注意事項：一.不得使用具特殊功能之計算機(器)。
二.計算部份應詳列計算之過程。
三.參考數值表參見第三頁。

一. The amount of time spent by North American adults watching television per day is normally distributed with a mean of 6 hours and a standard deviation of 1.5 hours.

(a) What proportion of the population watches television for more than 7 hours per day? (5%)

(b) What is the probability that the average number of hours spent watching television by a random sample of five adults is more than 7 hours? (5%)

(c) What is the probability that in a random sample of five adults all watch television for more than 7 hours per day? (5%)

二. An agronomist planted three test plots each with four variaties of wheat and obtained the following yields (in pounds per plot):

Variety A:	55,	55,	52
Variety B:	58,	58,	55
Variety C:	60,	61,	56
Variety D:	59,	52,	51

Use the 0.05 level of significance to test whether the differences among the four sample means can be attributed to chance. (12%)

三. 市場研究員為探討廠商投入之廣告費(X,萬元)對銷售額(Y,百萬元)之影響，乃建立迴歸模型 $Y=\beta_0+\beta_1 x+\varepsilon$，$\varepsilon$為誤差項
今隨機抽取五家廠商，得其廣告費與銷售額之關係表如右所示。並進而求得：

廣告費X	12	16	8	12	12
銷售額Y	8	12	4	6	5

$\Sigma x=60$，$\Sigma y=35$，$\Sigma xy=452$，$\Sigma x^2=752$，
$\Sigma y^2=285$，

(一) 試配合迴歸方程式 $\hat{y}=\hat{\beta}_0+\hat{\beta}_1 x$. (6%)

(二) 以 $\alpha=0.05$ 檢定迴歸模型是否與橫軸平行？(5%)

(三) 若廣告費為10萬元，試求銷售額之 $\mu_{Y|x}$ 的95%信賴區間。(4%)

四. 為美化成功大學校園，總務處擬於校園內種植鳳凰木，經請教生物系之教授甲、乙兩人，甲云有10%之鳳凰樹不能種活，乙則認為有20%不能種活，根據以往經驗知甲之推斷可靠程度為乙之2倍。且事實證明兩人中必有一人推斷正確。今種植一個月後，

(一) 隨機觀察4棵樹中已死去1棵，則甲、乙兩人判斷正確之機率分別為何？(6%)

(二) 若觀察4棵樹死去1棵，則必須再補充樹苗，若照甲之推測補充10%，照乙之推測補充20%。如果事實與判斷者相符，無損失可言；否則便造成損失，其數額如右表。今若欲使期望損失為最小，試問應補充樹苗10%或20%？(4%)

補充樹苗 \ 實際死去樹苗	10%	20%
10%	0	$20,000
20%	$4,000	0

(三) 若採購組承辦人員偷懶，未實地現場查看，故無4棵樹中有1棵死去之資訊。此時若仍欲藉該損失表及期望損失為最小之原則來下決策，試問應補充樹苗10%或20%？(4%)

(背面仍有題目，請繼續作答)

736003 A

五. 從理想公司之四位(2男2女)業務員中抽出2人，藉由其年度業績(萬元)估計全體之平均業績。今若全體四人之業績分別為：女：{120, 140}
男：{170, 190}
(一)若採單純隨機抽樣法(Simple random sampling)，則所有可能之隨機樣本為何？試列出。(4%)
(二)若採依比例配置之分層隨機抽樣法(Stratified random sampling with proportional allocation)，則所有可能之隨機樣本為何？試列出。(3%)
(三)在(一)中，求樣本平均數 $\bar{x}$ 之抽樣分配。(4%)
(四)求(三)之 $\bar{x}$ 抽樣分配的平均數 $\mu_{\bar{x}}$ 及標準誤 $\sigma_{\bar{x}}$。(4%)

六. 你是先鋒食品公司企劃部門的主管，受命主持一市場調查，以瞭解公司某一新產品之顧客偏好率。
(一)試簡述你理想中的抽樣設計。(3%)
(二)若你擬採用隨機抽樣法，並希望據所得之樣本比率推估該新產品之真正顧客偏好率，其誤差在3%內之機率為0.99時，則樣本大小應為何？(4%)
(三)若調查得該公司與競爭之對手公司各100位消費者之同型產品偏好率分別為0.20與0.18，試以 $\alpha = 0.01$ 判斷該兩比率之差異在統計上有無意義。(5%)

七. 某公司生產某種細繩，由過去之經驗知每一尺長內之不良品數 X 服從平均數 $\lambda = 2$ 之 Poisson 分配。若出售每一尺細繩之利潤為 Y，且 $Y = 50 - 2Y - Y^2$
試求售出一尺長細繩之期望利潤(Expected profit)為何？(7%)

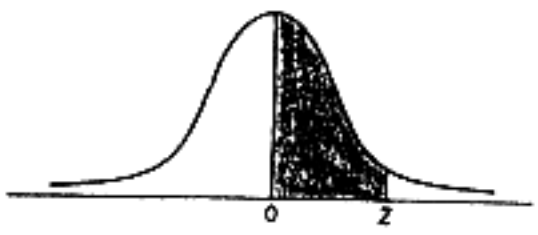
八. 某電子零件之壽命(以小時計)服從如下之機率密度函數：

$$f(x) = \frac{1}{\theta^2} x e^{-\frac{x}{\theta}}, \quad x > 0$$

令 $\hat{\theta}$ 為 θ 之最概估計量(Maximum likelihood estimator)，今若分別獨立地檢驗三個此種零件，得其壽命分別為123, 128及133小時。
(一)試求母數 θ 之最概估計值。(5%)
(二)求平均數 $\mu_{\bar{x}}$ 及變異數 $\sigma^2_{\bar{x}}$。(3%, 2%)

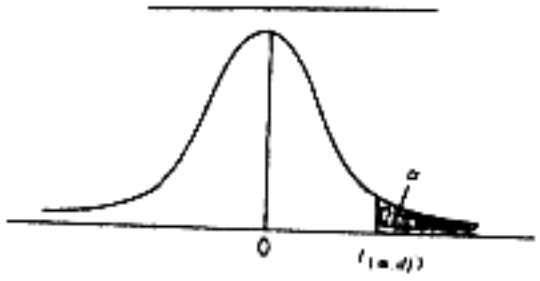
參考數值表

The standardized normal distribution



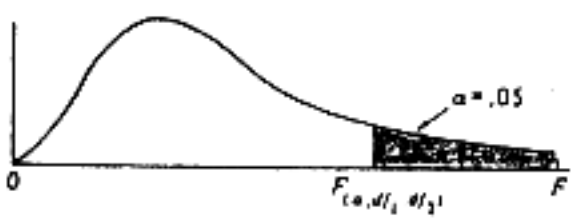
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.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	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.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

Critical values of *t*



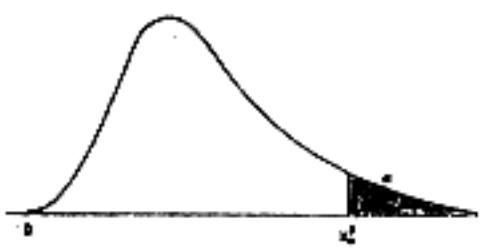
Degrees of Freedom	Upper Tail Areas					
	.25	.10	.05	.025	.01	.005
1	1.0000	3.0777	6.3138	12.7062	31.8207	63.6574
2	0.8165	1.8856	2.9200	4.3027	6.9646	9.9248
3	0.7649	1.6377	2.3534	3.1824	4.5407	5.8409
4	0.7407	1.5332	2.1318	2.7764	3.7469	4.6041
5	0.7267	1.4759	2.0150	2.5706	3.3649	4.0322
6	0.7176	1.4398	1.9432	2.4469	3.1427	3.7074
7	0.7111	1.4149	1.8946	2.3646	2.9980	3.4995
8	0.7064	1.3968	1.8595	2.3060	2.8965	3.3554
9	0.7027	1.3830	1.8331	2.2622	2.8214	3.2498
10	0.6998	1.3722	1.8125	2.2281	2.7638	3.1693

Critical values of *F*



Denominator df1	Numerator df1											
	1	2	3	4	5	6	7	8	9	10	12	15
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9
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
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
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	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62
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
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
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
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

Critical Values of χ^2



d.f.	$\chi^2_{.995}$	$\chi^2_{.99}$	$\chi^2_{.975}$	$\chi^2_{.95}$	$\chi^2_{.90}$	$\chi^2_{.005}$	$\chi^2_{.01}$	$\chi^2_{.001}$
1	.0000393	.000157	.000982	.00393	3.841	5.024	6.635	7.879
2	.0100	.0201	.0506	.103	5.991	7.378	9.210	10.597
3	.0717	.115	.216	.352	7.815	9.348	11.345	12.838
4	.207	.297	.484	.711	9.488	11.143	13.277	14.860
5	.412	.554	.831	1.145	11.070	12.832	15.086	16.750
6	.676	.872	1.237	1.635	12.592	14.449	16.812	18.548
7	.989	1.239	1.690	2.167	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	13 919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	21.026	23.337	26.217	28.300
18	3.565	4.107	5.009	5.892	22.362	24.736	27.688	29.819