

國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：統計學
考試時間：100 分鐘

系所：
亞太工商管理學系(甲組、乙組) 是否使用計算機：是
本科原始成績：100 分

本試題共8題，各題的配分如各小題所示。

(注意：一、請依題號順序在答案紙上作答。二、答案若有小數，請計算至小數點後第4位，再四捨五入至小數點後第3位。三、在第3、4頁附有 Z 、 χ^2 和 F 的機率表格以及 Critical values of the Durbin-Watson statistic。)

1. 若隨機變數 X 為 Poisson 分配，且已知 $P(X=2) = P(X=3)$ ，
(A) 請問 $P(X > 3) = ?$ (4 分) (請算出機率值至小數點後第 3 位，否則不給分)
(B) 請問 $P(\mu - 0.5\sigma < X < \mu + 2\sigma) = ?$ (4 分) (請算出機率值至小數點後第 3 位，否則不給分)

2. 已知一母群體的機率函數為 $f(x) = \begin{cases} \frac{x}{10} & \text{for } x=2 \\ \frac{2x}{15} & \text{for } x=4 \\ \frac{x}{30} & \text{for } x=8 \end{cases}$ ，自該母群體隨機抽樣 36 個樣本，

若 $P(|\bar{X} - \mu| > A) = 0.2$ ，請問 $A = ?$ (10 分)

3. 某公司生產經理宣稱該公司的產品良率至少 90%，小明對於這種說法有所存疑，乃隨機抽樣該公司的產品 60 件，若顯著水準 $\alpha=0.01$ 。
(A) 請問小明如何建立假設 H_0 和 H_1 。(3 分)
(B) 如果這位生產經理所說的話不實，則小明所抽的樣本中，良品應低於幾件？(5 分)
(C) 如果該公司的產品良率為 82%，請問這個假設檢定的型 II 錯誤機率 (β) = ? (5 分)
4. 某一城市之調解委員會每天安排 5 件調解案，下表為該城市收集 50 天內調解成功的案件之次數分配：

調解成功件數	0	1	2	3	4	5
天數	8	9	13	10	7	3

- (A) 欲檢定母群體是否為 Binomial distribution，請建立您的假設 H_0 和 H_1 。(3 分)
(B) 請以顯著水準 $\alpha=0.05$ ，檢定母群體是否為 Binomial distribution？(12 分)
(必須計算檢定正確者才給分，僅回答「是」或「否」者不給分)
5. Samples of size $n=25$ are drawn from a normal population with known standard deviation. If the 30th percentile and 80th percentile of the sample mean are 36.5 and 45.3, respectively.
(A) What are the first quartile (Q_1) and the third quartile (Q_3) of the population, respectively? (8 分)
(B) If samples of size $n=10$ are drawn from this population, what is the probability that the sample mean will be higher than 32.0? (7 分)

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6. A multiple linear regression equation \hat{Y} considers three independent variables x_1, x_2, x_3 . A sample of $n=20$ is collected. The total sum of squares is 854.106 and the computed F test statistic for this multiple linear regression model is 12.862. In addition, the sum of squares due to regression for the model that includes only the independent variables x_2 and x_3 is 520.780.

- (A) What is the multiple standard error of estimate $s_{Y|123}$? (3 分)
- (B) What is the coefficient of determination R^2 for the regression model that includes independent variables x_1, x_2, x_3 ? (3 分)
- (C) What is the adjusted coefficient of determination R_{adj}^2 for the regression model that includes independent variables x_1, x_2, x_3 ? (4 分)
- (D) What is the coefficient of partial determination between Y and x_1 , given that variables x_2 and x_3 is already in the model $R_{Y1.23}^2$? (4 分)

7. A multiple linear regression model with two independent variables is constructed. The residuals for 15 consecutive time periods are as follows:

Time period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Residual	+4	-8	-5	-4	3	5	-2	7	-1	6	0	2	-5	3	8

- (A) Compute the Durbin-Watson statistic (D). (6 分)
 - (B) At the 0.05 level of significance, is there evidence of positive autocorrelation among the residuals? (4 分) (必須計算檢定正確者才給分，僅回答「Yes」或「No」者不給分)
8. 一迴歸模式 \hat{Y} 考慮三個獨立變數 X_1, X_2, X_3 ，抽樣 25 個樣本。若只考慮 multiple linear regression model，則 $\hat{Y} = b_0 + b_1X_1 + b_2X_2 + b_3X_3$ ，經由計算得到 Mean square due to regression = 325 and Total sum of squares = 2,536，其 ANOVA table 如表 5-1。如果在迴歸模式中，再加入獨立變數之間的交互作用項 ($X_1 \times X_2$)、($X_1 \times X_3$) 和 ($X_2 \times X_3$)，經由計算得到 Sum of squares due to regression = 1,160，其 ANOVA table 如表 5-2。
- (A) 請完成表 5-1 之 ANOVA table。(5 分) (答案請寫在答案卷上)
 - (B) 請完成表 5-2 之 ANOVA table。(5 分) (答案請寫在答案卷上)
 - (C) 若顯著水準 $\alpha=0.05$ ，請問這三項交互作用項是否值得加入這個迴歸模式中？(5 分) (必須計算檢定正確者才給分，僅回答「是」或「否」者不給分)

表 5-1

	SS	df	MS	F
Regression				
Error				
Total				

表 5-2

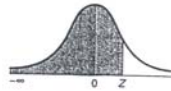
	SS	df	MS	F
Regression				
Error				
Total				

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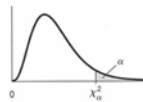
The Cumulative Standardized Normal Distribution
 Entry represents area under the cumulative standardized normal distribution from $-\infty$ to Z



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7518	0.7549
0.7	0.7580	0.7612	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9986	0.9986	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990
3.1	0.9990	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9992
3.2	0.9993	0.9993	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995
3.3	0.9995	0.9995	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996
3.4	0.9996	0.9996	0.9996	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997
3.5	0.9997	0.9997	0.9997	0.9997	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.7	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.9	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999

Percentiles of the chi-squared distribution.

Right-tail probability	df	α				
		0.10	0.05	0.025	0.01	0.005
Values of χ^2_α	1	2.706	3.841	5.024	6.635	7.879
	2	4.605	5.991	7.378	9.210	10.597
	3	6.251	7.815	9.348	11.345	12.838
	4	7.779	9.488	11.143	13.277	14.860
	5	9.236	11.070	12.833	15.086	16.750
	6	10.645	12.592	14.449	16.812	18.548
	7	12.017	14.067	16.013	18.475	20.278
	8	13.362	15.507	17.535	20.090	21.955
	9	14.684	16.919	19.023	21.666	23.589
	10	15.987	18.307	20.483	23.209	25.188
	11	17.275	19.675	21.920	24.725	26.757
	12	18.549	21.026	23.337	26.217	28.300
	13	19.812	22.362	24.736	27.688	29.819
	14	21.064	23.685	26.119	29.141	31.319
	15	22.307	24.996	27.488	30.578	32.801
	16	23.542	26.296	28.845	32.000	34.267
	17	24.769	27.587	30.191	33.409	35.718
	18	25.989	28.869	31.526	34.805	37.156
	19	27.204	30.143	32.852	36.191	38.582
	20	28.412	31.410	34.170	37.566	39.997
	21	29.615	32.671	35.479	38.932	41.401
	22	30.813	33.924	36.781	40.290	42.796
	23	32.007	35.172	38.076	41.638	44.181
	24	33.196	36.415	39.364	42.980	45.559
	25	34.382	37.653	40.647	44.314	46.928
	26	35.563	38.885	41.923	45.642	48.290
	27	36.741	40.113	43.195	46.963	49.645
	28	37.916	41.337	44.461	48.278	50.994
	29	39.087	42.557	45.722	49.588	52.336
	30	40.256	43.773	46.979	50.892	53.672
	40	51.805	55.759	59.342	63.691	66.767
	50	63.167	67.505	71.420	76.154	79.490
	60	74.397	79.082	83.298	88.381	91.955
	70	85.527	90.531	95.023	100.424	104.213
	80	96.578	101.879	106.628	112.328	116.320
	90	107.565	113.145	118.135	124.115	128.296
	100	118.499	124.343	129.563	135.811	140.177

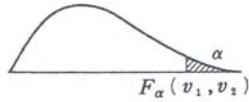


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$\alpha = .05$



F 分配右尾百分點 $F_{\alpha}(v_1, v_2)$

$v_1 \backslash v_2$	1	2	3	4	5	6	7	8	9
1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54
2	18.513	19.000	19.164	19.247	19.296	19.330	19.353	19.371	19.385
3	10.128	9.5521	9.2766	9.1172	9.0135	8.9406	8.8868	8.8452	8.8123
4	7.7086	6.9443	6.5914	6.3883	6.2560	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	4.2066	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	3.8378	3.6875	3.5806	3.5005	3.4381	3.3881
9	5.1174	4.2565	3.8626	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	4.3808	3.5219	3.1274	2.8951	2.7401	2.6283	2.5435	2.4768	2.4227
20	4.3513	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	2.3661
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	2.9751	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	2.2782	2.2229
30	4.1709	3.3158	2.9223	2.6896	2.5336	2.4205	2.3343	2.2662	2.2107
40	4.0848	3.2317	2.8387	2.6060	2.4495	2.3359	2.2490	2.1802	2.1240
60	4.0012	3.1504	2.7581	2.5252	2.3683	2.2540	2.1665	2.0970	2.0401
120	3.9201	3.0718	2.6802	2.4472	2.2900	2.1750	2.0867	2.0164	1.9588
∞	3.8415	2.9957	2.6049	2.3719	2.2141	2.0986	2.0096	1.9384	1.8800

Critical values of the Durbin-Watson statistic for $\alpha=0.05$

n	k=1		k=2		k=3		k=4	
	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U
15	1.08	1.36	0.95	1.54	0.82	1.75	0.69	1.97
16	1.10	1.37	0.98	1.54	0.86	1.73	0.74	1.93