逢甲大學108學年度碩士班考試入學試題

編號：06　　科目代碼：204

科目	統計學	適用系所	統計學系統計與精算碩士班應用統計暨計量財務組、精算組	時間	90分鐘

※請務必在答案卷作答區內作答。　　

1. (14%) A computer company manufactures PC at two plants, one in Hsinchu and the other in Taichung. The Hsinchu plant has 3 employees; the Taichung plant has 5 employees. A random sample of 3 employees is selected and the random variable x presents the number of employees worked at Hsinchu.

   (a) What is the mean and variance of the random variable x? (4 分)

   (b) What is the probability that 2 or more of the employees in the random sample work at Hsinchu? (5 分)

   (c) What is the probability that 1 of the employees in the random sample work at Taichung? (5 分)

2. (12%) The call center of a company receives customer complaint calls at a mean rate of 5 calls per hour. Suppose the number of calls per hour follows a Poisson probability distribution. Answer following questions:

   (a) What is the mean time (in minutes) between customer complaint calls? (2 分)

   (b) What is the probability that there will be 30 minutes or more between customer complaint calls? (5 分)

   (c) What is the probability that there will be more than 20 minutes, but less than 40 minutes between customer complaint calls? (5 分)

3. (8%) In a restaurant, the proportion of people who order coffee with their dinner is 0.9. A simple random sample of 144 patrons of the restaurant is taken.

   (a) (4%)What are the expected value and standard deviation of the sampling distribution of $\overline{p}$?

   (b) (4%)What is the probability that the proportion of people who will order coffee with their meal is between 0.85 and 0.875?

4. (16%) A random sample of 39 lunch customers was taken at a restaurant. The average amount of time these customers stayed in the restaurant was 45 minutes with a standard deviation of 14 minutes.

   (a) Construct a 95% confidence interval for the true average amount of time customers spent in the restaurant. (8 分)

   (b) With a 0.95 probability, how large of a sample would have to be taken to provide a margin of error of 2.5 minutes or less? (8 分)

5. (10%)Joan's Nursery specializes in custom-designed landscaping for residential areas. The estimated labor cost associated with a particular landscaping proposal is based on the number of plantings of trees, shrubs, and so on to be used for the project. For cost- estimating purposes, managers use two hours of labor time for the planting of a medium-sized tree. Actual times from a sample of 10 plantings during the past month follow (times in hours).

1.7 1.5 2.6 2.2 2.4 2.3 2.6 3.0 1.4 2.3

With a .05 level of significance, test to see whether the mean tree-planting time differs from two hours. (with df 9, $t_{0.1}$=1.383, $t_{0.05}$=2.132, $t_{0.025}$=2.262)

(a) (2%)State the null and alternative hypotheses.

(b) (2%)Compute the sample mean.

(c) (2%)Compute the sample standard deviation.

(d) (4%)What is your conclusion?

6. (15%)Americans spend nearly $7 billion on Halloween costumes and decorations (The Wall Street Journal, October 27, 2011). Sample data showing the amount, in dollars, 16 adults spent on a Halloween costume are as follows.

12	69	22	64	52	16	13	98
33	36	31	44	45	32	63	26

(a) (5%)What is the estimate of the population mean amount adults spend on a Halloween costume?

(b) (5%)What is the sample standard deviation?

(c) (5%)Provide a 95% confidence interval estimate of the population standard deviation for the amount adults spend on a Halloween costume? (with df 15, $\chi^2_{.025}$ = 27.488, $\chi^2_{.975}$ = 6.262)

7. (15%)To study the effect of temperature on yield in a chemical process, five batches were produced at each of three temperature levels. The results follow.

(a) (10%)Construct an analysis of variance table.

(b) (5%)Use a .05 level of significance to test whether the temperature level has an effect on the mean yield of the process. ($F_{0.05,2,12}$=3.8853)

50° C	**60° C**	**70° C**
34	30	23
24	31	28
36	34	28
39	23	30
32	27	31

8. (10%)Consider the simple linear regression model, $y_i = \beta_0 + \beta_1 X_i + \epsilon_i$, $i = 1,2,\ldots,n$, where the errors ϵ_i follow the usual assumptions. Obtain the $\text{LSE}_s(\widehat{\beta_0}, \widehat{\beta_1})$ of (β_0, β_1).

The following table is the cumulative probabilities for the standard normal distribution.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−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	.2296	.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

$t_{7,0.05} = 1.895$, $t_{7,0.025} = 2.365$, $t_{39,0.05} = 1.685$, $t_{39,0.025} = 2.023$, $t_{38,0.05} = 1.686$, $t_{38,0.025} = 2.024$

$t_{v,\alpha}$ is the t value for an area or probability α in the upper tail of the t distribution with degrees of freedom v.