國立臺北大學109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, unless stated otherwise. 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.

I. (15%) Suppose 9.5% of all undergraduate students in NTPU participated in the exchange student program and studied abroad in 2019. Assume that women make up 60% of the students who studied abroad in 2019, but women only make up 49% of the students who didn't participate in the program.

For the following questions, please round to the nearest ten thousandths (the 4th decimal) in your answers.

(a) What is the probability that a female student studied abroad in 2019?

(b) What were the percentage of male undergraduate students in 2019?

II. (20%) Suppose that you want to develop a program to identify a presidential candidate based on the words they use in their speeches. You have collected a sample of transcripts from each presidential candidates' recent speeches, and candidate A's speeches make up 10% of the sample. Suppose the proportion of A's speeches that have the following five words are given below.

great	0.51
economy	0.45
stupid	0.34
fake	0.14
rich	0.14

Assume the proportions of other candidates' speeches that have the same words are

great	0.015
economy	0.022
stupid	0.022
fake	0.041
rich	0.011

(a) If a transcript from the sample includes the word "great", what is the probability that this speech is given by candidate A? Should your program label this transcript as candidate A's speech?

(b) Which of the two words, "economy" or "stupid", is a stronger indicator that the speech is given by candidate A? Why?

III. (20%) Let x denote the number of car accidents in a week and the random variable x have a Poisson distribution. We collect a simple random sample of 50 observations and use the sample mean $\bar{x} = \sum x_i/n = 36$ to estimate the population mean of x. Suppose the population standard deviation of x is $\sigma = 6$.

(a) Describe the sampling distribution of $\bar{x}$. Develop a 90% confidence interval for the average number of accidents.
(b) Is our estimator for the population mean unbiased? Briefly explain your answer.
(c) Is our estimator for the population mean consistent? Briefly explain your answer.

IV. (20%) A job seeker suspects that the salaries in his current city (A) is lower than the salaries in the neighboring city (B). The newspaper reported a recent survey on the salaries in these two cities with the following information:

	City A	*City B*
Sample size	40	50
Sample average	$56,100	$59,400
Sample standard deviation	$6,000	$7,000

Based on the information, can the job seeker conclude that the average salary in city A are lower than those in city B? Conduct a hypothesis testing with confidence level $\alpha = 0.05$ so that a rejection of the null hypothesis can provide us answer to the job seeker's question.

V. (25%) An investor is interested in the relationship between the performances of two companies. Let A denote the stock prices of company A, and B denote the stock prices of company B. Suppose the investor believes that stock A's prices can help predict stock B's prices. He recorded several data points and use the sample to run a simple linear regression. The results are shown below:

Predictor	*Coefficient*	*SE of Coef.*
Constant	0.2747	0.9004
Independent Variable	0.9498	0.3569

Source	DF	Sum of Squares
Regression	1	50.255
Residual Error	8	56.781
Total	9	107.036

(a) What is the least squares regression model estimated by the researcher? What is the sample size?
(b) Is there a significant relationship between the two variables at the level of significance $\alpha = 0.05$?
(c) Does the estimated regression provide a good fit? Explain your answer.

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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

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