國立臺北大學 103 學年度碩士班一般入學考試試題

系（所）組別：統計學系

科　　目：統計學

☑可 ☐不可使用計算機

I. Use significance level α=.05 for the following questions unless otherwise specified.

1. (10%) Winter visitors are extremely important to the economy of Southwest Florida. Hotel occupancy is an often-reported measure of visitor volume and visitor activity. Hotel occupancy data for February in two consecutive years are as follows.

	Current Year	Previous Year
Occupied Rooms	1008	1520
Total Rooms	1200	2000

a. (5%) Conduct a hypothesis test to determine if there has been an increase in the proportion of rooms occupied over the one-year period.

b. (5%) What is the 95% confidence interval estimate of the change in occupancy for the one-year period?

2. (10%) The following data are from a completely randomized design and there are 6 subjects within each treatment.

	Treatment		
	A	B	C
Sample mean	156	142	134
Sample variance	164.4	131.2	110.4

Calculate the appropriate test statistics that can be used to determine whether the population means are equal among the three treatments.

3. (10%) The analysis is based on the salaries y and the grade point averages x for 6 students who obtained a bachelor's degree in business administration.

The estimated regression equation for these data is $\hat{y} = 2090.5 + 581.1x$ and MSE =21284.

$\bar{x} = 3.2 \quad \Sigma(x_i - \bar{x})^2 = 0.74$

a. (5%) Construct a 95% confidence interval for the mean salary for all students with a 3.2 GPA.

b. (5%) Construct a 95% prediction interval of the salary for Ryan, a student with a GPA of 3.2.

4. (10%) The National Highway Traffic Safety Administration reported the percentage of traffic accidents occurring each day of the week. Assume that a sample of 420 accidents provided the following data.

Sun.	Mon.	Tue.	Wed.	Thur.	Fri.	Sat.
66	50	53	47	55	69	80

Conduct a hypothesis test to determine if the proportion of traffic accidents is the same for each day of the week.

5. (10%) Consider the hypothesis : $H_o : \mu \geq 10$, $H_a : \mu < 10$. Use significance level α=.025.

The sample size is 100, and the population standard deviation is assumed known with σ=5.

a. (5%) If $\mu = 8.5$, what is the probability that the sample mean leads to the conclusion do not reject H_o ?

b. (5%) What is the power if $\mu = 8$?

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Table 1: t distribution. One tailed, v is degree of freedom. For example $P\{t(1) \le t(12.706,1)\} = 0.975$

	1	2	3	4	5	6	7	8	9	10
t-value	12.706	4.303	3.182	2.776	2.571	2.447	2.365	2.306	2.262	2.228

Table 2: χ^2 distribution. Entry is the χ^2 value with probability p=0.05 lying to its right, v is degree of freedom

v	1	2	3	4	5	6	7	8	9	10
χ^2	3.84	5.99	7.81	9.49	11.07	12.59	14.07	15.51	16.92	18.31

Table 3: Standard Normal distribution. (Entry 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

II. Public transportation is one way a student can use to get to the National Taipei University（NTPU, 台北大學）from the Banqiao Station（板橋車站）. The following histogram shows the travel time by public transportation reported by 100 NTPU students who came from the Banqiao Station last week. The sample mean time is 43 minutes and the sample standard deviation is 8 minutes.

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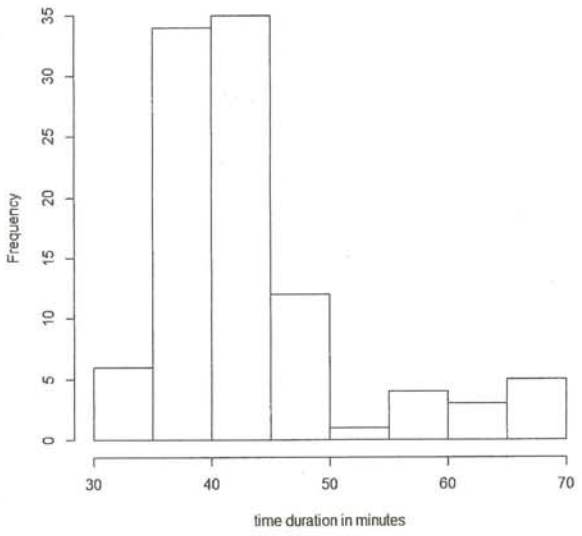

1. (10%) Use an appropriate measure to describe the central location of this data set. Explain your reason for using this measure. Based on the histogram, calculate a range for this measure you select to use.

2. (10%) Someone claimed to you that the time required to travel between the National Taipei University and the Banqiao Station follows an exponential distribution with a mean of 40 minutes. This exponential probability density function is

$$f(x)=\frac{1}{40}e^{-(x/40)},\quad x\geq 0.$$

You can use the histogram and this density function to evaluate whether it is reasonable to use this distributional assumption for your data. Describe how you would evaluate this assumption and make a guess about the conclusion.

3. (10%) Regardless of your answer to the prior question, suppose the travel time follows some distribution with both unknown mean and unknown standard deviation. Provide point estimates of the unknown mean travel time and the unknown standard deviation. Justify your estimates. (What statistical theory or what property of the estimators can support the use of your estimates?)

4. (5%) In addition to the point estimates you provided in the prior question, you also want to know how close your estimate is to the unknown mean travel time. What statistical theory enables you to make a probability statement about this thing you want to know? State this theory as explicitly as possible.

5. (10%) Calculate an approximate margin of error and provide a 95% confidence interval for the mean time to travel between the National Taipei University and the Banqiao Station.

6. (5%) If a 95% confidence level is required, what sample size do you need if you want to estimate the mean travel time with a margin of error of two minutes?

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