

國立臺北大學 110 學年度碩士班一般入學考試試題

系(所)組別：財政學系

科 目：統計學

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Notes: Please round to the nearest hundredths (the 2nd decimal) in your calculation. In making statistical inferences, clearly specify the hypothesis, test statistics, decision rules, and the conclusions derived from your tests. If needed, use the most appropriate table to find the critical values. 中英文作答皆可。

- I. (10%) A stock portfolio is composed of two stocks: A_1 and B_1 . Another stock portfolio also has two investments: stocks A_2 and B_2 . Suppose the mean prices (μ) and the standard deviations (σ) of A_1 and A_2 are equal, and the mean price and standard deviation of B_1 are equal to those of B_2 (i.e., $\mu_{A_1} = \mu_{A_2}$, $\mu_{B_1} = \mu_{B_2}$, $\sigma_{A_1} = \sigma_{A_2}$, $\sigma_{B_1} = \sigma_{B_2}$). Suppose each stock comprises 50% of the portfolio. However, the correlation between stocks is higher in the first portfolio (i.e., $\rho_1 > \rho_2$). Explain the difference in expected returns and risks between the two portfolios.
- II. (30%) A pollster plans to randomly select people and ask about their party affiliation. The respondent can choose to be identified with one of the four political parties: Party A, B, C, or D. The pollster is interested to know p_A , the share of population that are leaning toward Party A.
- (a) Describe the probability distribution of $\bar{P}_A$, the proportion of respondents who was identified with Party A in the sample. Explain whether normal distribution is appropriate to approximate the distribution of $\bar{P}_A$.
 - (b) Suppose 20% the population is leaning toward Party A. If the pollster is to interview 10 people, what is the probability that the pollster does not find anyone who is leaning toward Party A?
 - (c) Suppose the pollster interviewed 765 people and found that 407 of the respondents were affiliated with Party A. Can the pollster conclude at 5% significance level that Party A has more than 50% of support from the public? Explain your answer.
 - (d) Suppose the pollster wants to estimate p_A within 0.03 margin (i.e. $\pm 3\%$) with 95% confidence. How many people should the pollster interview?
- III. (25%) Suppose that the starting salaries of female managers have a positively skewed distribution with mean of \$56,000 and a standard deviation of \$12,000. The starting salaries of male managers are positively skewed with a mean of \$50,000 and a standard deviation of \$10,000. A random sample of 50 female managers and a random sample of 40 male managers are selected.
- (a) Explain what can we infer from the description that the salaries are “positively skewed”?
 - (b) Describe the sampling distribution of the differences between the average salaries of male and female managers, including its expected value and standard error.
 - (c) What is the probability that the sample mean salary of male managers will not exceed that of the female managers?
- IV. (15%) The city has recently installed red light cameras to discourage traffic signal violations. The Department of Transportation has collected the number of violations for the week prior to the installation of the camera (the first row) and the week after the installation (the second row). Based on the data, can we conclude at 5% significance level that the camera can reduce traffic light violations? Explain your answer.

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
The Week Before	7	21	27	18	20	24	16
The Week After	8	18	24	19	16	19	16

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- V. (20%) A survey was conducted to ask a random sample of 20 people their age and how many packs of cigarettes that they have purchased in the past week. It is suspected that elderly smokers tend to smoke more than younger smokers. The researcher ran a simple regression analysis and obtained the following output:

Regression Statistics		Descriptive Statistics	Age	Cigarettes (packs/week)
Multiple R	0.8020	Mean	53	3.65
R Square	0.6433	Minimum	38	1
Adjusted R Square	0.6234	Maximum	69	6
Standard Error	0.9397	Standard Deviation	9.77	1.53
Observations	20			

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	28.6571	28.6571	32.4565	2.11E-05
Residual	18	15.8929	0.8829		
Total	19	44.55			

	Coefficients	Standard Error	t stat.
Intercept	-3.0115	1.1880	-2.5349
Age	0.1257	0.0221	5.6971

- Determine the coefficient of determination and interpret its value.
- What does the estimate of *intercept* tell us?
- Calculate the 95% confidence intervals for the estimate of the slope.
- Conduct a test to determine at the 5% significance level whether a *positive* linear relationship exists between age and number of cigarettes smoked in a week.

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Table 1: Standard Normal Probability Table
Entries in the table show the upper tail probability, i.e., $\Pr(z \geq Z)$

Z	+0	+0.01	+0.02	+0.03	+0.04	+0.05	+0.06	+0.07	+0.08	+0.09
0	0.50000	0.49601	0.49202	0.48803	0.48405	0.48006	0.47608	0.47210	0.46812	0.46414
0.1	0.46020	0.45620	0.45224	0.44828	0.44433	0.44034	0.43640	0.43251	0.42858	0.42465
0.2	0.42070	0.41683	0.41294	0.40905	0.40517	0.40129	0.39743	0.39358	0.38974	0.38591
0.3	0.38209	0.37828	0.37448	0.37070	0.36693	0.36317	0.35942	0.35569	0.35197	0.34827
0.4	0.34458	0.34090	0.33724	0.33360	0.32997	0.32636	0.32276	0.31918	0.31561	0.31207
0.5	0.30854	0.30503	0.30153	0.29806	0.29460	0.29116	0.28774	0.28434	0.28096	0.27760
0.6	0.27425	0.27093	0.26763	0.26435	0.26109	0.25785	0.25463	0.25143	0.24825	0.24510
0.7	0.24196	0.23885	0.23576	0.23270	0.22965	0.22663	0.22363	0.22065	0.21770	0.21476
0.8	0.21186	0.20897	0.20611	0.20327	0.20045	0.19766	0.19489	0.19215	0.18943	0.18673
0.9	0.18406	0.18141	0.17879	0.17619	0.17361	0.17106	0.16853	0.16602	0.16354	0.16109
1.0	0.15866	0.15625	0.15386	0.15151	0.14917	0.14686	0.14457	0.14231	0.14007	0.13786
1.1	0.13567	0.13350	0.13136	0.12924	0.12714	0.12507	0.12302	0.12100	0.11900	0.11702
1.2	0.11507	0.11314	0.11123	0.10935	0.10749	0.10565	0.10383	0.10204	0.10027	0.09853
1.3	0.09680	0.09510	0.09342	0.09176	0.09012	0.08851	0.08692	0.08534	0.08379	0.08226
1.4	0.08076	0.07927	0.07780	0.07636	0.07493	0.07353	0.07215	0.07078	0.06944	0.06811
1.5	0.06681	0.06552	0.06426	0.06301	0.06178	0.06057	0.05938	0.05821	0.05705	0.05592
1.6	0.05480	0.05370	0.05262	0.05155	0.05050	0.04947	0.04846	0.04746	0.04648	0.04551
1.7	0.04457	0.04363	0.04272	0.04182	0.04093	0.04006	0.03920	0.03836	0.03754	0.03673
1.8	0.03593	0.03515	0.03438	0.03362	0.03288	0.03216	0.03144	0.03074	0.03005	0.02938
1.9	0.02872	0.02807	0.02743	0.02680	0.02619	0.02559	0.02500	0.02442	0.02385	0.02330
2.0	0.02275	0.02222	0.02169	0.02118	0.02068	0.02018	0.01970	0.01923	0.01876	0.01831
2.1	0.01786	0.01743	0.01700	0.01659	0.01618	0.01578	0.01539	0.01500	0.01463	0.01426
2.2	0.01390	0.01355	0.01321	0.01287	0.01255	0.01222	0.01191	0.01160	0.01130	0.01101
2.3	0.01072	0.01044	0.01017	0.00990	0.00964	0.00939	0.00914	0.00889	0.00866	0.00842
2.4	0.00820	0.00798	0.00776	0.00755	0.00734	0.00714	0.00695	0.00676	0.00657	0.00639
2.5	0.00621	0.00604	0.00587	0.00570	0.00554	0.00539	0.00523	0.00508	0.00494	0.00480
2.6	0.00466	0.00453	0.00440	0.00427	0.00415	0.00402	0.00391	0.00379	0.00368	0.00357
2.7	0.00347	0.00336	0.00326	0.00317	0.00307	0.00298	0.00289	0.00280	0.00272	0.00264
2.8	0.00256	0.00248	0.00240	0.00233	0.00226	0.00219	0.00212	0.00205	0.00199	0.00193
2.9	0.00187	0.00181	0.00175	0.00169	0.00164	0.00159	0.00154	0.00149	0.00144	0.00139
3.0	0.00135	0.00131	0.00126	0.00122	0.00118	0.00114	0.00111	0.00107	0.00104	0.00100

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Table 2: Student's t-distribution table

Entries in the table give t_x values, where x is the probability in the upper tail of the t -distribution.

Degrees of Freedom	Upper Tail Probability x					
	0.2	0.1	0.05	0.025	0.01	0.005
1	1.376	3.078	6.314	12.706	31.821	63.657
2	1.061	1.886	2.920	4.303	6.965	9.925
3	0.978	1.638	2.353	3.182	4.541	5.841
4	0.941	1.533	2.132	2.776	3.747	4.604
5	0.920	1.476	2.015	2.571	3.365	4.032
6	0.906	1.440	1.943	2.447	3.143	3.707
7	0.896	1.415	1.895	2.365	2.998	3.499
8	0.889	1.397	1.860	2.306	2.896	3.355
9	0.883	1.383	1.833	2.262	2.821	3.250
10	0.879	1.372	1.812	2.228	2.764	3.169
11	0.876	1.363	1.796	2.201	2.718	3.106
12	0.873	1.356	1.782	2.179	2.681	3.055
13	0.870	1.350	1.771	2.160	2.650	3.012
14	0.868	1.345	1.761	2.145	2.624	2.977
15	0.866	1.341	1.753	2.131	2.602	2.947
16	0.865	1.337	1.746	2.120	2.583	2.921
17	0.863	1.333	1.740	2.110	2.567	2.898
18	0.862	1.330	1.734	2.101	2.552	2.878
19	0.861	1.328	1.729	2.093	2.539	2.861
20	0.860	1.325	1.725	2.086	2.528	2.845
21	0.859	1.323	1.721	2.080	2.518	2.831
22	0.858	1.321	1.717	2.074	2.508	2.819
23	0.858	1.319	1.714	2.069	2.500	2.807
24	0.857	1.318	1.711	2.064	2.492	2.797
25	0.856	1.316	1.708	2.060	2.485	2.787
26	0.856	1.315	1.706	2.056	2.479	2.779
27	0.855	1.314	1.703	2.052	2.473	2.771
28	0.855	1.313	1.701	2.048	2.467	2.763
29	0.854	1.311	1.699	2.045	2.462	2.756
30	0.854	1.310	1.697	2.042	2.457	2.750
40	0.851	1.303	1.684	2.021	2.423	2.704
50	0.849	1.299	1.676	2.009	2.403	2.678
60	0.848	1.296	1.671	2.000	2.390	2.660
80	0.846	1.292	1.664	1.990	2.374	2.639
100	0.845	1.290	1.660	1.984	2.364	2.626
120	0.845	1.289	1.658	1.980	2.358	2.617
∞	0.842	1.282	1.645	1.960	2.326	2.576