慈 濟 大 學 101 學 年 度
研 究 所 碩 士 班 招 生 考 試 命 題 紙

科目：生物統計學 共3頁

1. Super Duper Cee 藥丸廣告每碇含有 750 毫克維他命 C。有一消費者團體認為維他命 C 含量低於廣告值。根據下列樣本，廣告的正確性是否被認可。使用 α= 0.05。

   700 780 715 720 760

   720 710 740 720 725

a. 計算此樣本的平均值與標準差。(2%)
b. 詳細敘述虛無和對立假設。 (4%)
c. 選擇適當的統計程序(Z 或 t)，並寫出選擇的理由與前提。(6%)
d. 找出顯著水準和相對應的臨界值。(2%)
e. 計算(Z 或 t)。(2%)
f. 決定你的結果是否顯著，並敘述一或兩句的結論。(2%)
g. 計算和解釋 95%信賴區間。(4%)
h. 如果你使用 Z 檢定，決定精確 P 值。如果你使用 t 檢定，利用 Z-distribution table 求近似的 P 值，並解釋 P 值代表的意義。(3%)

2. 根據台閩地區人口普查，台灣家庭人口數(母群體)的分佈情形如下表：

家庭人口數	1	2	3	4	5	6	7	≥8
分佈比例	.16	.19	.26	.21	.08	.04	.04	.02

a. 令 X 代表台灣家庭人口數，為一隨機變數，求出台灣家庭人口的期望值與變異數，亦即求 E(X)和 V(X)。(6%)
b. 計算 E(100X-50)，V(100X-50)。(4%)
c. 假如從台灣的家庭隨機抽樣抽出 400 戶，請詳述這 400 戶家庭人口數最可能的分佈情形(sample distribution)。(5%)
d. 假如連續抽 100 組樣本，每次抽 400 戶，計算樣本家戶人口平均值，再放回去再抽下一個樣本，如此進行 100 次。試問這 100 組樣本的平均值的分佈為何(Sampling distribution)？(6%)
e. 令 $\overline{X_{400}}$ 代表一組(n=400)隨機樣本的家戶人口平均值，已知 $P(L \le \overline{X_{400}} \le U) = 0.95$, 求一組以 E(X)為中間點的(L, U).(4%)

3. In a study of obesity the following results were obtained from samples of males and females between the ages of 20 and 75:

	Number of study subjects	Number of overweight
Males	250	25
Females	200	50

Test if there is a difference between males and females in the proportions who are overweight:

a. Construct a 2 x 2 contingency table, perform a chi-square test, and draw your conclusion. (10 %)

b. Construct a 95% confidence interval for the difference between the population proportions, and draw your conclusion. (10 %)

4. Consider a matched-pair study designed to investigate the amount of energy expended by patients with cystic fibrosis. The following table contains the measurements of resting energy expenditure for a sample of 15 patients with cystic fibrosis and 15 healthy individuals matched on age, sex, height, and weight for each pair of observations.

	Resting Energy Expenditure (kcal/day)	
Pair	CF	Healthy
1	1153	990
2	1132	1082
3	1165	1182
4	1460	1452
5	1634	1162
6	1493	1800
7	1358	1140
8	1453	1123
9	1185	1113
10	1824	1463
11	1793	1632
12	1930	1614
13	2075	1845
14	1235	1683
15	1380	1280

One would like to compare resting energy expenditure for persons suffering from CF to resting energy expenditure for individuals who are healthy.

a. Which test should one use, 2-independent-sample t-test or paired t-test? Specify your reason.(4%)

b. Write down the null and 2-sided alternative hypotheses and conduct the test in part (a). At α=0.05, what do you conclude?(10%)

c. If one would like to use nonparametric procedures, which test should one use, the sign test or Wilcoxon rank sum test?(2%)

d. Write down the null and 2-sided alternative hypothesis and conduct the test in part (c). Report the

exact p-value of your test.(10%)

e. Which analysis, (b) or (d), is more appropriate for this data set? Specify your reason.(4%)

To answer above questions, you may need some information in the following table.

Z-distribution table

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	0.7517	0.7549
0.7	0.7580	0.7611	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	0.9031	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	0.9924	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	0.9958	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

Chi distribution table

df	$\chi^2_{.995}$	$\chi^2_{.990}$	$\chi^2_{.975}$	$\chi^2_{.950}$	$\chi^2_{.900}$	$\chi^2_{.100}$	$\chi^2_{.050}$	$\chi^2_{.025}$	$\chi^2_{.010}$	$\chi^2_{.005}$
1	0.000	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750