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：國際企業研究所

科　　目：統計學

☑可 ☐不可 使用計算機

Part I (50%)

1. Suppose that the distribution of random variable X is a normal distribution with mean 0 and variance 4, i.e., $N(0,4)$ and $Y=X^2$.
   (a) (7%) Find $E(Y)$, the mean of Y.
   (b) (8%) Apply the kurtosis of a standard normal distribution is 3 to find $Var(Y)$, the variance of Y.

2. Let X and Y be random variables with joint density function
$$f(x,y)=\begin{cases}2, & x\geq 0,\ y\geq 0,\ 0\leq x+y\leq 1\\ 0, & \text{otherwise}\end{cases}$$
   (a) (8%) Find $f_Y(y)$, the marginal density of Y.
   (b) (7%) Find $f_{X|Y}(x\,|\,Y=\frac{1}{2})$, the conditional density of X given $Y=\frac{1}{2}$.

3. (10%) Suppose that using a rapid influenza diagnostic test (RIDT) the probability of a false positive is 0.1 and the probability of a false negative is 0.2. According to the historical data, a person suggested by a doctor to use the rapid test have a 60% chance of contracting an influenza. If a person suggested by a doctor to use the rapid test and the test result is negative, find the probability that this person contracting an influenza.
   [Note that a false positive is a test result that indicates a contracting when one does not; a false negative is a test result that indicates no contracting while in fact one does.]

4. (10%) A poll of President election was held. A random sample of 600 citizens were surveyed and there were 240 citizens would vote for candidate H. Find a 95% confidence interval for the percentage of ballots (turnout rate) of candidate H.

PartII The significance level for hypothesis testing is 0.05, unless otherwise specified.(50%)

1. (10%) A study was instituted to learn how the diets of women changed during the winter and the summer. A random group of 12 women were observed during the month of July, and the percentage of each woman's calories that came from fat was determined. Similar observations were made on a different randomly selected group of size 12 during the month of January. Suppose the results were as follows:
   July: mean =30.83, standard deviation=4.30
   January: mean =35.13, standard deviation=4.51
   If we assume the population standard deviations for all months are equal, conduct a test for testing the hypothesis if the mean fat intake is the same for both months.

2. (10%, 5% each) A study compares sales based on different magazine layouts, and three layouts are designated as A, B, and C. The sales data were collected for 5 days and summarized as follows:

Layout	Mean	Variance	sample size
A	16	9	5
B	20	10	5
C	27	11	5

   The Sum of square between layouts is 223.33, and the sum of square total is 403.33.
   (a) What is the mean square within?
   (b) What is the test statistics for testing the null hypothesis that the mean sales are equal for three layouts?

3. (15%, 5% each) We would like to test the hypothesis that the proportions between genders in favor of tax cut are the same (Men and women are treated as two populations). A random sample of 100 men revealed that 64 were in favor of tax cut and a random sample of 100 women revealed that 80 were in favor.
   (a) What is the point estimate of the difference between two population proportions in favor of tax cut?
   (b) Test the hypothesis that two population proportions in favor of tax cut are the same.
   (c) What is a 95% confidence interval for difference of the proportion in favor of tax cut between men and women?

4. (15%, 5% each) A candy bar manufacturer is trying to estimate how sales are influenced by flavors and the price of their products. To do this, the company randomly chose some stores and sold their candy bar of different flavors at different prices. Using candy bar sales as the dependent variable, the company conducted a regression analysis. The three flavors of candy bars are banana, apple and peach. The coding and the regression results are as follows:

$$X_1 = \begin{cases} 1 & \text{if flavor is banana} \\ 0 & \text{otherwise} \end{cases} \qquad X_2 = \begin{cases} 1 & \text{if flavor is apple} \\ 0 & \text{otherwise} \end{cases}$$

	Coefficient	Standard Error
intercept	141.15	10.27
X_1	-27.69	7.22
X_2	-22.23	6.13
Price	-30.52	5.97

ANOVA table

	df	SS
Regression		5847.495
Error		325.0046
Total	9	6172.5

(a) What percentage of the total variation in candy bar sales is explained by price and flavors together?
(b) Compute the test statistics to test the null hypothesis that all slope coefficients are zero.
(c) What is the predicted sales for apple flavor candy bar sold at $1?

Table 1. Percentiles of the t distributions: Entry is t(A;V) where P{t(v)≦t(A,v)}=A, for example, P{t(1)≦t(12.706,1)}=0.975,v is the degree of freedom.

	A			A			A			A	
v	0.975	0.95	v	0.975	0.95	v	0.975	0.95	V	0.975	0.95
1	12.706	6.314	7	2.365	1.895	13	2.160	1.771	19	2.093	1.729
2	4.303	2.92	8	2.306	1.86	14	2.145	1.761	20	2.086	1.725
3	3.182	2.353	9	2.262	1.833	15	2.131	1.753	21	2.080	1.721
4	2.776	2.132	10	2.228	1.812	16	2.120	1.746	22	2.074	1.717
5	2.571	2.015	11	2.201	1.796	17	2.110	1.740	23	2.069	1.714
6	2.447	1.943	12	2.179	1.782	18	2.101	1.734	24	2.064	1.711

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Table 2. Cumulative probability for z is the area under the standard normal curve to the left of z

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
−0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

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