

國立臺北大學 106 學年度碩士班一般入學考試試題

系（所）組別：統計學系

科 目：統計學

第 1 頁 共 4 頁

☒可 ☐不可使用計算機

第一大題（每格 5 分，共計 50 分）

注意事項

1~4 題為填充題，共 10 格，不須計算過程，答案完全正確始予計分，並請務必依格子順序作答於答案卷，

例如 (1) _____

(2) _____

:

(10) _____

- 1、A college basketball player who sinks 75% of his free throws comes to the line to shoot a “one and one”(if the first shot is successful, he is allowed a second shot, but no second shot is taken if the first is missed; one point is scored for each successful shot). Assume that the outcome of the second shot, if any, is independent of that of the first. Find the expected number of the points resulting from the “one and one”. _____(1)_____ Compare this with the expected number of points from a “two-shot foul”, where a second shot is allowed irrespective(無關) of the outcome of the first. _____(2)_____
- 2、Five inspectors are employed to check the quality of components produced on an assembly line. For each inspector, the number of components that can be checked in a shift can be represented by a random variable with mean 120 and standard deviation 16. Let X represents the number of components checked by an inspector in a shift. Then the total number components checked is $5X$, which has mean 600 and standard deviation 80. What is wrong with this argument? _____(3)_____ Assuming that inspectors' performances are independent of one another, find the mean and standard deviation of the total number components checked in a shift. _____(4)_____
- 3、A pizza delivery service delivers to a campus dormitory. Delivery times follow a normal distribution with mean 20 minutes and standard deviation 4 minutes.
- (a) Find the shortest range of times that includes 40% of all deliveries from this service? _____(5)_____
- (b) The service does not charge for the pizza if delivery takes more than 30 minutes. What is the probability of getting a free pizza from a single order? _____(6)_____
- (c) During final exams week, a student plans to order pizza five consecutive evenings. Assume that these delivery times are independent of each other. What is the probability that the student will get at least one free pizza? _____(7)_____
- 4、It has been found that times taken by people to complete a particular tax form follow a normal distribution with mean 100 minutes and standard deviation 30 minutes. A random sample of nine people who have completed this tax form was taken.
- (a) What is the probability that the sample mean time taken is more than two hours? _____(8)_____
- (b) The probability is 0.05 that the sample standard deviation of time taken is less than how many minutes? _____(9)_____
- (c) If the population mean is unknown, a random sample of nine people who have completed this tax form was taken. Let \bar{X} denote the sample mean. What is the probability that the interval $(\bar{X} - 10)$ to $(\bar{X} + 10)$ contains the true population mean? _____(10)_____

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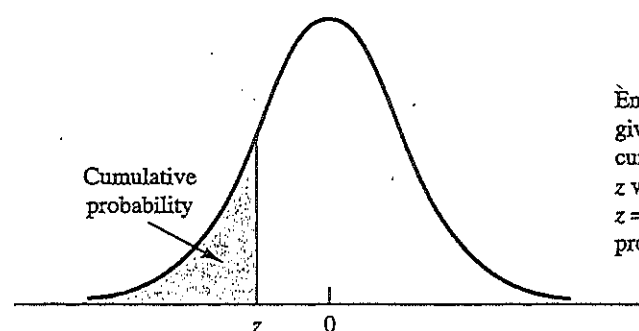
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CUMULATIVE PROBABILITIES FOR THE STANDARD NORMAL DISTRIBUTION



Entries in this table give the area under the curve to the left of the z value. For example, for $z = -0.85$, the cumulative probability is .1977.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

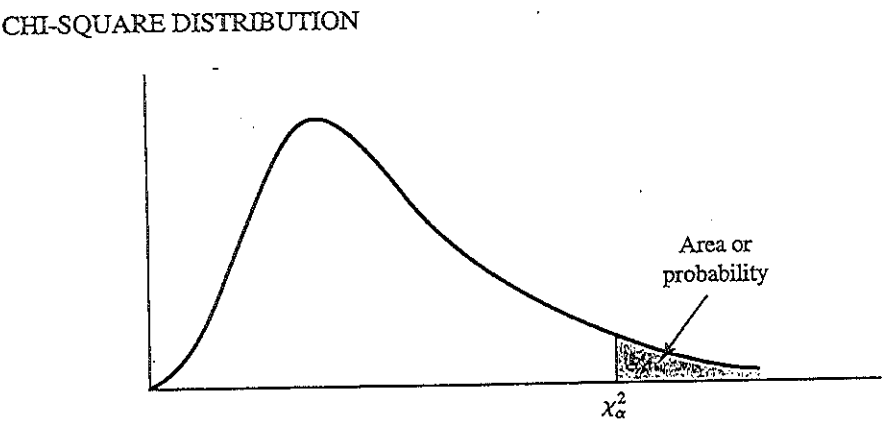
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Entries in the table give χ^2_{α} values, where α is the area or probability in the upper tail of the chi-square distribution. For example, with 10 degrees of freedom and a .01 area in the upper tail, $\chi^2_{.01} = 23.209$.

Degrees of Freedom	Area in Upper Tail									
	.995	.99	.975	.95	.90	.10	.05	.025	.01	.005
1	.000	.000	.001	.004	.016	2.706	3.841	5.024	6.635	7.879
2	.100	.020	.051	.103	.211	4.605	5.991	7.378	9.210	10.597
3	.072	.115	.216	.352	.584	6.251	7.815	9.348	11.345	12.838
4	.207	.297	.484	.711	1.064	7.779	9.488	11.143	13.277	14.860
5	.412	.554	.831	1.145	1.610	9.236	11.070	12.832	15.086	16.750
6	.676	.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.647	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	7.041	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	45.558
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	12.878	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	50.994
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.335

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第二大題（共計 50 分）

An analyst at a department store wants to conduct an analysis to evaluate the purchasing power of the store's credit card holder members and the non-member customers. During the anniversary sale, the department store collected data on the amount of money spent by randomly selected 400 members and 400 non-members.

- 1、(15%) The average amount of money spent by the credit card holder members was NT\$5000, and the sample standard deviation was NT\$2000. The average amount of money spent by the non-member customers was NT\$4500, and the sample standard deviation was NT\$1500. Conduct a test of hypothesis at 5% significance level to investigate whether the mean amount of money spent by the credit card holder members is higher than that by the non-member customers. Your answer should include: (i) the null hypothesis, (ii) the alternative hypothesis, (iii) the computed value of the test statistics, (iv) the sampling distribution of the test statistics, (v) the approximate critical value of the test statistics, and (vi) the conclusion of the test.
- 2、(15%) Suppose the department store defined customers who spent more than NT\$10000 during the anniversary sale as having high purchasing power. The sample proportion of customers with high purchasing power among the credit card holder members and the non-members were 10% and 6%, respectively. Conduct a test of hypothesis at 5% significance level to investigate whether the proportion of customers with high purchasing power is identical among the credit card holder members and the non-members. Your answer should include items (i) to (vi) as specified in 1.
- 3、(10%) On the basis of what assumptions and which theorems would your analyses in 1. and 2. be valid, respectively?
- 4、(10%) Suppose the analyst wants to use a simple linear regression model to compare the purchasing power between members and non-members. Let the amount of money spent during the anniversary sale be the response variable. Let the dummy variable "member" (=1 if member, =0 if non-member) be the explanatory variable.
 - (i) Obtain the estimated values of the intercept and slope parameters, β_0 and β_1 , in the linear regression model. Hint: Utilize your answers in 1.
 - (ii) Interpret $\widehat{\beta}_1$ in your model.

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