考試科目	統計學	系別	統計學系	考試時間	2005 7月 9日 星期 六 上午 下午 第二節

Note: Tables for areas under the normal curve, critical values of the Student's t distribution, critical values of the chi-square distribution, and critical values of the F distribution at a 5 percent level of Significance are attached in the last page.

1. (30pts). Please answer each of the following multiple choice questions.

   (a) A purchasing agent for a trucking company is shopping for replacement tires for their trucks from two suppliers. The suppliers' prices are the same. However, supplier A's tires have an average life of 50,000 miles with a standard deviation of 6,000 miles. Supplier B's tires have an average life of 50,000 miles with a standard deviation of 2,000 miles. Which of the following statements is true?

   (A). On average, supplier A's tires have a longer life than Supplier B's tires
   (B). The life of supplier B's tires is more predictable than the life of supplier A's tires
   (C). The dispersion of supplier A's tire life is less than the dispersion of supplier B's life
   (D). The two distributions of tire life are the same

   (b) What must you know to develop a binomial probability distribution?

   (A). Number of successes and number of trials
   (B). Number of trials and probability of success
   (C). Probability of success and number of successes
   (D). Number of successes, number of trials, and probability of success

   (c) A statewide sample survey is to be made. First, the state is subdivided into counties. Seven counties are selected at random and further sampling is concentrated on the seven counties. What type of sampling is this?

   (A). Simple random sampling
   (B). Cluster sampling
   (C). Stratified random sampling
   (D). Systematic random sampling

   (d) Which of the following is not necessary to determine how large a sample to select from a population?

   (A). Estimate of the population variation
   (B). Maximum allowable error in estimating the population parameter
   (C). Size of the population
   (D). Level of confidence in estimating the population parameter

   (e) The distribution of Student's t is

   (A). symmetrical
   (B). negatively skewed
   (C). positively skewed
   (D). a discrete probability distribution

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(f) What is a type I error?

(A). Accepting a false null hypothesis
(B). Rejecting a false null hypothesis
(C). Accepting a false alternate hypothesis
(D). Rejecting a false alternate hypothesis

(g) A random sample of 30 statistics students were given two tests: one having 10 multiple-choice questions and the other having 10 open-ended questions – all on the same material. We are interested in determining which type of questions the students score higher. Suppose the scores is not normally distributed. Which of the following techniques shall we use?

(A). Paired t-test
(B). ANOVA
(C). Wilcoxon signed-rank test
(D). Goodness-of-fit test

(h) Multiple regression analysis is applied when analyzing the relationship between

(A). an independent variables and several dependent variables
(B). a dependent variable and several independent variables
(C). several dependent variables and several independent variables
(D). several regression lines and a single sample

(i) The number of "near misses" recorded for the last 12 months at the Lima International Airport is 3,5,2,1,2,1,4,3,5,1,0, and 1. What kind of control chart should be constructed to monitor the process?

(A). Mean chart ($\bar{x}$ chart)
(B). Range chart (R chart)
(C). Percent defective chart (π chart)
(D). C-bar chart ($\bar{c}$ chart)

(j) Of the three components in any decision-making situation, which of the following cannot be controlled?

(A). Payoff table
(B). States of nature
(C). Actions (alternatives)
(D). None of the above

2. In a study of low tar cigarettes, five cigarettes from each of three brands were tested to see if the mean amount of tar per cigarette differs among the brands. Suppose the sum of squares for the brand is 0.07 and for the error is 0.09.

(a) (4pts). What assumptions are necessary for applying ANOVA on this data set?

(b) (8pts). Please develop the ANOVA table. (You may skip the p-value column)

(c) (8pts). Does the mean amount of tar per cigarette differs among the brands? Please take $\alpha = 0.05$ and give the test hypotheses, test statistics, decision rule, and conclusion.

備考	試題隨卷繳交	074

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3. The following stem-and-leaf display reports the number of hours of personal computer usage per week for a sample of 55 persons. Stem unit is 1 and leaf unit is 0.1.

2	0	11
6	1	2389
14	2	01456999
(14)	3	12244456677789
27	4	0134567789
17	5	0346789
10	6	1568
6	7	366
3	8	57
1	9	
1	10	1

   (a) (8pts). Please compute the interquartile range (IQR).

   (b) (4pts). Is it reasonable to assume that the number of hours of personal computer usage per week is normally distributed? Explain.

4. (10pts). An analysis of the grades on the first test in History 101 revealed that they approximate a normal curve with a mean of 75 and a standard deviation of 8. The instructor wants to award the grade of A to the upper 10 percent of the test grades. What is the dividing point between an A and a B grade? Please show your work.

5. A university sampled twenty-five recent graduates of the English Department for their starting salaries. The average salary from the sample was \$16,000 with a standard deviation of \$2,000. Suppose the salary is normally distributed.

   (a) (10pts). Please develop a 95% confidence interval for the mean salary of all recent graduates from the English Department.

   (b) (4pts). What do the results you obtain in (a) mean?

6. The quarterly production of pine lumber, in millions of board feet, by Northwest Lumber since 2000 is:

	Quarter			
Year	I	II	III	IV
2000	7.8	10.2	14.7	9.3
2001	6.9	11.6	17.5	9.3
2002	8.9	9.7	15.3	10.1
2003	10.7	12.4	16.8	10.7

   (a) (6pts). Using the ratio-to-moving average method, we find the four typical seasonal indexes to be 0.765, 0.963, 1.425, and 0.847 for quarter I, II, III, and IV, respectively. Please interpret the seasonal pattern accordingly.

   (b) (8pts). Suppose the fitted trend line using the least square method on the deseasonalized data is $\hat{Y} = 9.940 + 0.169t$, where t is measured in quarter and $t = 1$ is located in the first quarter of year 2000. Please predict the production for the "third" quarter (III) of Year 2004.

備考	試題隨卷繳交	075

2005

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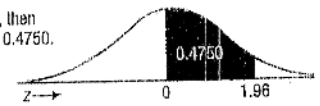
Areas under the Normal Curve

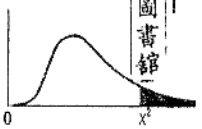
Example:
If $z = 1.96$, then
$P(0 \text{ to } z) = 0.4750$.



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

Critical Values of Chi-Square

This table contains the values of χ^2 that correspond to a specific right-tail area and specific number of degrees of freedom.



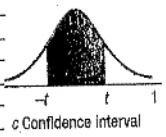
Example: With 17 *df* and a .02 area in the upper tail, $\chi^2 = 30.995$

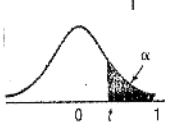
Degrees of Freedom, *df*	Right-Tail Area			
	0.10	0.05	0.02	0.01
1	2.706	3.841	5.412	6.635
2	4.605	5.991	7.824	9.210
3	6.251	7.815	9.837	11.345
4	7.779	9.488	11.668	13.277
5	9.236	11.070	13.388	15.086
6	10.645	12.592	15.033	16.812
7	12.017	14.067	16.622	18.475
8	13.362	15.507	18.168	20.090
9	14.684	16.919	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

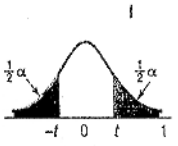
Critical Values of the *F* Distribution at a 5 Percent Level of Significance

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	5.96	5.91	5.86	5.80	5.77	5.75	5.72
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
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	3.29	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	2.46	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	2.08	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

Student's *t* Distribution







df	Confidence Intervals, *c*					
	80%	90%	95%	98%	99%	99.9%
	Level of Significance for One-Tailed Test, α					
	0.100	0.050	0.025	0.010	0.005	0.0005
	Level of Significance for Two-Tailed Test, α					
	0.20	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
40	1.303	1.684	2.021	2.423	2.704	3.551
60	1.296	1.671	2.000	2.390	2.660	3.460
20	1.289	1.658	1.980	2.358	2.617	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.291

備考	試題隨卷繳交	076

考試科目	微積分	系別	統計系	考試時間	7月9日 星期六 上午 下午 第四節

(1) Find the absolute maximum and absolute minimum of $f(x) = 2x - \sin^{-1}x$, $0 \le x \le 1$. (10%)

(2) Find the radius of convergence for ① $\sum_{k=1}^{\infty} \frac{k^4}{4^k} x^{2k}$ ② $\sum_{k=1}^{\infty} \frac{(k!)^2}{(2k)!} x^k$ (10%)

(3) Find ① $\lim_{x \to 0} \left(\frac{1}{x^2} - \frac{1}{x^2 \sec x} \right) = ?$ (20%)

② $\lim_{(x,y) \to (0,0)} (1 + 4x^2 + 4y^2)^{\frac{2}{x^2+y^2}} = ?$

(4) Find ① $\int_1^{\infty} \frac{dx}{x^4 + x^2} = ?$ ② $\int_0^{\frac{\pi}{2}} \frac{(\sin x)^2 \cos x}{2 + \sin x} dx = ?$ (20%)

(5) ① Find an equation of the tangent line to the curve $y = (4-x)^x$ at $x = 1$.

② $f(x,y) = e^{2x} \cdot \int_{2x}^{y} \sin(\cos t)\, dt$. Find $f_x(x,y) = ?$, $f_x(1,2) = ?$ (20%)

(6) ① R is the region $1 \le x < \infty$, $0 \le y \le \frac{1}{x}$,

Find $\iint_R \frac{1}{x} \sin(\frac{1}{x})\, dA = \int_?^? dx \int_?^? \frac{1}{x} \sin(\frac{1}{x})\, dy = ?$ (20%)

② Find $\int_0^3 dx \int_0^{9-x^2} \frac{x e^y}{9-y} dy = \int_?^? dy \int_?^? \frac{x e^y}{9-y} dx = ?$

備考	試題隨卷繳交	077