

# 國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：統計學【資管系碩士班乙組】

題號：442002

※本科目依簡章規定「不可以」使用計算機

共 2 頁 第 1 頁

全部計算題，共 100 分。

1. (每小題 5 分) An oil company is considering a prospect field for exploration. According to a geological assessment, there is a 20% chance that the field will produce oil. Further, there is an 75% that a particular well will strike oil given that oil is present in the prospect field.
  - (1) What extra information should we obtain to determine the probability that the prospect field will produce oil given the result of a drilled well?
  - (2) What are the reasonable assumptions about the extra information?
  - (3) Argue that based on the assumption in (2), if one well is drilled on the field and strikes oil, then oil is present in the prospect field definitely.
  - (4) Suppose that one well is drilled and it comes up dry. Another well on the field is then drilled and comes up dry too. What is the probability that the prospect field will produce oil? Assume that the results of these two drills are independent no matter the prospect field contains oil or not.
2. (每小題 5 分) Suppose that you roll a biased four-sided die that numbers from 1 to 4. The probability of a number shown is proportional to the number itself.
  - (1) Plot the probability distribution for the number shown after rolling. Compute the mean and the standard deviation of this distribution.
  - (2) Assume that you roll the die twice (sample size  $n=2$ ) to get a sample. List all possible such samples along with their associated probabilities.
  - (3) Find the possible values for the sample mean along with their associated probabilities.
  - (4) Plot the sampling distribution of the sample mean. Compute the mean and the standard deviation of this distribution.
  - (5) Compare the results of (1) and (4). With regard to the means of both distributions, what property do you observe? Which distribution has larger variance? How are their variances related?
3. (每小題 5 分) An investigation of ethnic differences in reports of pain perception was presented. A sample of 50 blacks and 160 whites participated in the study. Subjects rate (on a 13-point scale) the intensity and unpleasantness of pain felt when a bag of ice was placed on their foreheads for two minutes. The mean pain intensity for blacks was 8.0 and for whites, 6.8.
  - (1) Why is it dangerous to draw a statistical inference given the above information only?
  - (2) Give possible value of the missing sample standard deviation that would lead you to conclude (at  $\alpha = 0.05$ ) that blacks, on average, can stand for a pain intensity rating more than 7.5.
  - (3) What assumption(s) do you need to perform test in (2)?
  - (4) Give possible values of the missing sample standard deviations that would lead you to an inconclusive decision (at  $\alpha = 0.05$ ) regarding whether blacks or whites have a higher mean intensity rating.
4. (每小題 7 分) For each of the following hypothesis tests, identify what are the hypotheses, what kind of test can be used, what is the test statistic in the function form of the sample, what is the rejection region with appropriate degrees of freedom, and the assumptions behind each test.
  - (1) A pet food company is desired to know which product line, kidney- or shrimp-based cat foods, is of better quality. An experiment is conducted to compare the two products with a sample of 20 cats selected from the population at a local animal shelter. Ten cats were randomly assigned to each of the products being tested. Each of the cats was presented with 3 ounces of the selected food in a dish at feeding time. The researchers defined the variable to be measured as the number of ounces of food consumed within a 10-minute time interval right after the filled dish was presented.

# 國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：統計學【資管系碩士班乙組】

題號：442002

※本科目依簡章規定「不可以」使用計算機

共 2 頁第 2 頁

- (2) Shipments of meat, meat by-products, and other ingredients are mixed together in several filling lines at a pet food canning factory. Operations manager suspect that although the mean amount filled per can of pet food is usually stable, the variability of the cans filled in line A is greater than that of line B. A random sample of 10 8-ounce cans from line A and 12 8-ounce cans from line B is collected accordingly.
- (3) A bank branch located in a commercial district of a city had the business objective of improving the process for serving customers during the noon-to-1:00 P.M. lunch period. To do so, the waiting time (defined as the time the customer enters the line until he or she reaches the teller window) needs to be shortened to increase customer satisfaction. The previous standard waiting time is 5 minutes. A random sample of 15 customers during this hour is recorded over a period of a week.
- (4) An important quality characteristic used by the manufacturer of Boston asphalt shingles is the amount of moisture the shingles contain when they are packaged. Customers may feel that they have purchased a product lacking in quality if they find moisture and wet shingles inside the packaging. To monitor the amount of moisture present, the company conducts tests to measure the pounds of moisture per 100 square feet. It is desired that the mean moisture content is less than 0.35 pound per 100 square feet. A random sample of 36 measurements is recorded.
- (5) Nine experts rated four brands of Colombian coffee in a taste-testing experiment. A rating on a 7-point scale (1 = extremely unpleasing, 7 = extremely pleasing) is given for each of four characteristics: taste, aroma, richness, and acidity, and the summated rating, accumulated over all four characteristics represent the quality of a certain brand of Colombian coffee.