國立高雄大學 109 學年度研究所碩士班招生考試試題

科目：統計學　　系所：金融管理學系　　是否使用計算機：是
考試時間：100 分鐘　　本科原始成績：100 分

1. (12%) A study of 31,000 hospital admissions in New York State found that 4% of the admissions led to treatment-caused injuries. One-seventh of these treatment-caused injuries resulted in death, and one-fourth were caused by negligence. Malpractice claims were filed in one out of 7.5 cases involving negligence, and payments were made in one out of every two claims.

   Let I = treatment-caused injury

   D = death from injury

   N = injury caused by negligence

   M = malpractice claim filed

   $ = payment made in claim

   (1) What is the probability a person admitted to the hospital will suffer a treatment-caused injury due to negligence?
   (2) What is the probability a person admitted to the hospital will die from a treatment-caused injury?
   (3) In the case of a negligent treatment-caused injury, what is the probability a malpractice claim will be paid?

2. (8%) A local bank reviewed its credit card policy with the intention of recalling some of its credit cards. In the past approximately 5% of cardholders defaulted, leaving the bank unable to collect the outstanding balance. Hence, management established a prior probability of 0.05 that any particular cardholder will default. The bank also found that the probability of missing a monthly payment is 0.20 for customers who do not default. Of course, the probability of missing a monthly payment for those who default is 1.
   (1) Given that a customer missed one or more monthly payments, compute the posterior probability that the customer will default.
   (2) The bank would like to recall its card if the probability that a customer will default is greater than 0.20. Should the bank recall its card if the customer misses a monthly payment? Why or why not?

3. (8%) The U.S. Energy Information Administration (US EIA) reported that the average price for a gallon of regular gasoline is $3.94 (*US EIA website, April 6, 2012*). The US EIA updates its estimates of average gas prices on a weekly basis. Assume the standard deviation is $0.25 for the price of a gallon of regular gasoline and recommend the appropriate sample size for the US EIA to use if they wish to report each of the following margins of error at 95% confidence.
   (1) The desired margin of error is $0.10.
   (2) The desired margin of error is $0.07.

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4. (12%) A consumer research group is interested in testing an automobile manufacturer's claim that a new economy model will travel at least 25 miles per gallon of gasoline (H_0: $\mu \geq 25$). Assume that s is 3 miles per gallon.
   (1) With a 0.02 level of significance and a sample of 30 cars, what is the rejection rule based on the value of x for the test to determine whether the manufacturer's claim should be rejected?
   (2) What is the probability of committing a Type II error if the actual mileage is 23 miles per gallon?
   (3) What is the probability of committing a Type II error if the actual mileage is 25.5 miles per gallon?

5. (10%) Bank of America's Consumer Spending Survey collected data on annual credit card charges in seven different categories of expenditures: transportation, groceries, dining out, household expenses, home furnishings, apparel, and entertainment. Using data from a sample of 42 credit card accounts, assume that each account was used to identify the annual credit card charges for groceries (population 1) and the annual credit card charges for dining out (population 2). Using the difference data, the sample mean difference was $\bar{d}$= \$850, and the sample standard deviation was S_d = \$1123. ($t_{0.025} = 2.020, df = 41$)
   (1) Use a 0.05 level of significance. Can you conclude that the population means differ?
   (2) What is the 95% confidence interval estimate of the difference between the population means?

6. (8%) A survey asked the following question: do you favor or oppose providing tax-funded vouchers or tax deductions to parents who send their children to private schools? Of the 2010 individuals surveyed, 905 favored the proposal, 1045 opposed the proposal, and 60 offered no opinion. Do the data indicate a significant difference in the preferences for the financial support of parents who send their children to private schools? Use a nonparametric method and a 0.05 level of significance.

7. (12%) Market betas for individual stocks are determined by simple linear regression. For each stock, the dependent variable is its quarterly percentage return (capital appreciation plus dividends) minus the percentage return that could be obtained from a risk-free investment (the Treasury Bill rate is used as the risk-free rate). The independent variable is the quarterly percentage return (capital appreciation plus dividends) for the stock market (S&P 500) minus the percentage return from a risk-free investment. An estimated regression equation is developed with quarterly data; the market beta for the stock is the slope of the estimated regression equation (β). The value of

the market beta is often interpreted as a measure of the risk associated with the stock. Market betas greater than 1 indicate that the stock is more volatile than the market average; market betas less than 1 indicate that the stock is less volatile than the market average. Suppose that the following figures are the differences between the percentage return and the risk-free return for 10 quarters for the S&P 500 and horizon Technology.

(1) What is horizon Technology's market beta?

(2) Test for a significant relationship at the 0.05 level of significance.

S&P 500	Horizon
1.2	−.7
−2.5	−2.0
−3.0	−5.5
2.0	4.7
5.0	1.8
1.2	4.1
3.0	2.6
−1.0	2.0
.5	−1.3
2.5	5.5

8. (10%) The regression model is $Y_i = \alpha + \beta X_i + \varepsilon_i$, $\mathrm{E}(\varepsilon_i) = 0, E(\varepsilon_i^2) = \sigma^2, E(\varepsilon_i \varepsilon_j) = 0, i \neq j$. X is a non-stochastic variable. We have 20 observations and list them in order: $(X_1, Y_1), (X_2, Y_2), (X_3, Y_3) \ldots\ldots (X_{20}, Y_{20})$. Now we have

$$\mathbf{b} = \frac{\overline{Y_2} - \overline{Y_1}}{\overline{X_2} - \overline{X_1}} ,$$

which $\overline{X_1} = \frac{1}{10}\sum_{i=1}^{10} X_i, \overline{X_2} = \frac{1}{10}\sum_{i=11}^{20} X_i, \overline{Y_1} = \frac{1}{10}\sum_{i=1}^{10} Y_i, \overline{Y_2} = \frac{1}{10}\sum_{i=11}^{20} Y_i$.

(1) Is **b** an unbiased estimator of β?

(2) According to Gauss-Markov Theorem, is **b** a BLUE (Best Linear Unbiased Estimator) of β? Please explain.

9. (10%) Suppose there is a true regression as follow:

$\mathrm{Y} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$

(1) If one omits the variable X_2 in the regression model, what will the estimated coefficient $\widehat{\beta_0}$ and $\widehat{\beta_1}$ be affected?

(2) If one includes one more unnecessary variable X_3 into the true model, what will the estimated coefficient $\widehat{\beta_0}$, $\widehat{\beta_1}$,and $\widehat{\beta_2}$ be affected?

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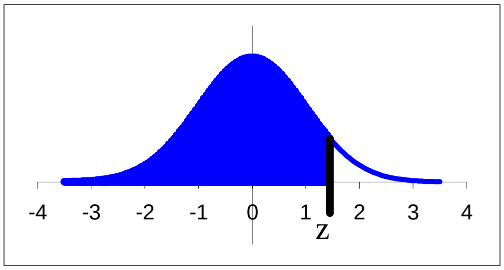
10. (10%) There are some red and white balls in a basket. Now we randomly select one ball from the basket with replacement until we obtain a red ball. Let X_i be the number of balls we select from the basket before we get the red ball. The whole process is repeated for n times, which means that we can have $(X_1, X_2, X_{3,}......, X_n)$ as a sample. Please use MLE to find out the estimator of the ratio R, where R=$\frac{\textit{The number of red balls}}{\textit{The number of white balls}}$.

Table 1b: Standard Normal Probabilities

The values in the table below are cumulative probabilities for the standard normal distribution Z (that is, the normal distribution with mean 0 and standard deviation 1). These probabilities are values of the following integral:

$$P(Z \le z) = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{-x^2/2} dx$$

Geometrically, the values represent the area to the left of z under the density curve of the standard normal distribution:



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.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	0.9131	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	0.9925	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	0.9959	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
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

Table 2: *t*-Distribution Critical Values

The entries in the table below are the critical values $t_{n,p}$, where *n* represents the number of degrees of freedom and *p* is the upper tail probability. That is, if *T* has the *t*-distribution with *n* degrees of freedom, then the value in the table represents the number $t_{n,p}$ such that $P\left(T > t_{n,p}\right) = p$.

	Upper Tail Probability p									
d.f.	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.0025	0.001	0.0005
1	1.376	1.963	3.078	6.314	12.706	31.821	63.657	127.321	318.309	636.619
2	1.061	1.386	1.886	2.920	4.303	6.965	9.925	14.089	22.327	31.599
3	0.978	1.250	1.638	2.353	3.182	4.541	5.841	7.453	10.215	12.924
4	0.941	1.190	1.533	2.132	2.776	3.747	4.604	5.598	7.173	8.610
5	0.920	1.156	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869
6	0.906	1.134	1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959
7	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408
8	0.889	1.108	1.397	1.860	2.306	2.896	3.355	3.833	4.501	5.041
9	0.883	1.100	1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10	0.879	1.093	1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11	0.876	1.088	1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437
12	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318
13	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221
14	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.326	3.787	4.140
15	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073
16	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.252	3.686	4.015
17	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.222	3.646	3.965
18	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.922
19	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883
20	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850
21	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.819
22	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.119	3.505	3.792
23	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.768
24	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.091	3.467	3.745
25	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.725
26	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.707
27	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.690
28	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674
29	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.038	3.396	3.659
30	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.646
35	0.852	1.052	1.306	1.690	2.030	2.438	2.724	2.996	3.340	3.591
40	0.851	1.050	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551
45	0.850	1.049	1.301	1.679	2.014	2.412	2.690	2.952	3.281	3.520
50	0.849	1.047	1.299	1.676	2.009	2.403	2.678	2.937	3.261	3.496
55	0.848	1.046	1.297	1.673	2.004	2.396	2.668	2.925	3.245	3.476
60	0.848	1.045	1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.460
65	0.847	1.045	1.295	1.669	1.997	2.385	2.654	2.906	3.220	3.447
70	0.847	1.044	1.294	1.667	1.994	2.381	2.648	2.899	3.211	3.435
75	0.846	1.044	1.293	1.665	1.992	2.377	2.643	2.892	3.202	3.425
80	0.846	1.043	1.292	1.664	1.990	2.374	2.639	2.887	3.195	3.416
85	0.846	1.043	1.292	1.663	1.988	2.371	2.635	2.882	3.189	3.409
90	0.846	1.042	1.291	1.662	1.987	2.368	2.632	2.878	3.183	3.402
95	0.845	1.042	1.291	1.661	1.985	2.366	2.629	2.874	3.178	3.396
100	0.845	1.042	1.290	1.660	1.984	2.364	2.626	2.871	3.174	3.390
150	0.844	1.040	1.287	1.655	1.976	2.351	2.609	2.849	3.145	3.357
250	0.843	1.039	1.285	1.651	1.969	2.341	2.596	2.832	3.123	3.330
1000	0.842	1.037	1.282	1.646	1.962	2.330	2.581	2.813	3.098	3.300
∞	0.842	1.036	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291