

考試科目	統計學	所別	統計所	441 446	考試時間	4月20日(上) 星期 日 下午第一節
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1. (20%)美國先前懷疑伊拉克持有大規模毀滅性武器，要求聯合國對伊拉克武檢，並於武檢後，由於堅持伊拉克持有大規模毀滅性武器，而對伊拉克開戰。以下摘錄自各大報對本次波灣戰爭前後的相關報導：

- ◇ 以下為媒體對開戰後的預測：『全球經濟成長將降至2%』『教宗擔憂演成宗教災難』『烽火家園 難民淚』『環境損害難估計』『擔心古文化灰飛煙滅』。
- ◇ 聯合國武檢代表和國際原子能總署長三月七日提出武檢報告：伊拉克「非常具體的解除武裝措施」，未發現與製造核武有關的任何證據。
- ◇ 美國總統布希三月十九日在白宮宣布，美英聯軍已經開始對伊拉克展開攻擊行動，解除伊拉克武裝，解放伊拉克人民，並保障全世界的安全。

- A. 若於開戰前欲以假設檢定方法檢定『是否伊拉克持有大規模毀滅性武器』，請根據上述報導，寫出虛無假設(null hypothesis)及對立假設(alternative hypothesis)。(5%)
- B. 針對上述假設檢定問題，聯合國武檢為樣本證據。美國政府即使在無充分樣本證據下，仍依照強烈主觀意識推論伊拉克擁有大規模毀滅性武器，乃至於採取開戰行動，此為運用何種統計理論方法？(5%)
- C. 無論武檢報告結果，美國堅持認定伊拉克持有大規模毀滅性武器，請問其犯型一誤差的機率(type I error rate)為何？型二誤差的機率(type II error rate)為何？(10%)

2. (30%)台北市銀行於今年農曆春節時發行『幸運水果』吉時樂彩券，並且宣稱中獎率為30%。

- A. 小明想推論上述宣稱是否屬實，在95%的信心水準(confidence)及抽樣誤差(sampling error)不超過3%之下，則至少應隨機採樣多少張彩券  $n = ?$  (10%)
- B. 考慮到有限的經費，小明僅隨機購買  $n=90$  張彩券，其中有38張中獎，在顯著水準  $\alpha = 5\%$  下，請問上述宣稱是否屬實？請計算 p-value。(10%)
- C. 如果今天小明改變調查的方式，每次隨機買3張彩券，記錄其中中獎的張數，以下為30次隨機實驗的結果，

0,0,0,0,0,0,1,1,1,1,1,1,1,1,1,1,1,1,2,2,2,2,2,2,2,2,2,2,3

在顯著水準  $\alpha = 5\%$  下，請問上述宣稱是否屬實？(10%)

備 考 試 題 隨 卷 繳 交

命 題 委 員:

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( 簽 章 )

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考試科目	統計學	所別	統計所 441 446	考試時間	4月20日(日) 下午第一節 星期日 下
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3. (20%) One is interested in comparing the number of minutes of music played per hour between 4 radio stations in Taipei. From a sample of 5 hours from each station, the following sample means were offered.

$$\bar{X}_1 = 51.6, \bar{X}_2 = 44, \bar{X}_3 = 46, \bar{X}_4 = 48.8, SS_{\text{total}} = 192.8$$

- A. (5%) Complete an ANOVA table.  
B. (5%) At significance level  $\alpha = 0.05$ , is there a difference in the treatment mean?

$$(F_{(3,16,0.05)} = 3.24)$$

- C. (10%) Construct a 95% confidence interval for difference in mean times between station 1 and station 4? Is there a difference?

4. (30%) 令 Y 為學生參加研究所入學考試統計學得分，X1 為學生大學『統計學』修課分數，X2 為學生主修 (X2=1, 數學系; X2=0, 統計系)。隨機抽取 30 位參加研究所考試學生，欲研究 X1, X2 與 Y 的關係。見 Table 1.

- A. 根據 Table 1 的分析，請寫下線性迴歸模型(linear regression model)及模型假設(model assumptions)。(10%)  
B. 根據 Table 1 的結果，請寫下預測方程式(predicted equation)，並詳敘迴歸係數(regression coefficient)及檢定其顯著性。 $\alpha = 0.05$ (10%)  
C. 若重新分析此資料，但不考慮 X1 變數，請問學生主修學系與入學考試成績有無關係？結論為何？ $\alpha = 0.05$ (10%)

$$n = 30, \sum y = 2466, \sum y^2 = 203060,$$

$$\sum x_2 = 17, \sum x_2 y = 1440, \sum x_2 y^2 = 122058$$

Table 1.  
ANOVA

	自由度	SS	MS	F	顯著值
迴歸	2	247.1	123.55	30.99	1.02E-07
殘差	27	107.7	3.99		
總和	29	354.8			

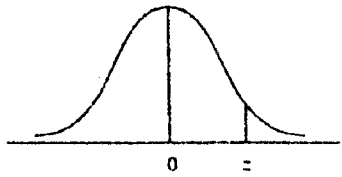
	係數	標準誤	t 統計	P-值	下限 95%	上限 95%
截距	81.24	5.24	15.52	5.65E-15	70.50	91.98
X1	-0.03	0.06	-0.44	0.659903	-0.16	0.10
X2	5.71	0.75	7.59	3.66E-08	4.17	7.26

備 考 試 題 隨 卷 繳 交

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Table 3

Normal Curve Areas



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	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

SOURCE: Abridged from Table 1 of A. Hald, *Statistical Tables and Formulas* (New York: Wiley & Sons, Inc.), 1952. Reproduced by permission of A. Hald and the publisher, John Wiley & Sons, Inc.

國立政治大學圖書館

備 考 試 題 隨 卷 繳 交

命 題 委 員 :

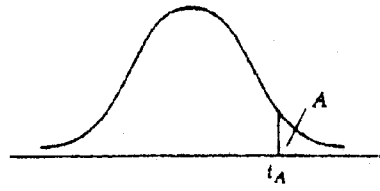
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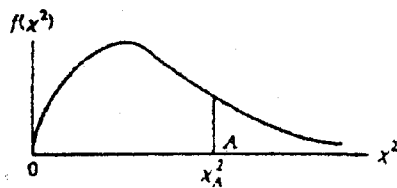
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Critical Values of  $t$



DEGREES OF FREEDOM	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.015}$	$t_{.005}$	DEGREES OF FREEDOM	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.010}$	$t_{.005}$
1	3.078	6.314	12.706	31.821	63.657	24	1.318	1.711	2.064	2.492	2.797
2	1.886	2.920	4.303	6.965	9.925	25	1.316	1.708	2.060	2.485	2.787
3	1.638	2.353	3.182	4.541	5.841	26	1.315	1.706	2.056	2.479	2.779
4	1.533	2.132	2.776	3.747	4.604	27	1.314	1.703	2.052	2.473	2.771
5	1.476	2.015	2.571	3.365	4.032	28	1.313	1.701	2.048	2.467	2.763
6	1.440	1.943	2.447	3.143	3.707	29	1.311	1.699	2.045	2.462	2.756
7	1.415	1.895	2.365	2.998	3.499	30	1.310	1.697	2.042	2.457	2.750
8	1.397	1.860	2.306	2.896	3.355	35	1.306	1.690	2.030	2.438	2.724
9	1.383	1.833	2.262	2.821	3.250	40	1.303	1.684	2.021	2.423	2.705
10	1.372	1.812	2.228	2.764	3.169	45	1.301	1.679	2.014	2.412	2.690
11	1.363	1.796	2.201	2.718	3.106	50	1.299	1.676	2.009	2.403	2.678
12	1.356	1.782	2.179	2.681	3.055	60	1.296	1.671	2.000	2.390	2.660
13	1.350	1.771	2.160	2.650	3.012	70	1.294	1.667	1.994	2.381	2.648
14	1.345	1.761	2.145	2.624	2.977	80	1.292	1.664	1.990	2.374	2.639
15	1.341	1.753	2.131	2.602	2.947	90	1.291	1.662	1.987	2.369	2.632
16	1.337	1.746	2.120	2.583	2.921	100	1.290	1.660	1.984	2.364	2.626
17	1.333	1.740	2.110	2.567	2.898	120	1.289	1.658	1.980	2.358	2.617
18	1.330	1.734	2.101	2.552	2.878	140	1.288	1.656	1.977	2.353	2.611
19	1.328	1.729	2.093	2.539	2.861	160	1.287	1.654	1.975	2.350	2.607
20	1.325	1.725	2.086	2.528	2.845	180	1.286	1.653	1.973	2.347	2.603
21	1.323	1.721	2.080	2.518	2.831	200	1.286	1.653	1.972	2.345	2.601
22	1.321	1.717	2.074	2.508	2.819	$\infty$	1.282	1.645	1.960	2.326	2.576
23	1.319	1.714	2.069	2.500	2.807						

Critical Values of  $\chi^2$



DEGREES OF FREEDOM	$\chi^2_{.995}$	$\chi^2_{.990}$	$\chi^2_{.975}$	$\chi^2_{.950}$	$\chi^2_{.900}$	$\chi^2_{.100}$	$\chi^2_{.050}$	$\chi^2_{.025}$
1	0.0000393	0.0001571	0.0009821	0.0039321	0.0157908	2.70554	3.84146	5.02389
2	0.0100251	0.0201007	0.0506356	0.102587	0.210720	4.60517	5.99147	7.37776
3	0.0717212	0.114832	0.215795	0.351846	0.584375	6.25139	7.81473	9.34840
4	0.206990	0.297110	0.484419	0.710721	1.063623	7.77944	9.48773	11.1433
5	0.411740	0.554300	0.831211	1.145476	1.61031	9.23635	11.0705	12.8325
6	0.675727	0.872085	1.237347	1.63539	2.20413	10.6446	12.5916	14.4494
7	0.989265	1.239043	1.68987	2.16735	2.83311	12.0170	14.0671	16.0128
8	1.344419	1.646482	2.17973	2.73264	3.48954	13.3616	15.5073	17.5346
9	1.734926	2.087912	2.70039	3.32511	4.16816	14.6837	16.9190	19.0228
10	2.15585	2.55821	3.24697	3.94030	4.86518	15.9871	18.3070	20.4831
11	2.60321	3.05347	3.81575	4.57481	5.57779	17.2750	19.6751	21.9200
12	3.07382	3.57056	4.40379	5.22603	6.30380	18.5494	21.0261	23.3367
13	3.56503	4.10691	5.00874	5.89186	7.04150	19.8119	22.3621	24.7356
14	4.07468	4.66043	5.62872	6.57063	7.78953	21.0642	23.6848	26.1190
15	4.60094	5.22935	6.26214	7.26094	8.54675	22.3072	24.9958	27.4884
16	5.14224	5.81221	6.90766	7.96164	9.31223	23.5418	26.2962	28.8454
17	5.69724	6.40776	7.56418	8.67176	10.0852	24.7690	27.5871	30.1910
18	6.26481	7.01491	8.23075	9.39046	10.8649	25.9894	28.8693	31.5264
19	6.84398	7.63273	8.90655	10.1170	11.6509	27.2036	30.1435	32.8523
20	7.43386	8.26040	9.59083	10.8508	12.4426	28.4120	31.4104	34.1696

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命題委

命題紙使用說明

月

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考試科目	數理統計	所別	統計學 <sup>44</sup> <sub>446</sub>	考試時間	4月20日 星期日 下午第2節
國立政治大學圖書館					
<p>1. A point is selected at random inside a circle. What is the probability that the point is closer to the center than to circumference? 5%</p> <p>2. The joint density function of <math>X</math> and <math>Y</math> is  <math>f(x, y) = 2e^{-x}e^{-y} \quad 0 &lt; x &lt; \infty \text{ and } 0 &lt; y &lt; \infty</math>  <math>0 \quad \text{otherwise}</math>            (1) Find <math>P(X &gt; 1, Y &lt; 1)</math>      (2) Find <math>P(X &lt; Y)</math>      5%+5%</p> <p>3. Consider a random sample from a normal distribution with parameters <math>\mu</math> and <math>\sigma^2</math>, <math>X_i \sim N(\mu, \sigma^2)</math>.</p> <p>(1) Show that the distribution is an exponential family or exponential class. 5%            (2) Find the joint sufficient statistics of <math>\mu</math> and <math>\sigma^2</math>. 6%            (3) Find the moment estimator (ME) of <math>\mu</math> and <math>\sigma^2</math>. 6%            (4) Find the maximum likelihood estimators (MLE) of <math>\mu</math> and <math>\sigma^2</math>. 6%            (5) Find the uniformly minimum variance unbiased estimators (UMVUE) of <math>\mu</math> and <math>\sigma^2</math>. 6%</p> <p>4. Random variable <math>Y \sim N(\mu, \sigma^2)</math>.            Let <math>L1 = k(Y - m)^2 \quad -\infty &lt; y &lt; \infty</math>            and  <math>L2 = k(Y - m)^2 \quad \mu - l\sigma &lt; y &lt; \mu + l\sigma</math>  <math>A \quad \text{otherwise,}</math>            where <math>k, m,</math> and <math>A</math> are constant.</p> <p>(1) Find the expectation of <math>L1</math>, that is <math>E(L1)</math>. 4%            (2) Determine the optimal values of <math>\mu</math> and <math>\sigma^2</math> to minimize <math>E(L1)</math>. 4%            (3) Find the expectation of <math>L2</math>, that is <math>E(L2)</math>. 6%            (4) Determine the optimal values of <math>\mu</math> and <math>\sigma^2</math> to minimize <math>E(L2)</math>. 5%            (5) Compare the results for <math>E(L1)</math> and <math>E(L2)</math>. 4%</p> <p>5. <math>T1</math> and <math>T2</math> are two independent exponential random variables with mean <math>1/\lambda_1</math> and <math>1/\lambda_2</math> respectively.</p> <p>(1) Find <math>E(T1   T1 &lt; h)</math>, where <math>h</math> is a constant and <math>h &gt; 0</math>. 6%            (2) Let <math>T^* = \min(T1, T2)</math> and <math>T^{**} = \max(T1, T2)</math>. 5%+5%+8%+9%            a. Find <math>E(T^*)</math>            b. Find <math>\text{Var}(T^*)</math>            c. Find <math>E(T^*   T^* &lt; h)</math>            d. Find <math>E(T^{**}   T^{**} &lt; h)</math></p>					
備 考 試 題 隨 卷 繳 交					