

國立臺北大學 106 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 ten thousandths (the 4th 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.

1. (15%) The professor announced that the average score of the final examination is 75 and its standard deviation is 5. If you scored 65 for the test, can you estimate what percentage of the students have scores lower than yours? Explain your answer and state any assumptions if necessary.

2. (20%) Shepard and Miranda work for an international corporation, Cerberus, Inc. Let X denote the number of business trips that Shepard makes in a month, and Y denote the number of business trips that Miranda makes in a month. The joint probability distribution of X and Y is shown in the following table:

		X	
		1	2
Y	1	.28	.42
	2	.12	.18

- a. What is the monthly total number of trips (i.e. $X+Y$) that the company can expect them to make?
- b. What is the variance of the total number of business trips?
- c. What is the coefficient of correlation between X and Y ? Provide interpretation for the value that you have calculated.
3. (20%) A random sample of 89 tourists in Omega shows that the tourists in Omega spent an average of \$2,860 (in a week) with the sample standard deviation of \$126. Another random sample of 64 tourists in Citadel shows that they spent an average of \$2,935 with the sample standard deviation of \$138. Conduct a hypothesis test using $\alpha = 0.05$ as the level of significance to determine if there is any statistical difference between the average expenditure of those who visited Omega vs. the expenditure of those who visited Citadel.

4. (25%) Information regarding the starting salaries from samples of students in four different majors is given below:

	Majors			
	Management	Marketing	Finance	Accounting
Sample size	12	10	9	14
Average(in \$1,000)	26	31	22	25
Sample variance	10	7	15	9

- a. Complete the following ANOVA table in your answer sheet.
- b. At 95% confidence, determine the critical value.
- c. Using the critical value approach, conduct a hypothesis test ($\alpha = 0.05$) to determine whether there is a significant difference among the means of salaries. State your hypothesis and interpret your results.

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F
Treatments	_____	_____	_____	_____
Error	_____	_____	_____	_____
Total	_____	_____	_____	_____

5. (20%) 藥商想測試一種新藥對腦部反應時間的影響，若在正常(未受藥物影響)的情況下，老鼠的平均反應時間是1.2秒，標準差為0.5。假設反應時間的變異數不受到藥物影響，在 $\alpha = 0.05$ 的顯著水準下，藥商想測試服用此藥，是否對平均反應時間有顯著的影響。於是對一百隻老鼠注射了藥物，再測量樣本中老鼠的反應時間。

若服用藥物後，老鼠真實的平均反應時間為1.1秒 (population mean = 1.1)，請問依據上述資訊進行的假設檢定，其檢定力(power)為何？檢定力的意涵又為何？

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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_{α} values, where α is the probability in the upper tail of the t -distribution

Degrees of Freedom	Upper Tail Probability α					
	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
110	0.845	1.289	1.659	1.982	2.361	2.621
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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Table 3: F Distribution

Entries in the table give F_{α} values, where α is the probability in the upper tail of the F distribution

$\alpha = 0.05$		Numerator Degrees of Freedom												
Denominator Degrees of Freedom		1	2	3	4	5	6	7	8	9	10	20	30	40
	1	161.448	199.500	215.707	224.583	230.162	233.986	236.768	238.883	240.543	241.882	248.013	250.095	251.143
	2	18.513	19.000	19.164	19.247	19.296	19.330	19.353	19.371	19.385	19.396	19.446	19.462	19.471
	3	10.128	9.552	9.277	9.117	9.013	8.941	8.887	8.845	8.812	8.786	8.660	8.617	8.594
	4	7.709	6.944	6.591	6.388	6.256	6.163	6.094	6.041	5.999	5.964	5.803	5.746	5.717
	5	6.608	5.786	5.409	5.192	5.050	4.950	4.876	4.818	4.772	4.735	4.558	4.496	4.464
	6	5.987	5.143	4.757	4.534	4.387	4.284	4.207	4.147	4.099	4.060	3.874	3.808	3.774
	7	5.591	4.737	4.347	4.120	3.972	3.866	3.787	3.726	3.677	3.637	3.445	3.376	3.340
	8	5.318	4.459	4.066	3.838	3.687	3.581	3.500	3.438	3.388	3.347	3.150	3.079	3.043
	9	5.117	4.256	3.863	3.633	3.482	3.374	3.293	3.230	3.179	3.137	2.936	2.864	2.826
	10	4.965	4.103	3.708	3.478	3.326	3.217	3.135	3.072	3.020	2.978	2.774	2.700	2.661
	11	4.844	3.982	3.587	3.357	3.204	3.095	3.012	2.948	2.896	2.854	2.646	2.570	2.531
	12	4.747	3.885	3.490	3.259	3.106	2.996	2.913	2.849	2.796	2.753	2.544	2.466	2.426
	13	4.667	3.806	3.411	3.179	3.025	2.915	2.832	2.767	2.714	2.671	2.459	2.380	2.339
	14	4.600	3.739	3.344	3.112	2.958	2.848	2.764	2.699	2.646	2.602	2.388	2.308	2.266
	15	4.543	3.682	3.287	3.056	2.901	2.790	2.707	2.641	2.588	2.544	2.328	2.247	2.204
	16	4.494	3.634	3.239	3.007	2.852	2.741	2.657	2.591	2.538	2.494	2.276	2.194	2.151
	17	4.451	3.592	3.197	2.965	2.810	2.699	2.614	2.548	2.494	2.450	2.230	2.148	2.104
	18	4.414	3.555	3.160	2.928	2.773	2.661	2.577	2.510	2.456	2.412	2.191	2.107	2.063
	19	4.381	3.522	3.127	2.895	2.740	2.628	2.544	2.477	2.423	2.378	2.155	2.071	2.026
	20	4.351	3.493	3.098	2.866	2.711	2.599	2.514	2.447	2.393	2.348	2.124	2.039	1.994
	30	4.171	3.316	2.922	2.690	2.534	2.421	2.334	2.266	2.211	2.165	1.932	1.841	1.792
	40	4.085	3.232	2.839	2.606	2.449	2.336	2.249	2.180	2.124	2.077	1.839	1.744	1.693

$\alpha = 0.025$		Numerator Degrees of Freedom												
Denominator Degrees of Freedom		1	2	3	4	5	6	7	8	9	10	20	30	40
	1	647.789	799.500	864.163	899.583	921.848	937.111	948.217	956.656	963.285	968.627	993.103	1001.41	1005.60
	2	38.506	39.000	39.165	39.248	39.298	39.331	39.355	39.373	39.387	39.398	39.448	39.465	39.473
	3	17.443	16.044	15.439	15.101	14.885	14.735	14.624	14.540	14.473	14.419	14.167	14.081	14.037
	4	12.218	10.649	9.979	9.605	9.364	9.197	9.074	8.980	8.905	8.844	8.560	8.461	8.411
	5	10.007	8.434	7.764	7.388	7.146	6.978	6.853	6.757	6.681	6.619	6.329	6.227	6.175
	6	8.813	7.260	6.599	6.227	5.988	5.820	5.695	5.600	5.523	5.461	5.168	5.065	5.012
	7	8.073	6.542	5.890	5.523	5.285	5.119	4.995	4.899	4.823	4.761	4.467	4.362	4.309
	8	7.571	6.059	5.416	5.053	4.817	4.652	4.529	4.433	4.357	4.295	3.999	3.894	3.840
	9	7.209	5.715	5.078	4.718	4.484	4.320	4.197	4.102	4.026	3.964	3.667	3.560	3.505
	10	6.937	5.456	4.826	4.468	4.236	4.072	3.950	3.855	3.779	3.717	3.419	3.311	3.255
	11	6.724	5.256	4.630	4.275	4.044	3.881	3.759	3.664	3.588	3.526	3.226	3.118	3.061
	12	6.554	5.096	4.474	4.121	3.891	3.728	3.607	3.512	3.436	3.374	3.073	2.963	2.906
	13	6.414	4.965	4.347	3.996	3.767	3.604	3.483	3.388	3.312	3.250	2.948	2.837	2.780
	14	6.298	4.857	4.242	3.892	3.663	3.501	3.380	3.285	3.209	3.147	2.844	2.732	2.674
	15	6.200	4.765	4.153	3.804	3.576	3.415	3.293	3.199	3.123	3.060	2.756	2.644	2.585
	16	6.115	4.687	4.077	3.729	3.502	3.341	3.219	3.125	3.049	2.986	2.681	2.568	2.509
	17	6.042	4.619	4.011	3.665	3.438	3.277	3.156	3.061	2.985	2.922	2.616	2.502	2.442
	18	5.978	4.560	3.954	3.608	3.382	3.221	3.100	3.005	2.929	2.866	2.559	2.445	2.384
	19	5.922	4.508	3.903	3.559	3.333	3.172	3.051	2.956	2.880	2.817	2.509	2.394	2.333
	20	5.871	4.461	3.859	3.515	3.289	3.128	3.007	2.913	2.837	2.774	2.464	2.349	2.287
	30	5.568	4.182	3.589	3.250	3.026	2.867	2.746	2.651	2.575	2.511	2.195	2.074	2.009
	40	5.424	4.051	3.463	3.126	2.904	2.744	2.624	2.529	2.452	2.388	2.068	1.943	1.875

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