

考試科目 Course	統計學	開課系級 Dept. & Class	統計學	日期 Date, Period	4月21日	試題編號 Course No.	
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DEGREES OF FREEDOM	$\chi^2_{.995}$	$\chi^2_{.990}$	$\chi^2_{.975}$	$\chi^2_{.950}$	$\chi^2_{.900}$	$\chi^2_{.800}$	$\chi^2_{.700}$	$\chi^2_{.600}$	$\chi^2_{.500}$	$\chi^2_{.400}$	$\chi^2_{.300}$	$\chi^2_{.200}$	$\chi^2_{.100}$
1	0.0000393	0.0001571	0.0009821	0.0039321	0.0157908	2.70554	3.84146	5.02389	6.63490	7.87944			
2	0.0100251	0.0201007	0.0506356	0.102587	0.210720	4.60517	5.99147	7.37776	9.21034	10.5966			
3	0.0717212	0.14832	0.215795	0.351846	0.584375	6.25139	7.81473	9.34840	11.3449	12.8381			
4	0.206990	0.297110	0.484419	0.710721	1.063623	7.77944	9.48773	11.1433	13.2767	14.8602			
5	0.411740	0.554300	0.831211	1.145476	1.61031	9.23655	11.0705	12.8325	15.0863	16.7496			
6	0.675727	0.920043	1.237347	1.63539	2.20413	10.6446	12.5916	14.4494	16.8119	18.5476			
7	0.989265	1.239043	1.68987	2.16735	2.83311	12.0173	14.0671	16.0128	18.4753	20.2777			
8	1.344419	1.646482	2.17973	2.73264	3.48954	13.3615	15.5073	17.5346	20.0902	21.9550			
9	1.734926	2.087912	2.70039	3.32511	4.16816	14.6837	16.9190	19.0228	21.6660	23.5893			
10	2.15385	2.55821	3.24697	3.94030	4.86518	15.9871	18.3070	20.4831	23.2093	25.1882			
11	2.60321	3.05347	3.81575	4.57481	5.57779	17.2750	19.6751	21.9200	24.7250	26.7569			
12	3.07382	3.57056	4.40379	5.22603	6.30380	18.5494	21.0261	23.3367	26.2170	28.2995			
13	3.56303	4.10691	5.00874	5.89186	7.04130	19.8119	22.3621	24.7356	27.5883	29.8194			
14	4.07468	4.66043	5.62872	6.57063	7.78953	21.0642	23.6848	26.1190	29.1413	31.3193			
15	4.60094	5.22935	6.26214	7.26094	8.54675	22.3072	24.9958	27.4884	30.5779	32.8013			
16	5.14224	5.81221	6.90766	7.96164	9.31223	23.5418	26.2962	28.8454	31.9999	34.2672			
17	5.69724	6.40776	7.56418	8.67176	10.0851	24.7690	27.5871	30.1910	33.4087	35.7185			
18	6.26481	7.01491	8.23075	9.39046	10.8649	25.9894	28.8693	31.5264	34.8053	37.1564			
19	6.84398	7.63273	8.90655	10.1170	11.6509	27.2036	30.1435	32.8523	36.1908	38.5822			
20	7.43386	8.26040	9.59083	10.8508	12.4426	28.4120	31.4104	34.1696	37.5662	39.9968			
21	8.03366	8.89720	10.28293	11.5913	13.2396	29.6151	32.6705	35.4789	38.9321	41.4010			
22	8.64272	9.54249	10.9823	12.3380	14.0415	30.8133	33.9244	36.7807	40.2894	42.7956			
23	9.26042	10.19567	11.6885	13.0905	14.8479	32.0069	35.1725	38.0757	41.6384	44.1813			
24	9.88623	10.8564	12.4011	13.8484	15.6587	33.1963	36.4151	39.3641	42.9798	45.5585			
25	10.5197	11.5240	13.1197	14.6114	16.4734	34.3816	37.6525	40.6465	44.3141	46.9278			
26	11.1603	12.1981	13.8439	15.3791	17.2919	35.631	38.8852	41.9232	45.6417	48.2899			
27	11.8076	12.8786	14.5733	16.1513	18.1138	36.7412	40.1133	43.1944	46.9630	49.6449			
28	12.4613	13.5648	15.3079	16.9279	18.9392	37.9159	41.3372	44.4607	48.2782	50.9933			
29	13.1211	14.2565	16.0471	17.7083	19.7677	39.0875	42.5569	45.7222	49.5879	52.3356			
30	13.7867	14.9535	16.7908	18.4926	20.5992	40.2560	43.7729	46.9792	50.8922	53.6720			
40	20.7063	22.1643	24.4331	26.5093	29.0505	51.8050	55.7585	59.3417	63.6907	66.7659			
50	27.9907	29.7067	32.3574	34.7642	37.6886	63.1671	67.5048	71.4202	76.1539	79.4900			
60	35.5346	37.4848	40.4817	43.1879	46.4589	74.3970	79.0819	83.2976	88.3794	91.9517			
70	43.2752	45.4418	48.7576	51.7393	55.3290	85.5271	90.5312	95.0231	100.425	104.215			
80	51.1720	53.5400	57.1532	60.3915	64.2778	96.5782	101.879	106.629	112.329	116.321			
90	59.1963	61.7541	65.6466	69.1260	73.2912	107.565	113.145	118.136	124.116	128.299			
100	67.3276	70.0648	74.2219	77.9295	82.3581	118.498	124.342	129.561	135.807	140.169			

χ^2 分配表

國立政治大學圖書館

Critical Values for the Wilcoxon Signed Rank Sum Test for the Matched Pairs Experiment

n	(a) $\alpha = .025$ one-tail $\alpha = .05$ two-tail		(b) $\alpha = .05$ one-tail $\alpha = .10$ two-tail	
	T_L	T_U	T_L	T_U
6	1	20	2	19
7	2	26	4	24
8	4	32	6	30
9	6	39	8	37
10	8	47	11	44
11	11	55	14	52
12	14	64	17	61
13	17	74	21	70
14	21	84	26	79
15	25	95	30	90
16	30	106	36	100
17	35	118	41	112
18	40	131	47	124
19	46	144	54	136
20	52	158	60	150
21	59	172	68	163
22	66	187	75	178
23	73	203	83	193
24	81	219	92	208
25	90	235	101	224
26	98	253	110	241
27	107	271	120	258
28	117	289	130	276
29	127	308	141	294
30	137	328	152	313

Wilcoxon 表格

考試科目	數理統計	所別	統計	考試時間	4月22日上午 星期 日 (下) 3:20~5:20
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國立政治大學圖書館

1. Two gamblers bet \$1 each on the successive tosses of a coin. Each has a bank of \$6.
- (10) (a) What is the probability that they break even after six tosses of the coin?
- (b) What is the probability that one player, say, Jones, wins all the money on the tenth toss of the coin?
2. Prove: Let Y be a random variable with finite mean μ and variance σ^2 . Then for any $K > 0$,
- (15) $P(|Y - \mu| < K\sigma) \geq 1 - \frac{1}{K^2}$ or $P(|Y - \mu| \geq K\sigma) \leq \frac{1}{K^2}$
3. Let Y_1, Y_2, \dots, Y_n be a random sample from a distribution with mean μ and finite variance σ^2 .
- (a) Show that $S^2 = \frac{\sum_{i=1}^n (Y_i - \bar{Y})^2}{n-1}$ converges in probability to σ^2 .
- (20) (b) Show that $T = \frac{\bar{Y} - \mu}{S/\sqrt{n}}$ converges in distribution to $N(0, 1)$
- where $\bar{Y} = \frac{1}{n} \sum_{i=1}^n Y_i$ is the sample mean.
4. Let Y_1, Y_2, \dots, Y_n be a random sample from the density function
- $$f(y|\theta, \sigma) = \frac{1}{\sigma} e^{-(y-\theta)/\sigma} \quad 0 < y < \infty \quad 0 < \sigma < \infty$$
- (a) Find a sufficient statistic for (θ, σ) .
- (20) (b) Find the m.l.e of θ and σ
- (c) Find UMVUE of θ .

考試科目	數理統計	所別	統計	考試時間	星期	月	日	上午	下午	第	節
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5. Let Y_1, Y_2, \dots, Y_n be a random sample from $N(\mu, \sigma^2)$ where μ is unknown and σ^2 is known.

(15) (a) Find the most powerful ^{level α} test for testing $H_0: \mu = \mu_0$ v.s. $H_a: \mu = \mu_1$, where $\mu_1 > \mu_0$.

(b) Is the test in (a) uniformly most powerful for testing $H_0: \mu = \mu_0$ v.s. $H_a: \mu > \mu_0$? Why or why not?

6. Suppose that we have two independent random samples:

X_1, X_2, \dots, X_n are from Exponential (θ) and Y_1, Y_2, \dots, Y_n are from Exponential (μ)

(a) Find the likelihood ratio test of $H_0: \theta = \mu$ v.s. $H_a: \theta \neq \mu$

(20) (b) Show that the test in part (a) can be based on the statistic

$$T = \frac{\sum X_i}{\sum X_i + \sum Y_i}$$

(c) Find the distribution of T when H_0 is true

國立政治大學圖書館

備

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試題隨卷繳交

命題委員:

考試科目	統計學	所別	統計所	考試時間	4 月 21 日 上 星期 下 午 第 節
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1. (15%) Suppose a rare disease infects one out of every 1000 people in Taipei. Also, suppose there is a test for this disease:

- If a person has the disease, the test comes back positive 99%.
- If a person doesn't have the disease, the test comes back positive 2%.

Assume that you are tested positive.

- (a) what are your chances of having the disease?
 (b) Comment on what you find in (a).
2. (15%) The following data are the ages of first symptom for diabetic patients randomly selected from a hospital.

10 21 23 38 38 41 41 45 47 47 48 48 53 54 55 56
 57 59 60 61 61 64 65 68 68 70 75 76 77 79 79 82

- (a) Use summary statistics, boxplot, or other plots to summarize this data set and comment on what you find.
 (b) State the Chebychev's inequality (柴比雪夫不等式) and use the data set here to check if it is valid.
3. (15%) A sequence of 300 pseudo-random digits was generated on my Casio fx-4000p calculator. The following data give the number of times each of the digits 0, 1, ..., 9 occurred. Do these data look like a sample from a discrete uniform distribution on 0, 1, ..., 9 ($\alpha = 0.05$)? Comment on the test you use.

Digit	0	1	2	3	4	5	6	7	8	9
Frequency	24	29	32	36	35	33	26	32	25	28

4. (20%) A random sample of 15 women and men each were selected randomly for a study of blood pressure. These are their systolic blood pressures:

Women					Men				
84	100	110	110	110	112	120	110	90	120
114	112	120	104	112	115	128	130	126	140
90	112	130	110	88	106	110	134	90	120

- (a) Do the data provide sufficient evidence to indicate there is a difference in the test of systolic blood pressure between men and women? ($\alpha = 0.05$)
 (b) Construct 95% confidence intervals for the two population variances.
 (c) Suppose the true ratio of the population variances is $\frac{(14.23)^2}{(15.27)^2}$. Does this

value fall within the confidence interval based on the data in this problem?

Note: $F(13,13,0.25)=.321$, $F(13,13,0.975)=3.115$, $F(14,14,0.025)=.3357$, $F(14,14,0.975)=2.9786$.

考試科目	統計學	所別	統計所	考試時間	4月21日 上午第 節 星期 下
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國立政治大學圖書館

5. (20%) A set of data was collected to investigate the relationship between mean annual temperature (X) and the mortality rate (Y) for a type of breast cancer in women. It is believed that we can use regression analysis to predict Y , based on the information of X , or $Y = \beta_0 + \beta_1 X$. Suppose we know the following information: ($n=16$)

$$\sum X = 713.5, \sum X^2 = 32285, \sum Y = 1333.5, \sum Y^2 = 114535, \text{ and } \sum XY = 60568.$$

(a) Test $H_0: \beta_1 = 0$ against $H_1: \beta_1 \neq 0$ at the $\alpha = 0.05$ significance level using a t-test.

(b) Complete the following ANOVA table:

Source	SS	d.f.	MS	F
Regression		1		
Error		14		
Total		15		

6. (15%) A sample of 10 couples (husbands and wives) was selected randomly to evaluate their favorite TV shows. (Rank 1 is the most favorite and rank 10 is the least favorite.) We want to know if there exists correlation between the favorites of husbands and wives.

TV Show	1	2	3	4	5	6	7	8	9	10
Rank(husbands)	1	4	5	7	6	2	8	10	9	3
Rank(wives)	5	10	2	6	8	7	1	4	3	9

(a) Define the correlation coefficient ρ_s .

(b) Use sign test (or called binomial test) or other nonparametric tests that are appropriate to decide if the correlation is significant. ($\alpha = 0.05$)

NATIONAL CHENGCHI UNIVERSITY EXAMINATION FORM

考試科目 Course	統計學	開課系級 Dept. & Class	統計系	日期 Date, Period	4月21日 第 節	試題編號 Course No.	
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國立政治大學圖書館

常態
分配

<i>z</i>	.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

七分配

DEGREES OF FREEDOM	<i>t</i>					DEGREES OF FREEDOM	<i>t</i>				
	<i>t</i> _{.100}	<i>t</i> _{.050}	<i>t</i> _{.025}	<i>t</i> _{.010}	<i>t</i> _{.005}		<i>t</i> _{.100}	<i>t</i> _{.050}	<i>t</i> _{.025}	<i>t</i> _{.010}	<i>t</i> _{.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	∞	1.282	1.645	1.960	2.326	2.576
23	1.319	1.714	2.069	2.500	2.807						