

考試科目	統計方法	系所別	統計學系	考試時間	2月2日(五)第4節
<p>1. 假設 $X \sim N(\mu, \sigma^2)$，隨機抽取一樣本，樣本大小為 n。</p> <p>若已知 σ^2 值，在顯著水準為 0.05 下，檢定 $H_0: \mu = \mu_0$ vs $H_1: \mu \neq \mu_0$</p> <p>(1) 檢定統計量及其分配為何？(5分)</p> <p>(2) 在 H_0 為真下，檢定統計量分配上的拒絕區臨界點為何？(5分)</p> <p>(3) 已知檢定結果拒絕 H_0，若事實上 $\mu = \mu_0 + \sigma$，欲使檢定力 $(1 - \beta) \geq 0.99$ 則 n 應為多少？(10分)</p> <p>2. 假設兩獨立樣本分別取自兩個常態母體，其母體平均值和變異數分別為 (μ_1, σ_1^2) 和 (μ_2, σ_2^2)。令 (n_1, S_1^2) 和 (n_2, S_2^2) 分別為兩組樣本的樣本大小(sample size)和樣本變異數。</p> <p>(1) 推導求得兩母體標準差比 (σ_1 / σ_2) 之 $100(1 - \alpha)\%$ 信賴區間 (Confidence Interval) 估計式。α 為顯著水準 (The level of significance)。(6分)</p> <p>(2) 分別自 A, B 兩廠隨機抽取樣本並測量生產的金膜厚(單位: mm)。隨機抽取的金膜厚值如下：(假設金膜厚呈常態分配)</p> <p>A: 15, 20, 25, 20, 30, 25, 25, 30, 30, 35, 35, 35, 35, 35, 35, 30.</p> <p>B: 20, 25, 30, 25, 30, 35, 20, 35, 20, 25, 30, 35.</p> <p>(2-1) 檢定 σ_1^2 與 σ_2^2 是否有異，顯著水準 = 0.05。(7分)</p> <p>(2-2) 依(2-1)的檢定結果檢定 μ_1 是否大於 μ_2，顯著水準為 0.05。(6分)</p> <p>(2-3) 若金膜厚 ≥ 30mm 即為不合格品，檢定兩廠生產的金膜厚品質是否有異，顯著水準 = 0.1。需說明你可以做此檢定的理由。(7分)</p> <p>(以上需清楚寫出虛無假設，對立假設，檢定統計量分配和檢定結果)</p> <p>3. 假設隨機變數 $X_j, j=1, 2, 3, 4, \dots, 2n$，為互相獨立的同分配，期望值為 μ，且變異數為 σ^2。</p> <p>令 $W_1 = (X_2 - X_1)^2 / 2, W_2 = (X_4 - X_3)^2 / 2, \dots, W_n = (X_{2n} - X_{2n-1})^2 / 2$。</p> <p>(1) 推導求得 W_i 之期望值 $(E(W_i))$，$i=1, 2, \dots, n$。(10分)</p> <p>(2) 若 $W_i > 5.024E(W)$ 則令 $I_i=1$；否則 $I_i=0$。令 $Y = \sum_{i=1}^n I_i$，推導求得 Y 之分配並寫出參數(parameters)。(5分)</p> <p>(3) 若 X_j 為常態分配，推導求得 W_i 之分配並寫出其期望值和變異數。(10分)</p> <p>(4) 就(3) W_i 之分配，計算機率 $P(W_i > 5.024E(W))$。(5分)</p>					
備註	<p>一、作答於試題上者，不予計分。</p> <p>二、試題請隨卷繳交。</p>				

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4. 通訊公司想了解手機銷售量(y)和在電視上做廣告次數(x)之關係，隨機抽取之數據如下表：

x	y
3	50
6	57
2	41
4	54
5	54
2	38
8	63
4	48

- (1) 畫出 y 和 X 之散佈圖並依散佈圖寫出 y 和 x 的迴歸模式。(3%)
- (2) 迴歸模式中參數之最小平方估計值為何?(8%)
- (3) 檢定迴歸模式中的斜率是否為零，並說明需具備的假設條件。
顯著水準為 0.05。(6%)
- (4) 以迴歸模式中的斜率估計值計算 y 和 x 的樣本相關係數。(3%)
- (5) 計算 y 和 x 之樣本共變數(sample covariance) (4%)

備

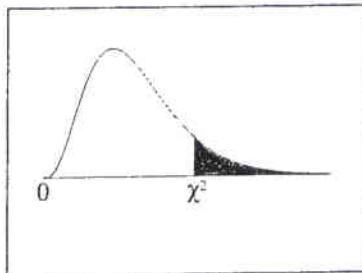
註

- 一、作答於試題上者，不予計分。
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附表如下：

Chi-Square Distribution Table



The shaded area is equal to α for $\chi^2 = \chi^2_{\alpha}$.

df	$\chi^2_{.995}$	$\chi^2_{.990}$	$\chi^2_{.975}$	$\chi^2_{.950}$	$\chi^2_{.900}$	$\chi^2_{.100}$	$\chi^2_{.050}$	$\chi^2_{.025}$	$\chi^2_{.010}$	$\chi^2_{.005}$
1	0.000	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

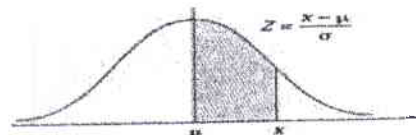
備註

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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

b. Z Table



c. t Table



TABLE B: t-DISTRIBUTION CRITICAL VALUES

df	Tail probability p											
	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	.816	1.061	1.386	1.960	2.920	4.305	4.849	6.965	9.925	14.00	22.32	31.60
3	.765	.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	.741	.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.172	8.610
5	.727	.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	.718	.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	.711	.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	.706	.893	1.108	1.397	1.860	2.306	2.449	2.896	3.353	3.853	4.501	5.041
9	.703	.893	1.100	1.383	1.833	2.262	2.398	2.821	3.230	3.690	4.297	4.781
10	.700	.892	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.164	4.587
11	.697	.891	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.023	4.437
12	.695	.891	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	.694	.890	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	.692	.889	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	.691	.888	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	.690	.888	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	.689	.887	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.963
18	.688	.887	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	.688	.886	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	.687	.886	1.064	1.325	1.723	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	.686	.885	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	.686	.885	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	.685	.885	1.060	1.319	1.714	2.069	2.177	2.492	2.797	3.104	3.485	3.768
24	.685	.885	1.059	1.318	1.711	2.064	2.172	2.482	2.777	3.091	3.467	3.745
25	.684	.885	1.058	1.316	1.708	2.060	2.167	2.475	2.771	3.078	3.450	3.725
26	.684	.885	1.058	1.315	1.706	2.056	2.162	2.470	2.771	3.067	3.435	3.707
27	.684	.885	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	.683	.885	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	.683	.884	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	.683	.884	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	.681	.883	1.053	1.307	1.693	2.035	2.140	2.448	2.737	2.997	3.351	3.611
50	.679	.882	1.051	1.305	1.689	2.028	2.134	2.440	2.727	2.977	3.322	3.560
60	.679	.882	1.049	1.303	1.684	2.021	2.123	2.432	2.704	2.971	3.297	3.531
80	.678	.881	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.486
100	.677	.881	1.046	1.298	1.674	2.000	2.099	2.390	2.660	2.915	3.232	3.460
1000	.675	.880	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
∞	.674	.881	1.036	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.291
	50%	60%	70%	80%	90%	95%	96%	98%	99%	99.5%	99.8%	99.9%

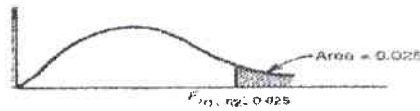
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d. F(0.025)Table

Values of $F_{\alpha, n_1, n_2, 0.025}$ such that $\text{Prob}[F_{n_1, n_2} > F_{\alpha, n_1, n_2, 0.025}] = 0.025$



$n_1 \backslash n_2$	1	2	3	4	5	6	7	8	9	10	11	12	13	14	16
1	648	800	864	900	922	937	948	957	963	969	973	977	980	983	987
2	38.5	39.0	39.2	39.2	39.3	39.3	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4
3	17.4	16.0	15.4	15.1	14.9	14.7	14.6	14.5	14.5	14.4	14.4	14.3	14.3	14.3	14.2
4	12.2	10.6	9.98	9.60	9.36	9.20	9.07	8.98	8.90	8.84	8.79	8.75	8.72	8.69	8.64
5	10.0	8.43	7.76	7.39	7.15	6.98	6.85	6.76	6.68	6.62	6.57	6.52	6.49	6.46	6.41
6	8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.52	5.46	5.41	5.37	5.33	5.30	5.25
7	8.07	6.54	5.89	5.52	5.29	5.12	4.99	4.90	4.82	4.76	4.71	4.67	4.63	4.60	4.54
8	7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.36	4.30	4.24	4.20	4.16	4.13	4.08
9	7.21	5.71	5.08	4.72	4.48	4.32	4.20	4.10	4.03	3.96	3.91	3.87	3.83	3.80	3.74
10	6.94	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.78	3.72	3.66	3.62	3.58	3.55	3.50
11	6.72	5.26	4.63	4.28	4.04	3.88	3.76	3.66	3.59	3.53	3.47	3.43	3.39	3.36	3.30
12	6.55	5.10	4.47	4.12	3.89	3.73	3.61	3.51	3.44	3.37	3.32	3.28	3.24	3.21	3.15
13	6.41	4.97	4.35	4.00	3.77	3.60	3.48	3.39	3.31	3.25	3.20	3.15	3.12	3.08	3.03
14	6.30	4.86	4.24	3.89	3.66	3.50	3.38	3.29	3.21	3.15	3.09	3.05	3.01	2.98	2.92
16	6.12	4.69	4.08	3.73	3.50	3.34	3.22	3.12	3.05	2.99	2.93	2.89	2.85	2.82	2.76
18	5.98	4.56	3.95	3.61	3.38	3.22	3.10	3.01	2.93	2.87	2.81	2.77	2.73	2.70	2.64
20	5.87	4.46	3.86	3.51	3.29	3.13	3.01	2.91	2.84	2.77	2.72	2.68	2.64	2.60	2.55
22	5.79	4.38	3.78	3.44	3.22	3.05	2.93	2.84	2.76	2.70	2.65	2.60	2.56	2.53	2.47
24	5.72	4.32	3.72	3.38	3.15	2.99	2.87	2.78	2.70	2.64	2.59	2.54	2.50	2.47	2.41
26	5.66	4.27	3.67	3.33	3.10	2.94	2.82	2.73	2.65	2.59	2.54	2.49	2.45	2.42	2.36
28	5.61	4.22	3.63	3.29	3.06	2.90	2.78	2.69	2.61	2.55	2.49	2.45	2.41	2.37	2.32
30	5.57	4.18	3.59	3.25	3.03	2.87	2.75	2.65	2.57	2.51	2.46	2.41	2.37	2.34	2.28
40	5.42	4.05	3.46	3.13	2.90	2.74	2.62	2.53	2.45	2.39	2.33	2.29	2.25	2.21	2.15
50	5.34	3.98	3.39	3.06	2.83	2.67	2.55	2.46	2.38	2.32	2.26	2.22	2.18	2.14	2.08
60	5.29	3.93	3.34	3.01	2.79	2.63	2.51	2.41	2.33	2.27	2.22	2.17	2.13	2.09	2.03
80	5.22	3.86	3.28	2.95	2.73	2.57	2.45	2.36	2.28	2.21	2.16	2.11	2.07	2.03	1.97
100	5.18	3.83	3.25	2.92	2.70	2.54	2.42	2.32	2.24	2.18	2.12	2.08	2.04	2.00	1.94
200	5.10	3.76	3.18	2.85	2.63	2.47	2.35	2.26	2.18	2.11	2.06	2.01	1.97	1.93	1.87
500	5.05	3.72	3.14	2.81	2.59	2.43	2.31	2.22	2.14	2.07	2.02	1.97	1.93	1.89	1.83
∞	5.02	3.69	3.12	2.79	2.57	2.41	2.29	2.19	2.11	2.05	1.99	1.94	1.90	1.87	1.80

備註

- 一、作答於試題上者，不予計分。
- 二、試題請隨卷繳交。