

考試科目	統計學	系別	統計學系	考試時間	7月10日 星期五 第二節
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1. (36pts). For each of the following statements, determine whether it is true or false. (True or false questions. Do not give explanation)
- If the standard deviation is zero, then all the data values are the same.
  - If two events  $A$  and  $B$  are mutually exclusive ( $A \cap B = \emptyset$ ), then they are independent.
  - For a binomial distribution with the trial number  $n = 15$  as the success probability  $\pi$  changes from 0.5 towards 0.95 the distribution will become more negatively skewed.
  - In stratified random sampling, we hope to divide the population into subgroups in the way such that the characteristic we are interested in is homogeneous in each stratum and heterogeneous between strata.
  - There are three factors that can determine an appropriate sample size when we wish to estimate the population mean: desired level of confidence, maximum allowable error and variation in population. Particularly, the larger the maximum allowable error, the larger the appropriate sample size.
  - A type II error is committed if we reject true alternative hypothesis.
  - When none of the points on a control chart fall beyond the control limits, then the process is in control.
  - Moving Average method can be used to smooth the trend in a time series. A three-year moving average for a time series will be smoother than a five-year moving average.
  - Wilcoxon rank-sum test is designed to determine two dependent samples came from equivalent populations.
2. (8pts). In establishing warranties on HDTV sets, the manufacturer wants to set the limits so that few will need repair at the manufacture's expense. On the other hand, the warranty period must be long enough to make the purchase attractive to the buyer. Suppose for a new HDTV the number of months until repairs are needed follows a normal distribution and the mean number of months is 37.50. What shall the standard deviation be set so that the warranty limit is 36 months and only 5% of the HDTVs need repairs at the manufacturer's expense?

備 考 試 題 隨 卷 繳 交

命 題 委 員 :

(簽章) 2009 年 6 月 15 日

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3. (6pts). Personnel in a consumer testing laboratory are evaluating the absorbency of paper towels. They wish to compare the amount of liquid the paper towels taking between brand A and brand B. A random sample of 9 towels are drawn from each brand. Suppose the amount of liquid the paper has taken follows a normal distribution. However the mean and the variance may differ for different brands. An appropriate test is performed. What is the distribution of the test statistic under the appropriate null hypothesis?
4. (18pts). The fuel efficiencies for a sample of 27 compact, midsize, and large cars are entered into a statistical software package. Analysis of variance is used to investigate if there is a difference in the mean mileage of the three kinds of cars. The output is as follows:

Summary					
Groups	Count	Average	Variance		
Compact	12	22.35833	9.388106		
Midsize	9	19.15556	7.315278		
Large	6	16.75	7.303		
Source	DF	SS	MS	F	P
Size	—	136.4803	—	8.258752	0.001866
Error	—	—	8.262766	—	—
Total	—	—	—	—	—

Complete the above ANOVA table. Please copy the whole ANOVA table to the answer sheet and there is no need to show your work.

5. (8pts). A survey investigated the public's attitude toward the federal deficit. Each sampled citizen was classified as to whether they felt the government should reduce the deficit, increase the deficit, or if they had no opinion. The sample results of the study are reported by age: less than 25, 25 up to 40, 40 up to 60, and 60 and older. The chi-square goodness of fit test is used to conclude that age is dependent or not of a person's opinion on the deficit. What is the corresponding degree of freedom and the critical value (take  $\alpha = 0.05$ )?

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6. Suppose that the sales manager of a large automotive parts distributor wants to estimate the total annual sales. Several factor appear to be related to sales. Five independent variables were finally selected as being the most important: Number of retail outlets, number of automobiles registered (millions), personal income (\$ billions), average age of automobiles (years), and number of supervisors. Then the data were gathered for a recent year and a multiple regression analysis is performed.

(a) (4pts). Consider the following correlation matrix.

	sales	outlets	cars	income	age
outlets	0.899				
cars	0.605	0.775			
income	0.964	0.825	0.409		
age	-0.323	-0.489	-0.447	-0.349	
bosses	0.286	0.183	0.395	0.155	0.291

The correlation between variables outlets and income and between cars and outlets are fairly strong. This could be a problem. What is this condition called?

(b) (10pts). The analysis output for all five variables is following:

Predictor	Coef	StDev	t	p
constant	-19.672	5.422	-3.62818	0.022196
outlets	-0.00063	0.002638	-0.23844	0.823258
cars	1.7399	0.553	3.146293	0.034637
income	0.40994	0.04385	9.348689	0.000729
age	2.0357	0.8779	2.318829	0.081241
bosses	-0.0344	0.188	-0.18298	0.863715

Source	DF	SS	MS	F	p
Regression	5	1593.81	318.762	140.4238	0.00014
Error	4	9.08	2.27		
Total	9	1602.89			

What does the F test for? Please give the test hypotheses, decision rule, and conclusion (take  $\alpha = 0.5$ ).

(c) (10pts). From the t-tests above, any of the regression coefficients are zero (take  $\alpha = 0.5$ )? Do you suggest to discard all of them together? Why?

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Areas under the Normal Curve	z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753	0.0793
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141	0.1179
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517	0.1554
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879	0.1915
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224	0.2257
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549	0.2580
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852	0.2881
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133	0.3159
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389	0.3413
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621	0.3643
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830	0.3849
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015	0.4032
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177	0.4192
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319	0.4332
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441	0.4452
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545	0.4554
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633	0.4641
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706	0.4713
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767	0.4772
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817	0.4821
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857	0.4861
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890	0.4893
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916	0.4918
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936	0.4938
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952	0.4953
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964	0.4965
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974	0.4975
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4989	0.4990	0.4990



Critical Values of the F Distribution at a 5 Percent Level of Significance



Degrees of Freedom for the Denominator	Degrees of Freedom for the Numerator															
	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40
1	161	200	216	225	230	234	237	239	241	242	244	246	248	249	250	251
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
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
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.98	5.91	5.86	5.80	5.77	5.75	5.72
5	6.61	5.79	5.41	5.18	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46
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
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
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
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
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
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
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
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
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27
15	4.54	3.68	3.28	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96
22	4.30	3.44	3.05	2.82	2.66	2.55	2.48	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.06	2.00	1.92	1.84	1.79	1.74	1.69
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59
120	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39

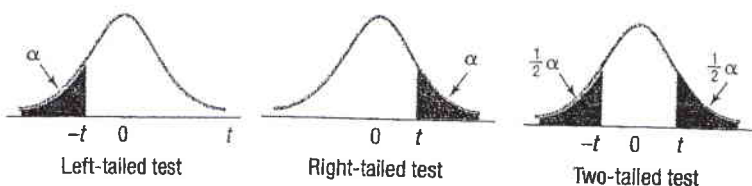
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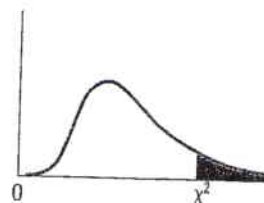
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### Student's t Distribution



### Critical Values of Chi-Square



df	Confidence Intervals, c					
	80%	90%	95%	98%	99%	99.9%
	Level of Significance for One-Tailed Test, $\alpha$					
	0.100	0.050	0.025	0.010	0.005	0.0005
df	Level of Significance for Two-Tailed Test, $\alpha$					
	0.200	0.10	0.05	0.02	0.01	0.001
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.599
3	1.638	2.353	3.182	4.541	5.841	12.924
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.869
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.408
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.069	2.500	2.807	3.768
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
31	1.309	1.696	2.040	2.453	2.744	3.633
32	1.309	1.694	2.037	2.449	2.738	3.622
33	1.308	1.692	2.035	2.445	2.733	3.611
34	1.307	1.691	2.032	2.441	2.728	3.601
35	1.306	1.690	2.030	2.438	2.724	3.591

Degrees of Freedom, df	Right-Tail Area			
	0.10	0.05	0.02	0.01
1	2.706	3.841	5.412	6.635
2	4.605	5.991	7.824	9.210
3	6.251	7.815	9.837	11.345
4	7.779	9.488	11.668	13.277
5	9.236	11.070	13.388	15.086
6	10.645	12.592	15.033	16.812
7	12.017	14.067	16.622	18.475
8	13.362	15.507	18.168	20.090
9	14.684	16.919	19.679	21.666
10	15.987	18.307	21.161	23.209
11	17.275	19.675	22.618	24.725
12	18.549	21.026	24.054	26.217
13	19.812	22.362	25.472	27.688
14	21.064	23.685	26.873	29.141
15	22.307	24.996	28.259	30.578
16	23.542	26.296	29.633	32.000
17	24.769	27.587	30.995	33.409
18	25.989	28.869	32.346	34.805
19	27.204	30.144	33.687	36.191
20	28.412	31.410	35.020	37.566
21	29.615	32.671	36.343	38.932
22	30.813	33.924	37.659	40.289
23	32.007	35.172	38.968	41.638
24	33.196	36.415	40.270	42.980
25	34.382	37.652	41.566	44.314
26	35.563	38.885	42.856	45.642
27	36.741	40.113	44.140	46.963
28	37.916	41.337	45.419	48.278
29	39.087	42.557	46.693	49.588
30	40.256	43.773	47.962	50.892

備 考試 題 隨 卷 繳 交

命題委員：

(簽章) 2009 年 6 月 25 日

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考試科目	微積分	系別	統計系	考試時間	7月10日 星期五	第IV節
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1. 
$$f(x) = \begin{cases} mx & x < 3 \\ n & x = 3 \\ -2x+9 & x > 3 \end{cases} \quad (10\text{pts})$$

Find  $m$  and  $n$  so that  $f$  is continuous.

2. Find  $dy/dx$  and  $d^2y/dx^2$  if  $x^2+y^2=4$ . (10pts)

3. Consider the graphs of  $y=x^2-1$  and  $y=1-x$ . Find the maximum vertical distance between the graphs on the interval  $-2 \leq x \leq 1$ . (15pts)

4. Find the length of the graph of  $y=4x^{3/2}$  from the origin  $(0, 0)$  to the point  $(1, 4)$ . (10pts)

5. Evaluate  $\int \frac{x+3}{x^4+9x^2} dx$  (10pts)

6. Evaluate the following limits:

(a)  $\lim_{x \rightarrow \pi/2^+} \frac{\tan x}{\tan 3x}$

(b)  $\lim_{x \rightarrow 0^+} \frac{x^2}{\ln^2(1+3x)}$  (10pts)

7. Evaluate  $\int_0^e \ln x dx$  (10pts)

8. Find the interval of convergence for  $\sum_{k=1}^{\infty} \frac{(x-5)^k}{k3^k}$  (15pts)

9. Evaluate  $\iint_R xe^{y^2} dA$  over the region  $R$  in the first quadrant bounded by the graphs of  $y=x^2$ ,  $x=0$ ,  $y=4$ . (10pts)

備 考 試 題 隨 卷 繳 交

命 題 委 員 :

(簽章) 98年 6 月 30 日

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