, the power of the test
   (a) will decrease (b) will increase (c) will remain the same (d) cannot be determined
7. Which distribution has the same mean and variance ?
   (a)Binomial distribution (b) Hypergeometric distribution (c) Poisson distribution (d)Exponential distribution
8. Let U have a uniform distribution given by $f(u)=\frac{1}{20}$， 0<u<20，zero elsewhere. Then the mean of U is
   (a) 10 (b) 20 (c)1/30 (d) 40
9. Let W have a chi-square distribution with 4 degree of freedom. Then the variance of W is
   (a)4 (b) 8 (c) 12 (d)16
10. If all the points fall on a straight line, the correlation coefficient r could be
    (a)∞ (b) 1 (c) 0.5 (d) 0
11. The dean mailed a survey to a total of 500 students. The sample included 125 students randomly selected from each of the freshman, sophomore, junior, and senior classes on campus last term. What sampling method was used ?
    (a) simple random sample (b) systematic sample (c) cluster sample (d) stratified sample
12. The following sum of squares are produced：$\sum(y_i-\bar{y})^2=200$, $\sum(y_i-\hat{y}_i)^2=80$, and $\sum(\hat{y}_i-\bar{y})^2=120$. The percentage of the variation in y that is explained by the variation in x is：
    (a) 25% (b) 80% (c) 33% (d) 60%

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13. A nonparametric version of the parametric analysis of variance test is
(a)Kruskal-Wallis test (b) Mann-Whitney-Wilcoxon test (c) Sign test (d)Wilcoxon Signed-rank test

14. An ANOVA procedure is applied to data obtained from 6 samples where each sample contains 20 observations. The degrees of freedom for the critical value of F are
(a) 6 numerator and 20 denominator degrees of freedom (b) 5 numerator and 20 denominator degrees of freedom (c) 5 numerator and 114 denominator degrees of freedom (d) 6 numerator and 20 denominator degrees of freedom

15. Which of the following statements is correct regarding the percentile points of the F-distribution ?
(a) $F_{0.10,8,15} = 1/F_{0.90,8,15}$ (b) $F_{0.90,8,15} = 1/F_{0.10,15,8}$ (c) $F_{0.10,8,15} = 1/F_{0.10,15,8}$
(d) $F_{0.90,8,15} = 1/F_{0.90,15,8}$

二、計算題(共計 70 分)

1. The score of Statistics of a student in a Graduate School Entrance Examination is a random variable having Normal distribution with mean μ and variance σ^2. Suppose that $X_1, X_2, \cdots, X_n$ are the n scores of Statistics chosen randomly from the participants.
(1)What is the $100(1-\alpha)\%$ confidence interval for μ. (5 分)
(2)If a random sample of 100 participants from the population produced the following data：

$$\sum_{i=1}^{100} x_i = 1{,}600 \text{ ， } \sum_{i=1}^{100} (x_i - \bar{x})^2 = 6{,}336$$

Construct a 95% confidence interval for the population mean. (5 分)

2, An agronomist planted three test plots each with four varieties of wheat and obtained the following yields (in pounds per plot)

Variety A:	65	64	60
Variety B:	55	56	63
Variety C:	56	59	59
Variety D:	62	59	62

Assume that these data constitute random samples from four normal populations with the same standard deviation , suppose we know the following information:

Total sum of squares $SST = 118$

Treatment sum of squares $SS(T_r) = 54$

Test at the 0.05 level of significance whether the differences among the four sample mean can be attributed to chance. (10 分)

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3.為研究某減肥藥之成效，隨機選取 5 位參與減肥活動者，得彼在減肥前與減肥活動一個月後之體重資料如下表所示，茲以 μ_1、μ_2 分別表示減肥前與減肥後之平均體重（公斤），且服藥前後之體重均服從常態分配。

(1)試以 α=0.05 為顯著水準，檢定該減肥藥是否確有成效？ (6 分)

減肥前 x	85	69	63	58	56
減肥後 y	80	62	54	55	60

(2)若研究者不確知服藥前後之體重是否服從常態分配，而欲改採符號檢定法(Sign test)，試據該法檢定之。 (4 分)

4. 心理學家欲知一成人視覺受刺激後，引起反應之平均時間是否為 0.38 秒? 隨機抽取 n=36 之樣本，若樣本平均數在 0.36 秒至 0.40 秒之間，則接受 $H_0:\mu=0.38$ 之假設，否則棄卻此假設。今若已知母體之標準差 $\sigma=0.06$，

(1)試探討此檢定所可能犯之誤差及其大小。 (4 分)

(2)若此檢定之對立假設為 $H_A:\mu=0.41$，則犯型 II 誤差之大小為何？ (4 分)

5.某公司之印刷電路板之缺點數分配據稱服從卜瓦松分配（Poisson Distribution），今隨機抽出 60 塊電路板檢驗，得其缺點數分配如下表所示。為驗證此種說法，於是將資料配予期望（理論）次數如表內第 3 欄所示(簡化至個位數)：

(1)試以缺點數 $x=0$ 為例，說明其期望次數係如何推算而得？ (3 分)

(2)若欲藉 χ^2 檢定法進行檢定，則有關之自由度為何？何故？（2 分）

(3)以 $\alpha=0.05$ 檢定此資料是否支持該公司印刷電路板之缺點數分配為一卜瓦松分配？ (5 分)

缺點數 x	0	1	2	3
觀察次數 o	32	15	9	4
期望次數 e	29	21	8	2

6. 兩變數 x 及 y 之 5 個觀察值如下：

x	1	2	3	4	5
y	3	7	5	11	14

今已求得：$\bar{x}=3$，$\bar{y}=8$，$\sum(x-\bar{x})(y-\bar{y})=26$，$\sum(x-\bar{x})^2=10$，$\sum(y-\bar{y})^2=80$，$\sum(y-\hat{y})^2=12.40$

(1)試用最小平方法配合迴歸直線 $\hat{y}=a+bx$。（4 分）

(2)求判定係數(Coefficient of determination) r^2。（2 分）

(3)驗證估計標準誤(Standard error of the estimate) $s_e=2.03$。（2 分）

(4)以 $\alpha=0.05$ 之顯著水準檢定母體迴歸係數 $\beta=0$ 是否成立？（4 分）

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7. 自下列分配抽出一大小為 n 的隨機樣本 $X_1, X_2, \cdots, X_n$，以估計未知母數 θ，試據最概法(Method of maximum likelihood)推求 θ 之最概估計量(Maximum likelihood estimator)。

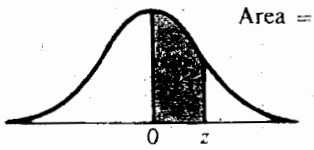
(1) $f(x)=\frac{1}{\sqrt{2\pi\theta}}e^{-\frac{1}{2\theta}(x-\mu)^2}$，$-\infty<x<\infty$，$\mu$ 已知 （4 分）

(2) $f(x)=\frac{1}{\theta}$，$0<x<\theta$ （3 分）

並驗證(1)中所求得之最概估計量 $\hat{\theta}$ 是否為母體變異數 $\theta=\sigma^2$ 之一不偏估計量(Unbiased estimator)。 （3 分）

參 考 數 值 表 摘 錄

標準常態分配數值表



z_0	.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

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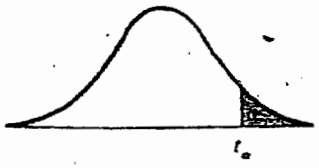
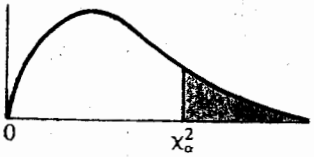


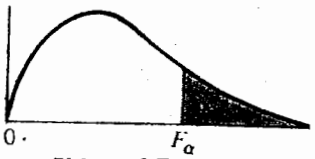
Degrees of Freedom	.10	.05	.025	.01	.005
1	3.078	6.314	12.706	31.821	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250

χ^2 分配數值表



d.f.	$\chi^2_{.995}$	$\chi^2_{.99}$	$\chi^2_{.975}$	$\chi^2_{.95}$	$\chi^2_{.05}$	$\chi^2_{.025}$	$\chi^2_{.01}$	$\chi^2_{.005}$	*d.f.*
1	.0000393	.000157	.000982	.00393	3.841	5.024	6.635	7.879	1
2	.0100	.0201	.0506	.103	5.991	7.378	9.210	10.597	2
3	.0717	.115	.216	.352	7.815	9.348	11.345	12.838	3
4	.207	.297	.484	.711	9.488	11.143	13.277	14.860	4
5	.412	.554	.831	1.145	11.070	12.832	15.086	16.750	5

F 分配數值表



Values of $F_{0.05}$

Degrees of freedom for denominator	Degrees of freedom for numerator: 1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161	200	216	225	230	234	237	239	241	242	244	246	248	249	250	251	252	253	254
2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.5	19.5	19.5	19.5	19.5	19.5
3	10.1	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	4.37
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