國立臺北科技大學

九十二學年度商業自動化與管理研究所入學考試

統計學試題

填准考證號碼

注意事項：

1. 本試題共 八 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。
4. 除第七題與第八題外，其餘各題均需列示計算過程於答案卷之答案欄內，否則不予計分。
5. 所需使用之統計表 (Statistical Tables) 均附在本試題簿之後。

(1) Peter and Mary are trying to decide who should pay for the coffee they have ordered. They decide to do this by tossing a coin. One try is composed of one toss by Mary and one toss by Peter. For one try, if Mary's toss turns out to be the head side, Peter will pay for the coffee. On the other hand, Mary will pay for the coffee if Mary's toss turns out to be the tail side and Peter's toss turns out to be the head side. In the case of a tie (i.e., both Mary's toss and Peter's toss turn out to be the tail sides), they agree to go into another try until a decision is reached. It is assumed that each try is independent of another. At lease how many tries are needed to ensure that there is a 99% chance (i.e., 99% probability) of reaching a decision? (十分)

(2) The sign on the wall of an elevator says that the maximum capacity of this elevator is "700 kilograms or 10 people". It is assumed that the weights of all potential passengers of this elevator follow a normal distribution with the mean of 60 kilograms and a standard deviation of 15 kilograms. What is the probability that the total weight of 10 people in this elevator is more than 700 kilograms? (十分)

(Use the attached Standard Normal Table to answer this problem)

(3) On the market, a product is produced by three factories of a company. The production rates and defective rate at each factory are shown in the following table.

Factory	Production Rate	Defective Rate
f_1	40%	3%
f_2	25%	6%
f_3	35%	4%

A product item is selected from the market and found to be a defective one. What is the probability that this defective item is produced by Factory f_2 ? (十分)

(4) The student union president at a small college of 2,000 students is trying to find out if the students would support his call for a one-day rally to protest tuition increase. He randomly surveyed 625 students and found that 38% of them support his idea. Find an interval centered at 38% such that there is a 95% probability the true supporting rate among all 2,000 students will fall in this interval. (十分)

(Use the attached Standard Normal Table to answer this problem)

(5) A die has six sides. They are marked with one, two, three, four, five, and six dots, respectively. It is commonly believed that when a fair die is cast, each side has equal chance of facing upward. That is, each number of 1, 2, 3, 4, 5, and 6 should have equal chance of facing upward. To find out whether a particular die is a fair one, it was cast 12,000 times. The number of times each dot (i.e., number) facing upward was recorded in the following table. At the significance level of 2.5%, can we conclude that this die is a fair one? (十四分)

(Use the attached Chi-Square Table to answer this problem)

Dot	Number of Times Facing Upward
1	1,951
2	1,970
3	2,015
4	1,997
5	2,029
6	2,038

注意：背面尚有試題

(6) In order to meet the safety standard set by the National Transportation Board (NTB), the average inflation time of all air bags installed on a particular model of cars cannot be more than 500 *ms* (*milli-seconds*). Assume that the standard deviation of the inflation times of all air bags installed on this model of cars can be estimated as 150 *ms*. A hypothesis test is to be conducted based on a total of 100 randomly selected cars of this model.

(Use the attached Standard Normal Table to answer this problem)

(6-1) State the appropriate decision rule for the following hypothesis test at the significance level of 10% where μ represents the average inflation time of all air bags installed on this model of cars. (i.e., Find the critical value in the unit of *milli-seconds* so that if the average inflation time of a total of 100 randomly selected cars exceeds this value, the null hypothesis H_0 will be rejected.) (十分)

H_0: $\mu \leq 500$ *ms* (meets safety standard)

H_A: $\mu > 500$ *ms* (does not meet safety standard)

(6-2) By adopting the decision rule derived from the answer to the above question, what is the probability that we would incorrectly claim the air bag of this car model does not meet the safety standard set by NTB while it actually does? (四分)

(6-3) Assume that the average inflation time of this car model is actually 560 *ms*, instead of 500 *ms* as was originally assumed, and the standard deviation of 150 *ms* remains the same for both cases. If your decision rule is set to reject the null hypothesis H_0 when the average inflation time of a total of 100 randomly selected cars exceeds 530 *ms*, what is the probability that we would correctly claim the air bag of this car model does not meet the safety standard set by NTB? (十分)

(7) The following table contains the partial information of a fitted simple linear regression model $\hat{Y} = b_0 + b_1X$, based on 15 observations. Restore the following table by filling in the missing entries, **A, B, C, D, E, F, G, H, I, J, K,** and **L.** (十三分)

Predictor	Coefficient	Standard Deviation	*t*-Ratio
Constant	10.278	1.42	(**A**)
X	(**C**)	0.393	(**B**)

Analysis of the Variance

Source	Degrees of Freedom	Sum of Squares	Mean Square	F-Value
Regression	(**D**)	841.766	(**I**)	156.886
Error	(**E**)	(**G**)	(**J**)	
Total	(**F**)	(**H**)		

Standard Error of Estimate = (**K**)

Coefficient of Determination = (**L**)

Coefficient of Correlation = (**M**)

(8) Several statistical tests have been developed for the verification of the assumptions made on the error terms of a linear regression model. For each type of these statistical tests listed on the Left-Hand-Side (LHS) column below, indicate which item is the most appropriate description of the test purpose as listed on the Right-Hand-Side (RHS) column. (九分)

(Note that LHS has one more item than those at the RHS. This means two items at the LHS will be connected to the same item at the RHS.)

(8-1)	____ VIF Test	(a)	Significance of individual predictors in the regression model
(8-2)	____ Durbin-Watson Test	(b)	Unusual observation outlying with respect to both predictors and response
(8-3)	____ NSCORE Test	(c)	Auto-correlation among the error terms
(8-4)	____ *t*-Test	(d)	Multi-collinearity among the predictors
(8-5)	____ *F*-Test	(e)	Unusual observations outlying with respect to only the predictors
(8-6)	____ Cook's Distance	(f)	Significance of all predictors as a whole in the regression model
(8-8)	____ Hi (Leverage)	(g)	Normality (normal distribution) of error terms
(8-9)	____ Anderson-Darling Test		

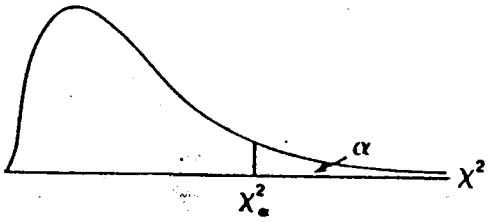
Table of Areas for Standard Normal Probability Distribution

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2518	0.2549
0.7	0.2580	0.2612	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.49865	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
4.0	0.4999683									

Illustration: For $Z = 1.93$, shaded area is 0.4732 out of total area of 1.

注意：背面尚有參考資料

The Chi-Square Distribution



The following table provides the values of χ^2_α that correspond to a given right-tail area α and a specified number of degrees of freedom:

df	Right-tail area, α							
	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01
1	0.00016	0.00098	0.0039	0.016	2.706	3.841	5.024	6.635
2	0.02001	0.05064	0.103	0.211	4.605	5.991	7.378	9.210
3	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345
4	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277
5	0.554	0.831	1.145	1.610	9.236	11.070	12.832	15.086
6	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812
7	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475
8	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090
9	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666
10	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209
11	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725
12	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217
13	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688
14	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141
15	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578
16	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000
17	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409
18	7.015	8.231	9.390	10.865	25.989	28.869	31.527	34.805
19	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191
20	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566
21	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932
22	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289
23	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638
24	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980
25	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314
26	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642
27	12.879	14.573	16.151	18.114	36.741	40.113	43.194	46.963
28	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278
29	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588
30	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892