

1. In previous IB examinations for Estonian A1 language it has been found the students mean average mark is 58%, with a variance of 81, with the results being distributed normally.

In 2007 the cohort had a mean average mark of 75%. The chief examiner is confident that the examination is of similar standard to previous years, and therefore claims that the 2007 cohort are of a better standard.

- a) State a null and alternate hypothesis for the chief examiner's claim.
 - b) Find the z-value of your test.
 - c) State your conclusion using a significance level of,
 - i) 10%,
 - ii) 5%,
 - iii) 1%.
2. A coin is thought to be biased in favour of heads. An experiment is carried out by flicking the coin 200 times. 110 heads are recorded.
- a) State suitable hypotheses.
 - b) Calculate the expected mean and variance.
 - c) Calculate the z-value of your test.
 - d) Stating the critical value at the 5% level of significance, draw a suitable conclusion to the test.
3. Mercury chocolate produce the famous Tit-Tat bar. Mercury claim that each bar produced has a mean weight of 220g and a variance of 100g. The consumer group, What Chocolate?, do not believe the claims made by Mercury. What Chocolate? carried out a test on 50 bars of Tit-Tat and found the mean average weight to be 197g.

Showing clearly all your working, including suitable hypotheses, carry out a suitable test at the 5% level of significance to test whether or not Mercury's claims are false. You may assume that this test is 1-tailed.

4. The battery life of an E-pod MP3 player is known to be normally distributed with a mean of 4000 hours and a variance of 2500 hours.

The maker's of E-pod, Raspberry, believe that the battery life of the second generation E-pod do not have the same mean. They test a large number of batteries and record a sample life span of x hours.

- a) This test will be a two-tailed test. Explain why.
 - b) State suitable hypotheses.
 - c) Write down the calculation required to find the z -value for this test.
 - d) Write down the critical values when this test is carried out at the 5% level of significance.
 - e) If the sample life span (x) is 4100 hours, find a conclusion to your test.
 - f) Explain how this may affect the claims by Raspberry.
5. A roulette wheel in a Casino is thought to be biased. A consumer group claims that the ball will fall in the white 0 more times than it should.

A roulette wheel has 35 numbers, with the numbers from 0 to 34 inclusive. Each number should have a equally likely chance of the ball landing in it.

The consumer group carry out 350 spins of the wheel and the ball lands in the 0 a total of 16 times. Carry out a suitable test at the 5% level of significance, to check if the roulette wheel is biased.

Explain the implications of your conclusion for the casino.

Answers

1. a) $H_0 : \mu = 58\%$
 $H_1 : \mu > 58\%$
- b) $z = 1.89$
- c) i) Reject H_0 in favour of H_1 .
ii) Reject H_0 in favour of H_1 .
iii) Do not reject H_0 in favour of H_1

2. a) $H_0 : \mu = \frac{1}{2}$
 $H_1 : \mu > \frac{1}{2}$
- b) $E(X) = 100$ $V(X) = 50$
- c) $z = 1.414$
- d) Critical value = 1.645.
Do not reject H_0 in favour of H_1 .

3. $H_0 : \mu = 220g$
 $H_1 : \mu < 220g$

$$z = -2.3$$

Critical value = -1.645.
Reject H_0 in favour of H_1 .

Hypothesis testing

IB HL Stats Option

4. a) Claims (or doubts) do not state whether the mean life span of battery has increased or decreased.

b) $H_0 : \mu = 4000$

$H_0 : \mu \neq 4000$

c) $z = \frac{x - 4000}{50}$

d) Critical values are -1.96 and 1.96.

e) $z = 2$, therefore reject H_0 in favour of H_1 .

5. $H_0 : \mu = \frac{1}{35}$

$H_1 : \mu > \frac{1}{35}$

$X \sim N(10, 9.714)$

$z = 1.925$

Critical value = 1.645

Reject H_0 in favour of H_1 .

The casino must realign its wheel, as at this level of significance there is sufficient evidence to suggest that it is biased.