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第一大題(3pt for each, please write down the item numbers and answers in order)

1. The mean, as a measure of central location, would be inappropriate for which one of the following?
(a) Ages of adults at a senior citizen center
(b) Incomes of lawyers
(c) Number of pages in textbooks on statistics
(d) Marital status of college students at a particular university
2. Which descriptive summary measures are resistant statistics?
(a) The sample mean and standard deviation
(b) The interquartile range and range
(c) The model and variance
(d) The median and interquartile range
3. Which of the following is true?
(a) The distribution of the sample mean has a standard deviation that is larger the standard deviation of the distribution of the population from which it was sampled
(b) The distribution of the sample mean has a standard deviation that is smaller the standard deviation of the distribution of the population from which it was sampled
(c) The distribution of the sample mean has a mean that is larger than the mean of the distribution of the population from which it was sampled from
(d) None of the above
4. Suppose that X is a normal variable with mean 5. If $P(X > 9) = 0.1977$, approximately what is variance of X?
(a) 13.23
(b) 4.71
(c) 22.15
(d) 47.68
5. Suppose that in a certain hypothesis test the null hypothesis is rejected at the 0.10 level; it is also rejected at the 0.05 level; however, it cannot be rejected at the 0.01 level. The most accurate statement that can be made about the *p*-value for this test is that:
(a) *p*-value = 0.01
(b) *p*-value = 0.10
(c) 0.01 < *p*-value < 0.05
(d) 0.05 < *p*-value < 0.10

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6. The life expectancy in the United States is 75 with a standard deviation of 7 years. A random sample of 49 individuals is selected. What is the probability that the sample mean will be larger than 77 years?
(a) Smaller than 0.01
(b) Larger than 0.05
(c) Between 0.05 and 0.03
(d) Smaller than 0.025

7. Five types of apples are displayed side by side in several supermarkets in the city of Miami. It was noted that in one day, 180 customers purchased apples. Of these, 30 picked type A, 40 picked type B, 25 picked type C, 35 picked type D, and 50 picked type E. Which of following method can be applied for testing the preferred type of apples?
(a) Test of independent
(b) Test the equality of multiple proportions
(c) Goodness of fit test
(d) ANOVA test

8. David's gasoline station offers 5 cents off per gallon if the customer pays in cash and does not use a credit card. Past evidence indicates some customers were willing to pay in cash. What type of distribution can be used to model the number of customers who pay in cash within one-hour period?
(a) Uniform distribution
(b) Poisson probability distribution
(c) Binomial probability distribution
(d) Hypergeometric probability distribution

9. A 95% confidence interval for the mean μ of a population is computed from a random sample and found to be 9 ± 2. We may conclude
(a) There is a 99% probability that μ is between 6 and 12
(b) There is a 95% probability that μ is between 7 and 11
(c) If we took many, many additional random samples and from each computed a 95% confidence interval for μ, approximately 95% of these intervals would contain μ
(d) All of the above

10. Two different companies have applied to provide cable television service in a certain region. Let p denote the proportion of all potential subscribers who favor the first company over the second. Consider testing H_0: $p \leq 0.5$ versus H_1: $p > 0.5$ based on a random sample of 25 individuals. Let X denote the number in the sample who favor the first company. Which of the following rejection regions is most appropriate?
(a) $\{X < 7\}$ or $\{X > 18\}$
(b) $\{X < 7\}$
(c) $\{X > 18\}$

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(d) None of them

第二大題(25%, 5pts for each)

(a) The weight of corn chips dispensed into a 10-ounce bag by the dispensing machine has a mean of 10.5 ounces and a standard deviation of 0.2 ounce. Suppose 100 bags of chips are randomly selected. Find the probability that the mean weight of these 100 bags exceeds 10.45 ounces

(b) Suppose weights of baby giraffes are normally distributed with mean 50 kg and standard deviation 15 kg. To be at the 95th percentile in weight, how much must a baby giraffe weigh?

(c) Verizon's contract with the MTA states that at it must keep at least 96% of subway payphones in proper working order at all times. A random sample of 16 subway phones are tested and it is found that 11 are working. We are interested in whether or not Verizon is fulfilling its contract. Test $H_0: p \leq 96\%$ *vs.* $H_1: p > 96\%$, where p is the true proportion of subway payphones in proper working. Find the **test statistic**

(d) A computer program is simulating the number of heads in the toss of two independent coins. The experiment is repeatedly done 50 times, and the results are as follows. Based on this data, report the **test statistic** for the hypothesis that the probability of heads for each of the two coins is 0.5 in every simulation.

0 heads	9
1 head	28
2 heads	15

(e) The average cost of tuition, room and board at small private liberal arts colleges is reported to be $8,500 per term, but a financial administrator believes that the average cost is higher. A study conducted using 16 small liberal arts colleges showed that the average cost per term is $8,745 with a standard deviation of $1,000. Report the ***p*-value** for this test? Ps. use the following tables to obtain a possible range of *p*-value

第三大題(20%)

A national manufacturer of ball bearings is experimenting with two different processes for producing precision ball bearings. It is important that the diameters be as close as possible to an industry standard. The output from each process is sampled, and the results are presented here. Please use α= 0.05 to do the following testing problems.

Ps., your answers should include the hypotheses, test statistic and conclusion

Process A : 15,20,25,20,30,25,25,30,30,35,35,35,35,35,35,30

Process B : 20,25,30,25,30,35,20,35,20,25,30,35

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	Process A	Process B
Sample mean	28.75	27.5
Sample deviation	6.455	5.839

a. (5pt) The researcher is interested in determining whether there is evidence that the two processes yield different population standard deviations.

b. (7pt) The researcher is interested in determining whether or not the two processes have the different population means. Do the ANOVA table and conclude the test

c. (8pt) The item is defective if its diameter ≥30. Please use the Chi-square test to determine that two processes yield different defective rates?

第四大題(10%)

In a least square regression $E(Y) = \beta_0 + \beta_1 X$, we find the estimates of β_0 and β_1 are 2 and 1, respectively. Suppose the sample size is 10. Suppose now we get two new variables, X^* and Y^* with the following relationship: $Y^* = 2Y + 1, X^* = 5X - 3$. Then in the least square regression model $E(Y^*) = \gamma_0 + \gamma_1 X^*$, please find the estimates of γ_0 and γ_1. Show your work to get the points

第五大題(15%)

Suppose a box contains 4 balls, θ white balls and $(4-\theta)$ black balls. Test H_0: $\theta = 2$ against H_1: $\theta \neq 2$ as follows: Draw 2 balls with replacement and reject H_0 if balls are the same color; otherwise do not reject

a. (4pt) State the definitions of the Type I and II errors

b. (2pt) Find the probability of making Type I error for the test

c. (6pt) 若可以選擇取後不放回，試問這兩種取法，何者較好？請說明原因

d. (3pt) Find another test that has a zero probability of making Type I error

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。

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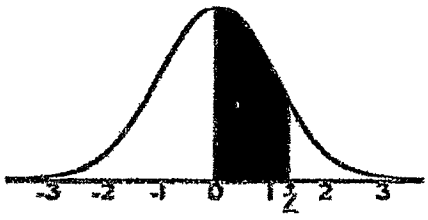

STANDARD NORMAL TABLE (Z)

Entries in the table give the area under the curve between the mean and z standard deviations above the mean. For example, for $z = 1.25$ the area under the curve between the mean (0) and z is 0.3944.

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	0.2969	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	0.3513	0.3554	0.3577	0.3529	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

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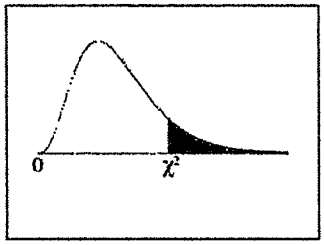
Chi-Square Distribution Table



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

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。

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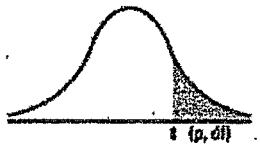
t table



df/p	0.40	0.25	0.10	0.05	0.025	0.01	0.005	0.0005
1	0.324920	1.000000	3.077684	6.313752	12.70620	31.82052	63.65674	636.6192
2	0.288675	0.816497	1.885618	2.919986	4.30265	6.96456	9.92484	31.5991
3	0.276671	0.764892	1.637744	2.353363	3.18245	4.54070	5.84091	12.9240
4	0.270722	0.740697	1.533206	2.131847	2.77645	3.74695	4.60409	8.6103
5	0.267181	0.726687	1.475884	2.015048	2.57058	3.36493	4.03214	6.8688
6	0.264835	0.717558	1.439756	1.943180	2.44691	3.14267	3.70743	5.9588
7	0.263167	0.711142	1.414924	1.894579	2.36462	2.99795	3.49948	5.4079
8	0.261921	0.706387	1.396815	1.859548	2.30600	2.89646	3.35539	5.0413
9	0.260955	0.702722	1.383029	1.833113	2.26216	2.82144	3.24984	4.7809
10	0.260185	0.699812	1.372184	1.812461	2.22814	2.76377	3.16927	4.5869
11	0.259556	0.697445	1.363430	1.795885	2.20099	2.71808	3.10581	4.4370
12	0.259033	0.695483	1.356217	1.782288	2.17881	2.68100	3.05454	43178
13	0.258591	0.693829	1.350171	1.770933	2.16037	2.65031	3.01228	4.2208
14	0.258213	0.692417	1.345030	1.761310	2.14479	2.62449	2.97684	4.1405
15	0.257885	0.691197	1.340606	1.753050	2.13145	2.60248	2.94671	4.0728

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Save

F-table of Critical Values of α = 0.05 for F(df1, df2)

DF2=1	DF1=1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	243.91	245.95	248.01	249.05	250.10	251.14	252.20	253.25	254.31
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10.13	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	8.57	8.55	8.53
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	5.69	5.66	5.63
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	4.43	4.40	4.37
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	3.74	3.70	3.67
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	3.30	3.27	3.23
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	3.01	2.97	2.93
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	2.79	2.75	2.71
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	2.62	2.58	2.54
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	2.49	2.45	2.40
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	2.38	2.34	2.30
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	2.30	2.25	2.21
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	2.22	2.18	2.13
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	2.16	2.11	2.07
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	2.11	2.06	2.01
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	2.06	2.01	1.96
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	2.02	1.97	1.92
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	1.98	1.93	1.88
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	1.95	1.90	1.84
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	1.92	1.87	1.81
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	1.89	1.84	1.78
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	1.86	1.81	1.76
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	1.84	1.79	1.73
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	1.82	1.77	1.71
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。