第壹部份：解釋名詞（每題 3 分，計 15 分）

1. process capability index (C_p)
2. acceptance sampling
3. p chart
4. c chart
5. nonparametric statistics

第貳部份：問答及計算

1. 某汽車銷售商考慮其銷售產品組合，行銷部門乃就銷售量對各廠牌作相關分析，其結果如下：

	Ford	Mercury	Buick	Oldsmo	裕隆	Corona	喜美
Ford	-						
Mercury	+0.159	-					
Buick	-0.358	-0.213	-				
Oldsmo	-0.345	-0.254	+0.451	-			
裕隆	-0.419	-0.350	+0.213	+0.192	-		
Corona	-0.450	-0.311	+0.312	+0.111	-0.215	-	
喜美	-0.671	-0.455	+0.411	+0.311	-0.691	-0.511	-

(1) 試問此銷售商欲使其銷售風險最小化，其產品組合的原則爲何？(5分)

(2) 參考以上之表格，在風險最小化條件下，選定適當之產品組合？(5分)

(3) 若此銷售商除考慮其風險最小外，尚考慮維修，人員訓練及存貨，其產品組合應如何建議？(5分)

2. 下表爲某實驗成對抽樣 (paired sampling) 之結果 (n = 6)

pair / treatment	1	2
1	7	8
2	10	8
3	12	11
4	2	3
5	15	12
6	8	9

(1) 試問在 $\alpha = 0.05$ 時，兩種 treatments 之平均值是否有差異？(6分)

(2) 求出兩種 treatments 平均值差異之 95% 信賴區間？(6分)

(3) 試比較 (1), (2) 之結果是否有差異？(3分)

3. 某一大型機器設備之壽命 (length of life) 爲如下之指數分配 (exponential distribution)：

$$f(x) = e^{-x/75000} / 75000 \qquad x > 0$$

(1) 問此項機器設備之操作壽命超過 100000 小時之機率？(5分)

(2) 問此項機器設備之操作壽命少於 25000 小時之機率？(5分)

(3) 試求出去除最小及最高之各 2.5% 之機率後之區間 (即雙尾, $\alpha = 0.05$)？(8分)

4. (1) 說明：一個分層 (a stratum) 及一個群落 (a cluster). (4 分)

(2) 說明：分層隨機抽樣 (stratified random sampling) 及群落抽樣 (cluster sampling) 之意義. (4 分)

(3) 說明：分層隨機抽樣及群落抽樣各自應用的場合. (4分)

5. (1) 測度資料分散的程度，可使用多種測度的方式，如標準差 (standard deviation)，若欲消除單位及平均數的影響，常使用何者測度？詳細說明知之 (4 分)

(2) 甲，乙兩位同學分別修習 A,B 兩班之統計，甲同學四次考試成績分別爲 80, 76, 78, 及 82；乙同學四次考試成績分別爲 70,68,72, 及 66；試問兩位同學何者成績較穩定均勻？(6 分)

6. 某研究試查郵寄問卷調查的特性，若 Y = 註冊人數, X_1 = 郵寄家數, X_2 = 郵寄當天與開會相距時間，樣本數 n = 25. 若考最以下之二階模式(second-order model)：

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1^2 + \beta_4 X_2^2 + \beta_5 X_1 X_2 + \varepsilon$$

參閱以下之電腦 SAS 報表，試問

(1) 註冊人數可說明的變動佔總變動多少百分比？(5 分)

(2) 在 $\alpha = 0.05$ 下，檢驗各係數的顯著性. (5 分)

(3) 最終採用之最簡化模式. (5 分)

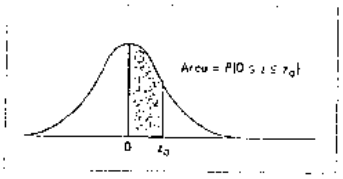
參考用

DEPENDENT VARIABLE: ENROLLMENT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE
MODEL	5	1391.723645	278.344729	31.26
ERROR	19	169.179451	8.904182	
CORRECTED TOTAL	24	1560.903099		

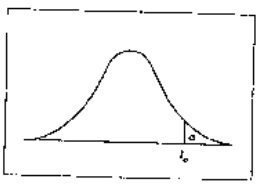
R-SQUARE 0.8916

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	8.267885	5.518542	1.4982	0.1505
NO. MAILINGS (X1)	1	3.362369	0.901247	3.7308	0.0014
LEAD TIME (X2)	1	-0.103668	0.771424	-0.1344	0.8945
X1 SQ	1	-0.084138	0.032465	-2.5917	0.0179
X2 SQ	1	0.052671	0.063488	0.8296	0.4171
(X1)(X2)	1	0.019078	0.064719	-0.2948	0.7714



Normal curve areas

Critical values of t



z_0	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2391	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

This table is abridged from Table I in Statistical Tables and Formulas, by A. Hald (New York: John Wiley & Sons, Inc., 1952). Reproduced by permission of A. Hald and the publishers.

df	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.010}$	$t_{.005}$	df
1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	7
8	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
11	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.131	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
inf.	1.282	1.645	1.960	2.326	2.576	inf

From "Table of Percentage Points of the t-Distribution," computed by Maxine Merrington, *Biometrika*, Vol. 32 (1941), p. 300. Reproduced by permission of the Biometrika Trustees.