



National University of Ireland, Galway  
Ollscoil na hÉireann, Gaillimh

Summer Examinations 1999

## Applied Economic Techniques II — EC216

Second Arts

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Time allowed: THREE hours

Answer *ALL* questions in Part I (each worth 2 marks), *TWO* questions in Part II (each worth 30 marks), and *EIGHT* questions in Part III (each worth 12 marks). Notice, there are 180 marks and 180 minutes.

### Part I

For *ALL* of the following 12 statements indicate whether they are true or false. This part is worth 24 marks out of the total 180 marks.

- I – 1. In a distribution skewed left, one generally finds mean > median > mode.
- I – 2. Mutually exclusive events are independent.
- I – 3. If a null hypothesis is rejected at the 0.01 level of significance, it should also be rejected at the 0.05 level.
- I – 4. The expected value of the sample mean is the population mean.
- I – 5. A parameter is a measure computed from sample data.
- I – 6. The standard normal distribution has smaller dispersion than the  $t$  distribution.
- I – 7. If the probability of an event  $C$  is 0.4, the probability of the complement of  $C$  is  $(1 - 0.6)$ .
- I – 8. In regression analysis, the standard error of estimate,  $S_{YX}$ , must be positive.
- I – 9. If salaries are 50 percent of a company's expenses, then a pie chart of expenses would show  $50^\circ$  for salaries.
- I – 10.  $SST$  measures the variation within a treatment group.
- I – 11. At least 75 percent of the observations in any distribution lie within an interval of two standard deviations on either side of the mean.
- I – 12. A Type II error cannot be made if the null hypothesis is rejected

## Part II

Answer *TWO* of the following three questions. This part is worth 60 marks out of the total 180 marks.

- II - 1. A company manufacturing parts would like to develop a model to estimate the number of worker-hours required for production runs of varying lot size. A random sample of 14 production runs gives the following results for worker-hours,  $H$ , and lot size,  $L$  (measured in number of parts in the lot):

$$\begin{array}{lll} \sum H = 1,550 & \sum L = 700 & \sum LH = 88,480 \\ \sum H^2 = 193,402 & \sum L^2 = 40,600 & \end{array}$$

- Assuming a linear relationship, use the least squares method to find the regression coefficients of  $b_0$  and  $b_1$ , where you explain worker-hours using lot size as the explanatory variable.
  - Interpret the meaning of  $b_0$  and  $b_1$  in this model.
  - Use the regression model to predict the average number of worker-hours required for a production run with a lot size of 45.
  - Calculate the standard error of the estimate,  $S_{HL}$ , and the standard error for the slope,  $S_{b_1}$ .
  - Test at the .05 level of significance if there is evidence of a relationship between worker-hours and lot size.
- II - 2. A soft drink bottling company maintains records concerning the number of unacceptable bottles of soft drink obtained from the filling and capping machines. Based on past data, the probability that a bottle came from machine I *and* was nonconforming is .01 and the probability that a bottle came from machine II *and* was nonconforming is .025. Half the bottles are filled on machine I and the other half are filled on machine II.
- If a filled bottle of soft drink is selected at random, what is the probability that
    - it was filled on machine II?
    - it is filled on machine I *and* is a conforming bottle?
    - it is filled on machine I *or* is a conforming bottle?
  - Suppose we know that the bottle was produced on machine I. What is the probability that it is nonconforming?
  - Suppose we know that the bottle is nonconforming. What is the probability that it was produced on machine I?
  - Explain the difference in the answers to (b) and (c).

- II - 3. The engineering manager of Magnadynamics Electronic Division is trying to evaluate which of three engineering software packages to install for cost estimating on the work stations his engineers use. To test them, he acquires a copy of each software program. He then selects 12 engineers, randomly assigning 4 of the engineers to each of the 3 software programs, and measures the time required to perform specified cost estimates. The employees work independently of one another, so they do not have the opportunity to learn from one another. The estimating times (in minutes) are given in the table:

Software A	Software B	Software C
62	51	51
55	57	43
69	66	69
79	68	54

- State  $H_0$  and  $H_1$ .
- Develop the ANOVA table
- Test the null hypothesis at the .05 level of significance and interpret the results.

### Part III

Answer *EIGHT* of the following 10 questions. This part is worth 96 marks out of the total 180 marks.

III - 1. A new breakfast cereal is test-marketed for 1 month at stores of a large supermarket chain. The results for a sample of 16 stores indicate average sales of £1,200 with a sample standard deviation of £180. Set up a 99% confidence interval estimate of the true average sales of this new breakfast cereal.

III - 2. Under what circumstances will the coefficient of correlation be zero?

III - 3. Suppose that the following information is available for two groups:

$$n_1 = 16 \quad S_1^2 = 47.3 \quad n_2 = 13 \quad S_2^2 = 36.4$$

(a) At the .05 level of significance, is there evidence of a difference between  $\sigma_1^2$  and  $\sigma_2^2$ ?

(b) Suppose that we had wanted to perform a one-tailed test. At the .05 level of significance, what is the upper-tailed critical value of the  $F$ -test statistic to determine if there is evidence that  $\sigma_1^2 > \sigma_2^2$ ?

III - 4. Given the following set of data for a population of size  $N = 10$ :

7 5 11 8 3 6 2 1 9 8

(a) Compute the mean, median, standard deviation and coefficient of variation.

(b) Are these data skewed? If so, how?

III - 5. The director of admissions at a large university would like to advise parents of incoming students concerning the cost of textbooks during a typical semester. A sample of 100 students enrolled in the university indicates a sample average cost of £315.40 with a sample standard deviation of £43.20.

(a) Using the .10 level of significance, is there evidence that the population average is above £300?

(b) What will your answer be in (a) if the standard deviation is £75 and the .05 level of significance is used?

III - 6. The probability that a sales person will sell a magazine subscription to someone who has been randomly selected from the telephone directory is .20. If the salesperson calls 10 individuals this evening, what is the probability that

(a) no subscriptions will be sold?

(b) at least two subscriptions will be sold?

III - 7. A soft-drink machine is regulated so that the amount dispensed is normally distributed with  $\mu = 7$  ounces and  $\sigma = 0.5$  ounce. If samples of nine cups are taken, what value will be exceeded by 95% of the sample means?

III - 8. Suppose a marketing experiment is to be conducted in which students are to taste two different brands of soft drink. Their task is to correctly identify the brand tasted. If random samples of 200 students are selected and it is assumed that the students have no ability to distinguish between the two brands Based on past data, 30% of the credit card purchases at a large department store are for amounts above £100. If a random samples of 100 credit card purchases are selected

- (a) What proportion of the samples will to have between 50% and 60% of the identification correct?
- (b) Within what symmetrical limits of the population percentage will 90% of the sample percentages fall?

III - 9. A television manufacturer had claimed in its warranty that in the past not more than 10% of its television sets needed any repair during their first 2 years of operation. To test the validity of this claim, a government testing agency selects a sample of 100 sets and finds that 14 sets required some repair within their first 2 years of operation. Using the .01 level of significance,

- (a) Is the manufacturer's claim valid or is there evidence that the claim is not valid?
- (b) Compute the  $p$ -value and interpret its meaning.

III - 10. A professor of accountancy was studying the readability of the annual reports of two major companies. A random sample of 100 certified public accountants was selected. Fifty were randomly assigned to read the annual report of Company A, and the other 50 were to read the annual report of Company B. Based on a standard measure of readability, 17 found Company A's annual report "understandable" and 23 found Company B's annual report "understandable."

- (a) At the .10 level of significance, is there any evidence of a difference between the two companies in the proportion of CPAs who find the annual reports understandable?
- (b) Compute the  $p$ -value and interpret its meaning.