Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination

Strand 1

Sample Questions

Mathematics

Higher and Ordinary Level

Strand 1

Sample Questions

Mathematics

Higher Level

Question 1 **(25 marks)**

A survey of 50 Leaving Certificate candidates in 2014, randomly selected in the Dublin region, found that they had a mean mark of 374 in a certain subject. The standard deviation of this sample was 45.

(a) Find the 95% confidence interval for the mean mark in the subject, in the Dublin region. Interpret this interval.

(b) The mean mark in the subject for all Leaving Certificate candidates, in 2014, was 385 and the standard deviation was 45. John suggests that the mean mark in the Dublin region is not the same as in the whole country. Test this hypothesis using a 5% level of significance. Clearly state your null hypothesis, your alternative hypothesis and your conclusion.

Question 2 **(50 marks)**

The principal of a large school claims that the average distance from a student's home to the school is 3·5 km. In order to test this claim, a sample of 60 students from the school was randomly selected. The students were asked how far from the school they lived. The mean distance from these students' homes to the school is 3·7 km with a standard deviation of 0·5 km.

(a) Test the principal's claim using a 5% level of significance. Clearly state your null hypothesis, your alternative hypothesis and your conclusion.

(b) In the above sample of 60 students, 20% of them lived within 2·5 km of the school. Find the 95% confidence interval for the proportion of students from that school who live within 2·5 km of the school.

(c) Data from 10 years ago shows that, at that time, 26% of the student population lived within 2·5 km of the school. Is it possible to conclude, at the 5% level of significance, that the proportion of students living within 2·5 km of the school has changed since that time? Explain your answer.

Answer:

Reason:

(d) A statistician wishes to estimate, with 95% confidence, the proportion of students who live within a certain distance of the school. She wishes to be accurate to within 10 percentage points of the true proportion. What is the minimum sample size necessary for the statistician to carry out this analysis?

Question 3 **(25 marks)**

(a) The mean lifetime of light bulbs produced by a company has, in the past, been 1500 hours. A sample of 100 bulbs, recently produced by the company, had a mean lifetime of 1475 hours with a standard deviation of 110 hours. Test the hypothesis that the mean lifetime of the bulbs has not changed, using a 0·05 level of significance.

(b) Find the *p*-value of the test you performed in part **(a)** above and explain what this value represents in the context of the question.

p-value:

Meaning:

Question 4 **(50 marks)**

A car rental company has been using *Evertread* tyres on their fleet of economy cars. All cars in this fleet are identical. The company manages the tyres on each car in such a way that the four tyres all wear out at the same time. The company keeps a record of the lifespan of each set of tyres. The records show that the lifespan of these sets of tyres is normally distributed with mean 45 000 km and standard deviation 8000 km.

(a) A car from the economy fleet is chosen at random. Find the probability that the tyres on this car will last for at least 40 000 km.

(b) Twenty cars from the economy fleet are chosen at random. Find the probability that the tyres on at least eighteen of these cars will last for more than 40 000 km.

(c) The company is considering switching brands from *Evertread* tyres to *SafeRun* tyres, because they are cheaper. The distributors of *SafeRun* tyres claim that these tyres have the same mean lifespan as *Evertread* tyres. The car rental company wants to check this claim before they switch brands. They have enough data on *Evertread* tyres to regard these as a known population. They want to test a sample of *SafeRun* tyres against it.

The company selects 25 cars at random from the economy fleet and fits them with the new tyres. For these cars, it is found that the mean life span of the tyres is 43 850 km.

Assume that that the lifespan of the sets of *SafeRun* tyres is normally distributed and has a standard deviation of 8000 km. Test, at the 5% level of significance, the hypothesis that the mean lifespan of *SafeRun* tyres is the same as the mean lifespan of *Evertread* tyres. State clearly what the company can conclude about the tyres.

Strand 1

Sample Questions

Mathematics

Ordinary Level

Question 1 **(25 marks)**

A survey is being conducted of voters' opinions on several different issues.

(a) What is the overall margin of error of the survey, at 95% confidence, if it is based on a simple random sample of 1111 voters?

(b) A political party had claimed that it has the support of 24% of the electorate. Of the voters in the sample above, 243 stated that they support the party. Is this sufficient evidence to reject the party's claim, at the 5% level of significance?

Question 2 **(25 marks)**

(a) A widget-manufacturing company repeatedly asserts that 80% of traders recommend their brand of widget. In a survey of 40 traders, 24 said that they would recommend the company's widget. Use a hypothesis test at the 5% level of significance to decide whether there is sufficient evidence to reject the company's claim. State clearly the null hypothesis and your conclusion.

(b) A large group of students has a mean height of 170 cm with a standard deviation of 14 cm. The heights of these students are normally distributed. Use the empirical rule to find a height interval that will contain the heights of approximately 95% of the students.

Note to readers of this document:

These sample questions are intended to help teachers and candidates prepare for the June 2015 and subsequent examinations in *Mathematics*.

In 2015 and subsequent years, Leaving Certificate Mathematics papers at Higher and Ordinary Level will contain two sections.

Section A of the examination paper will consist of six questions, each carrying 25 marks. There will no longer be a choice within Question 6.

Section B will consist of two, three, or four questions. These questions will not necessarily carry equal marks. The number of marks for each will be stated on the examination paper. The total number of marks for Section B will be 150.