國立臺北大學 111 學年度日間學士班轉學生招生考試試題

學制系級：統計學系日間學士班 2、3 年級

科　　目：統計學

☑可　☐不可 使用計算機

1. A recent hypothesis states that vigorous exercise (劇烈運動) is an effective preventive measure for subsequent cardiovascular death. To test this hypothesis, a sample of 750 men aged 50–75 who report that they jog at least 10 miles per week is ascertained. After 6 years, 64 have died of cardiovascular disease.
   (a) Compute a 95% CI for the incidence of cardiovascular death in this group. (10%)
   (b) If the expected death rate from cardiovascular disease over 6 years in 50–75-year-old men based on large samples is 10%, then can a conclusion be drawn concerning this hypothesis from these data? (5%)

2. Will improving customer service result in higher stock prices for the companies providing the better service? "When a company's satisfaction score has improved over the prior year's results and is above the national average (75.7), studies show its shares have a good chance of outperforming the broad stock market in the long run." The average satisfaction scores of three companies for the 4th quarters of two previous years obtained from Customer Satisfaction Index are seen in the following table. Assume that these scores are based on a poll of 60 customers from each company. Because the polling has been done for several years, the standard deviation can be assumed to equal 6 points in each case. The procedure of the hypothesis testing is required for the following questions.

Company	Year 1	Year 2
A	73	76
B	75	77
C	77	78

   (a) For Company A, is the increase in the satisfaction score from year 1 to year 2 statistically significant? Use $\alpha = 0.05$. What can you conclude? (5%)
   (b) Can you conclude that the year 2 score for Company A is above the national average of 75.7? Use $\alpha = 0.05$. (5%)
   (c) When conducting a hypothesis test with the values given for the standard deviation, sample size, and $\alpha = 0.05$, how large must the increase from year 1 to year 2 be for it to be statistically significant? (7%)
   (d) Use the result of part (c) to state whether the increase for Company C from year 1 to year 2 is statistically significant. (3%)

3. A sale representative for a national clothing company makes 4 calls per day. Based on historical records, the following probability distribution describes the number of successful calls each day:

Successful Calls	Probability
0	0.10
1	0.30
2	0.30
3	0.20
4	0.10

   (a) Compute the probability that the sales rep will have a total of 2 successful calls in two-day period. (5%)
   (b) Compute the expected number of successful sales calls per day. (5%)
   (c) Compute the probability of having at least 2 successful calls in one day. (5%)

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4. Consider 3 populations. Given the following table.

	Populations		
Response	**1**	**2**	**3**
Yes	150	150	96
No	100	150	104

Use the above sample data to test the hypotheses

$H_0: p_1 = p_2 = p_3$

H_a: Not all population proportions are equal

where p_i is the population proportion of **Yes** responses for population i.

Using a 0.05 level of significance, what is the final conclusion? The procedure of the hypothesis testing is required. (15%)

5. To study the effect of temperature on yield in a chemical process, five batches were produced at each of three temperature levels, **50°C, 60°C and 70°C**. The incomplete table of analysis of variance is given in the following table.

(a) Fill out the parts with the question notations in the following table. (10%)

(b) Use a 0.05 level of significance to test whether the temperature level has an effect on the mean yield of the process. The procedure of the hypothesis testing is required. (10%)

Source of Variation	**Sum of Squares**	**Degrees of Freedom**	**Mean Square**	***F***	***p*-value**
Treatments	70	?	?	?	
Error	236	?	?		
Total	?	?			

6. Consider an experiment in which you roll a pair of dices. Suppose we are interested in the sum of the numbers displayed on two dices.

(a) What is the probability of getting the sum of the numbers to be 9? (5%)

(b) What is the probability of getting a value where the sum of the numbers is 10 or greater? (5%)

(c) The sum of the dice on each roll has six possible even numbers (2, 4, 6, 8, 10, and 12) and only five possible odd numbers (3, 5, 7, 9, and 11). The sum of numbers should be even more often than the sum of numbers being odd. Do you agree with this statement? Explain it. (5%)

$P(Z > z_\alpha) = \alpha$; $z_{0.05} = 1.645$; $z_{0.025} = 1.96$; $z_{0.0031} = 2.74$; $z_{0.3483} = 0.39$

$P(\chi^2 > \chi^2_\alpha(n)) = \alpha$; $\chi^2_{0.05}(10) = 18.307$; $\chi^2_{0.05}(2) = 5.99$; $\chi^2_{0.05}(6) = 12.592$;

$P(F > F_\alpha(n_1, n_2)) = \alpha$; $F_{0.05}(2,12)=3.885$; $F_{0.025}(2,10)=5.46$; $F_{0.025}(2,14)=4.857$; $F_{0.05}(6,12)=3$;

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