

國立臺北大學 107 學年度碩士班一般入學考試試題

系（所）組別：國際企業研究所
科 目：統計學

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I. (50%)

1.1.(10%) Let X have a distribution with p.d.f.

$$f(x) = \frac{e^{-x}}{(1+e^{-x})^2}, -\infty < x < \infty.$$

What is the distribution of $Y = 1/(1+e^{-X})$?

1.2.(10%) ABC Construction Company bids on projects assuming that the mean idle time per worker is 72 or fewer minutes per day. A sample of 36 construction workers will be used to test this assumption. Assume that the population standard deviation is 12 minutes.

- (a) What is the null hypothesis for this question?
- (b) Write down the probability of making a Type II error when the population mean idle time is 80 minutes at .05 level of significance in a probability form without checking the Standard Normal table. ($Z_{0.025} = 1.96$ and $Z_{0.05} = 1.645$)

1.3.(10%) The data consists of n independently selected pairs

$(X_i, Y_i), i = 1, 2, \dots, n$. Let $D_i = X_i - Y_i$, the D_i 's are assumed to be normally distributed with variance σ_D^2 and the correlation between X_i and Y_i is ρ .

- (a) What is the variance of $\bar{D}$?
- (b) If the two-sample t test is incorrectly used to analyze paired data, what will happen if $\rho > 0$?

1.4.(10%) Consider a random sample $X_i, i = 1, \dots, n$. Let μ and σ^2 denote the

population mean and variance. Define $\bar{X} = n^{-1} \sum_{i=1}^n X_i$, $s_1^2 = n^{-1} \sum_{i=1}^n (X_i - \mu)^2$, $s_2^2 = n^{-1} \sum_{i=1}^n (X_i - \bar{X})^2$, What are the distributions of ns_1^2/σ^2 and ns_2^2/σ^2 if $n=50$? (Justify your answers)

1.5.(10%) The following table shows part of the probability distribution for a random

Variable x. The mean of the distribution is known to be 1.8 ($E(x) = 1.8$).

Determine $f(1)$ and $f(3)$.

X	0	1	2	3	4
f(x)	0.2	?	0.15	?	0.15

II. (50%)

2.1. (20%) The table below gives beverage preferences for random samples of teens and adults.

	Teens	Adults	Total
Coffee	50	200	250
Tea	100	150	250
Soft Drink	200	200	400
Other	50	50	100
	400	600	1000

We are interested in determining whether or not drink preferences is independent of age (i.e., adult and teen)

- (a) State the null and alternative hypotheses to be tested.
- (b) Compute the test statistic.
- (c) The null hypothesis is to be tested at the 5% level. Determine the critical value for this test. What do you conclude?
- (d) Determine the p-value and perform the test.

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2.2. (10%) The heating bills for a random sample of houses in a city using three forms of heating (i.e., Natural Gas, Central Electric, and Heat Pump) with five bills for each of the 3 heating forms are obtained. Part of an ANOVA table is shown below.

Source of Variation	SS	df	MS	F
Between Groups	_____?	_____?	_____?	_____?
Within Groups	1584	_____?	_____?	
Total	1757	14		

- (a) Fill in all the blanks in the above ANOVA table.
- (b) At $\alpha = .05$, test to see if there is a significant difference among the average heating bills of all homes in the city using 3 forms of heating. (State the null and alternative hypotheses, compute the test statistic, and make your conclusion).
- 2.3. (10%) A regression analysis was applied to determine the relationship between a dependent variable and 8 independent variables and the following information was obtained.

R Square = .80; SSR = 4280; Total number of observations, $n = 56$

- (a) Fill in all the blanks in the following ANOVA table.
- (b) Is the model significant? Let $\alpha = .05$. (State the null and alternative hypotheses, compute the test statistic, and make your conclusion).

ANOVA

	df	SS	MS	F
Regression	_____?	_____?	_____?	_____?
Error	_____?	_____?	_____?	
Total	_____?	_____?		

2.4. (10%) A regression analysis involving 45 observations relating a dependent variable and two independent variables resulted in the following information.

$\hat{Y} = .408 + 1.34x_1 + 2x_2$

The SSE for the above model is 49.

When two other independent variables were added to the model, the following information was provided.

$\hat{Y} = 1.2 + 3x_1 + 12x_2 + 4x_3 + 8x_4$

This model's SSE is 40.

We want to test whether or not the addition of 2 variables to a model will be statistically significant.

- (a) State the null and alternative hypotheses.
- (b) At a .05 level of significance, test to determine if the two added independent variables contribute significantly to the model. (Compute the test statistic, and make your conclusion).

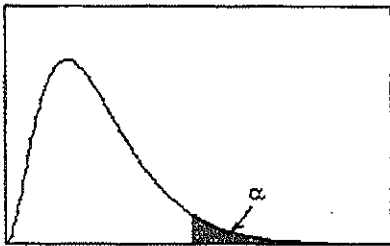
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卡方分配表

$P(\chi_k^2 \geq \chi_{k,\alpha}^2) = \alpha$



自由度	單尾顯著水準							
	0.99	0.975	0.95	0.9	0.1	0.05	0.025	0.01
1	0.0002	0.0010	0.0039	0.0158	2.7055	3.8415	5.0239	6.6349
2	0.0201	0.0506	0.1026	0.2107	4.6052	5.9915	7.3778	9.2103
3	0.1148	0.2158	0.3518	0.5844	6.2514	7.8147	9.3484	11.3449
4	0.2971	0.4844	0.7107	1.0636	7.7794	9.4877	11.1433	13.2767
5	0.5543	0.8312	1.1455	1.6103	9.2364	11.0705	12.8325	15.0863
6	0.8721	1.2373	1.6354	2.2041	10.6446	12.5916	14.4494	16.8119
7	1.2390	1.6899	2.1674	2.8331	12.0170	14.0671	16.0128	18.4753
8	1.6465	2.1797	2.7326	3.4895	13.3616	15.5073	17.5346	20.0902
9	2.0879	2.7004	3.3251	4.1682	14.6837	16.9190	19.0228	21.6660
10	2.5582	3.2470	3.9403	4.8652	15.9872	18.3070	20.4831	23.2093
11	3.0535	3.8158	4.5748	5.5778	17.2750	19.6751	21.9200	24.7250
12	3.5706	4.4038	5.2260	6.3038	18.5494	21.0261	23.3367	26.2170
13	4.1069	5.0087	5.8919	7.0415	19.8119	22.3621	24.7356	27.6883
14	4.6604	5.6287	6.5706	7.7895	21.0642	23.6848	26.1190	29.1413
15	5.2294	6.2621	7.2609	8.5468	22.3072	24.9958	27.4884	30.5779
16	5.8122	6.9077	7.9616	9.3122	23.5418	26.2962	28.8454	31.9999
17	6.4078	7.5642	8.6718	10.0852	24.7690	27.5871	30.1910	33.4087
18	7.0149	8.2308	9.3905	10.8649	25.9894	28.8693	31.5264	34.8053
19	7.6327	8.9066	10.1170	11.6509	27.2036	30.1435	32.8523	36.1908
20	8.2604	9.5908	10.8508	12.4426	28.4120	31.4104	34.1696	37.5662
21	8.8972	10.2829	11.5913	13.2396	29.6151	32.6705	35.4789	38.9321
22	9.5425	10.9823	12.3380	14.0415	30.8133	33.9244	36.7807	40.2894
23	10.1957	11.6885	13.0905	14.8479	32.0069	35.1725	38.0757	41.6384
24	10.8564	12.4012	13.8484	15.6587	33.1963	36.4151	39.3641	42.9798
25	11.5240	13.1197	14.6114	16.4734	34.3816	37.6525	40.6465	44.3141
26	12.1981	13.8439	15.3791	17.2919	35.5631	38.8852	41.9232	45.6417
27	12.8786	14.5733	16.1513	18.1138	36.7412	40.1133	43.1944	46.9630
28	13.5648	15.3079	16.9279	18.9392	37.9159	41.3372	44.4607	48.2782
29	14.2565	16.0471	17.7083	19.7677	39.0875	42.5569	45.7222	49.5879
30	14.9535	16.7908	18.4926	20.5992	40.2560	43.7729	46.9792	50.8922
35	18.5089	20.5694	22.4650	24.7967	46.0588	49.8018	53.2033	57.3421
40	22.1643	24.4331	26.5093	29.0505	51.8050	55.7585	59.3417	63.6907
45	25.9013	28.3662	30.6123	33.3504	57.5053	61.6562	65.4102	69.9568
50	29.7067	32.3574	34.7642	37.6886	63.1671	67.5048	71.4202	76.1539
60	37.4849	40.4817	43.1879	46.4589	74.3970	79.0819	83.2976	88.3794
70	45.4418	48.7576	51.7393	55.3290	85.5271	90.5312	95.0231	100.4252
80	53.5400	57.1532	60.3915	64.2778	96.5782	101.8795	106.6286	112.3288
90	61.7541	65.6466	69.1260	73.2912	107.5650	113.1453	118.1359	124.1163
100	70.0648	74.2219	77.9295	82.3581	118.4980	124.3421	129.5612	135.8067
200	156.4320	162.7280	168.2786	174.8353	226.0210	233.9943	241.0579	249.4451
300	245.9725	253.9123	260.8781	269.0679	331.7885	341.3951	349.8745	359.9064
400	337.1553	346.4818	354.6410	364.2074	436.6490	447.6325	457.3055	468.7245
500	429.3875	439.9360	449.1468	459.9261	540.9303	553.1268	563.8515	576.4928

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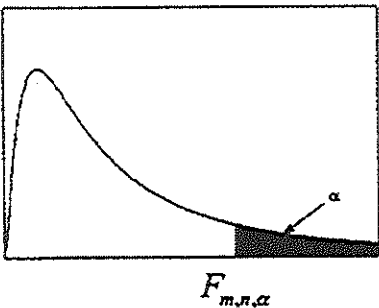
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F 分配表

(ii) $\alpha = 0.05$
 $P(F_{m,n} \geq F_{m,n,\alpha}) = \alpha$



分
母
自
由
度
n

		分子自由度 m								
		1	2	3	4	5	6	7	8	9
1	161.448	199.500	215.707	224.583	230.162	233.986	236.768	238.883	240.543	
2	18.5128	19.0000	19.1643	19.2468	19.2964	19.3295	19.3532	19.3710	19.3848	
3	10.1280	9.5521	9.2766	9.1172	9.0135	8.9406	8.8867	8.8452	8.8123	
4	7.7086	6.9443	6.5914	6.3882	6.2561	6.1631	6.0942	6.0410	5.9988	
5	6.6079	5.7861	5.4095	5.1922	5.0503	4.9503	4.8759	4.8183	4.7725	
6	5.9874	5.1433	4.7571	4.5337	4.3874	4.2839	4.2067	4.1468	4.0990	
7	5.5914	4.7374	4.3468	4.1203	3.9715	3.8660	3.7870	3.7257	3.6767	
8	5.3177	4.4590	4.0662	3.8379	3.6875	3.5806	3.5005	3.4381	3.3881	
9	5.1174	4.2565	3.8625	3.6331	3.4817	3.3738	3.2927	3.2296	3.1789	
10	4.9646	4.1028	3.7083	3.4780	3.3258	3.2172	3.1355	3.0717	3.0204	
11	4.8443	3.9823	3.5874	3.3567	3.2039	3.0946	3.0123	2.9480	2.8962	
12	4.7472	3.8853	3.4903	3.2592	3.1059	2.9961	2.9134	2.8486	2.7964	
13	4.6672	3.8056	3.4105	3.1791	3.0254	2.9153	2.8321	2.7669	2.7144	
14	4.6001	3.7389	3.3439	3.1122	2.9582	2.8477	2.7642	2.6987	2.6458	
15	4.5431	3.6823	3.2874	3.0556	2.9013	2.7905	2.7066	2.6408	2.5876	
16	4.4940	3.6337	3.2389	3.0069	2.8524	2.7413	2.6572	2.5911	2.5377	
17	4.4513	3.5915	3.1968	2.9647	2.8100	2.6987	2.6143	2.5480	2.4943	
18	4.4139	3.5546	3.1599	2.9277	2.7729	2.6613	2.5767	2.5102	2.4563	
19	4.3807	3.5219	3.1274	2.8951	2.7401	2.6283	2.5435	2.4768	2.4227	
20	4.3512	3.4928	3.0984	2.8661	2.7109	2.5990	2.5140	2.4471	2.3928	
21	4.3248	3.4668	3.0725	2.8401	2.6848	2.5727	2.4876	2.4205	2.3660	
22	4.3009	3.4434	3.0491	2.8167	2.6613	2.5491	2.4638	2.3965	2.3419	
23	4.2793	3.4221	3.0280	2.7955	2.6400	2.5277	2.4422	2.3748	2.3201	
24	4.2597	3.4028	3.0088	2.7763	2.6207	2.5082	2.4226	2.3551	2.3002	
25	4.2417	3.3852	2.9912	2.7587	2.6030	2.4904	2.4047	2.3371	2.2821	
26	4.2252	3.3690	2.9752	2.7426	2.5868	2.4741	2.3883	2.3205	2.2655	
27	4.2100	3.3541	2.9604	2.7278	2.5719	2.4591	2.3732	2.3053	2.2501	
28	4.1960	3.3404	2.9467	2.7141	2.5581	2.4453	2.3593	2.2913	2.2360	
29	4.1830	3.3277	2.9340	2.7014	2.5454	2.4324	2.3463	2.2783	2.2229	
30	4.1709	3.3158	2.9223	2.6896	2.5336	2.4205	2.3343	2.2662	2.2107	
35	4.1213	3.2674	2.8742	2.6415	2.4851	2.3718	2.2852	2.2167	2.1608	
40	4.0847	3.2317	2.8387	2.6060	2.4495	2.3359	2.2490	2.1802	2.1240	
45	4.0566	3.2043	2.8115	2.5787	2.4221	2.3083	2.2212	2.1521	2.0958	
50	4.0343	3.1826	2.7900	2.5572	2.4004	2.2864	2.1992	2.1299	2.0734	
60	4.0012	3.1504	2.7581	2.5252	2.3683	2.2541	2.1665	2.0970	2.0401	
70	3.9778	3.1277	2.7355	2.5027	2.3456	2.2312	2.1435	2.0737	2.0166	
80	3.9604	3.1108	2.7188	2.4859	2.3287	2.2142	2.1263	2.0564	1.9991	
90	3.9469	3.0977	2.7058	2.4729	2.3157	2.2011	2.1131	2.0430	1.9856	
100	3.9361	3.0873	2.6955	2.4626	2.3053	2.1906	2.1025	2.0323	1.9748	
120	3.9201	3.0718	2.6802	2.4472	2.2899	2.1750	2.0868	2.0164	1.9588	

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