一、解釋名詞 **(25%)**

1. 中央極限定理 (Central limit theorem)
2. 檢定力 (Power)
3. 右偏 (Skewed to the right)
4. 型 I 誤差 (Type I error)
5. 不偏性 (Unbiasedness)

二、選擇題 **(25%)**

1. If you are conducting an experiment where the probability of a success is 0.02 and you are interested in the probability of 4 successes in 15 trials, the correct probability function to use is the
   (A) standard normal probability density function.
   (B) normal probability density function.
   (C) Poisson probability function.
   (D) binomial probability function.
   (E) None of these alternatives is correct.

2. As the sample size increases, the
   (A) standard deviation of the population decreases.
   (B) population mean increases.
   (C) standard error of the mean decreases.
   (D) standard error of the mean increases.
   (E) None of these alternatives is correct.

3. The difference between the point estimate, such as the sample mean, and the value of the population parameter it estimates, such as the population mean, is known as the
   (A) confidence level.
   (B) sampling error
   (C) parameter estimate
   (D) interval estimate
   (E) None of these alternatives is correct.

4. The level of significance is the
   (A) maximum allowable probability of Type II error.
   (B) maximum allowable probability of Type I error.
   (C) same as the confidence coefficient.
   (D) same as the p-value.
   (E) None of these alternatives is correct.

5. Which of the following statements is a required hypothesis for developing an interval estimate of the difference between two sample means when the samples are small?
   (A) $s_1^2 = s_2^2$
   (B) $\sigma_1^2 = \sigma_2^2$
   (C) Dependent random samples are selected from the two populations.
   (D) The means of the two populations must be positive.
   (E) All of these alternatives are required assumptions.

三、計算題 **(50%)**

1. 宜大民調中心針對某項民生議題進行民意調查，結果估得該議題民眾贊成比例的 95%信賴區間爲(0.24, 0.36)，問宜大民調中心此次所使用的樣本數至少取多少個？ (10 分)

2. 蘭陽公司欲瞭解其甲、乙兩條生產線之產品含雜質的變異性，分別自生產線中抽查 8 批與 10 批產品，得到雜質率之樣本標準差爲 0.4744 與 0.2739。現假定雜質率的分配呈常態，則在顯著水準 0.05 之下，請檢定生產線甲的產品雜質率變異數是否明顯高過於生產線乙至少 1.5 倍？ (10 分)

3. 宜大民調中心受某大學的委託，瞭解不同學院之住宿同學對於住宿品質的滿意比例是否相同，因此由甲、乙、丙、丁四個學院的住宿同學中各隨機抽取 50 人、50 人、100 人、100 人詢問之，結果分別有 30 人、40 人、60 人、80 人表示滿意，試問在顯著水準 0.05 下，該校四個學院之住宿同學的住宿滿意比例是否相同？ (10 分)

4. 設估計蘭陽公司的銷售額 Y (單位：萬元)對廣告費用 X(單位：萬元)的線性迴歸模式爲 $\hat{y}=\hat{\beta}_0+\hat{\beta}_1 x$；請考慮下列個別情況下，推導出所估計之新參數與原估計參數間的關係。
   (1) 若將 Y 值單位改成十萬元時。 (2) 若同時將 Y 與 X 值單位改成千元時。 (10 分)

5. 宜大語言中心宣稱某項語言測驗及格比例(P)是低於七成；現有 40 位同學參加該項測驗，令 X 表示及格的人數，且統計假設爲 $\begin{cases} H_0 : P \geq 0.70 \\ H_1 : P < 0.70 \end{cases}$，又已知拒絕域爲 R：$X < 25$，則當 P 爲 0.575 時，在該拒絕域之下會產生型 II 誤差的機率爲何？ (10 分)

$P[Z < z]$

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.5	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−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	.2297	.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

$t_\alpha(v)$

自由度 (v) \ α	.25	.10	.05	.025	.01
1	1.000	3.078	6.314	12.706	31.821
2	.816	1.886	2.920	4.303	6.965
3	.765	1.638	2.353	3.182	4.541
4	.741	1.533	2.132	2.776	3.747
5	.727	1.476	2.015	2.571	3.365
6	.718	1.440	1.943	2.447	3.143
7	.711	1.415	1.895	2.365	2.998
8	.706	1.397	1.860	2.306	2.896
9	.703	1.383	1.833	2.262	2.821
10	.700	1.372	1.812	2.228	2.764
11	.697	1.363	1.796	2.201	2.718
12	.695	1.356	1.782	2.179	2.681
13	.694	1.350	1.771	2.160	2.650
14	.692	1.345	1.761	2.145	2.624
15	.691	1.341	1.753	2.131	2.602
16	.690	1.337	1.746	2.120	2.583
17	.689	1.333	1.740	2.110	2.567
18	.688	1.330	1.734	2.101	2.552
19	.688	1.328	1.729	2.093	2.539
20	.687	1.325	1.725	2.086	2.528
21	.686	1.323	1.721	2.080	2.518
22	.686	1.321	1.717	2.074	2.508
23	.685	1.319	1.714	2.069	2.500
24	.685	1.318	1.711	2.064	2.492

$\chi^2_\alpha(v)$

自由度 (v) \ α	.99	.975	.95	.90	.50	.10	.05	.025
1	.0002	.001	.004	.02	.45	2.71	3.84	5.02
2	.02	.05	.10	.21	1.39	4.61	5.99	7.38
3	.11	.22	.35	.58	2.37	6.25	7.81	9.35
4	.30	.48	.71	1.06	3.36	7.78	9.49	11.14
5	.55	.83	1.15	1.61	4.35	9.24	11.07	12.83
6	.87	1.24	1.64	2.20	5.35	10.64	12.59	14.45
7	1.24	1.69	2.17	2.83	6.35	12.02	14.07	16.01
8	1.65	2.18	2.73	3.49	7.34	13.36	15.51	17.53
9	2.09	2.70	3.33	4.17	8.34	14.68	16.92	19.02

$\alpha = .05$

$F_\alpha(v_1, v_2)$

v_2 \ v_1	1	2	3	4	5	6	7	8	9	10	12	15	20	25	30
1	161.5	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	246.0	248.0	249.3	250.1
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	19.45	19.46	19.46
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	8.66	8.63	8.62
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	5.80	5.77	5.75
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	4.56	4.52	4.50
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	3.87	3.83	3.81
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	3.44	3.40	3.38
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	3.15	3.11	3.08
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	2.94	2.89	2.86
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.73	2.70
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.60	2.57
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.50	2.47
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.41	2.38
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.34	2.31
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.28	2.25