Home assignment

Problem 1. The following are the weaning weights (in pounds) of lambs in a large flock.

68 79 93 67 73 81 82 81 85 78
72 69 64 82 77 59 68 54 71 57
88 97 69 60 92 62 64 64 90 60

a. Estimate the mean and standard deviation of weight of weaning.

b. Draw a histogram to see the shape of the weaning weight distribution. Try different grouping intervals of equal length. Does the distribution look normal?

c. What is the standard error of the population mean estimate?

Problem 2. The population distribution of IQ is normally distributed with mean 100 and standard deviation 15. That is $\frac{X-100}{15}$ has the standard normal distribution if X is the IQ of a randomly chosen man. Compute

a. The proportion of people with IQ below 85.

b. The proportion of people with IQ above 145.

c. The proportion of people with IQ between 85 and 115.

Problem 3. A biologist studying the sex ratio in a population of rare insects counted 46 males and 35 females.

a. What is a null hypothesis of interest?

b. State a two-sided and a one-sided alternative hypotheses.

c. Find the two-sided and one-sided P-values of the test. Would you reject the null hypothesis?

ANSWERS

1a. $\bar{X}$=73.53, s^2=137.64, s=11.73

1b. Use, for example, intervals 51-60, 61-70, 71-80, 81-90, 91-100.
Looking at this histogram it is difficult to say if the distribution is normall.

1c. $s_{\bar{X}}$=2.14.

2a. 15.87%

2b. 0.13%

2a. 68.26%

3a. Parametric statistical model: the number of males in a sample of size $n = 81$ is $X \in \text{Bin}(81, p)$. In terms of the model a natural null hypothesis is H_0: $p = 0.5$ (sex ratio is 50:50).

3b. Two-sided H_1: $p \neq 0.5$, one-sided H_1: $p > 0.5$.

3c. Apply the large sample test for population proportion with H_0: $p = 0.5$. Observed Z-score: $Z = \frac{46-81\cdot0.5}{\sqrt{81\cdot0.5\cdot0.5}} = 1.22$.

One-sided P-value $P_1 = 1 - 0.8888 = 0.1112$, two-sided P-value $P_2 = 0.2224$.

Conclusion: do not reject H_0 since the deviation from the 50:50 sex ratio is not significant (P-value is larger than 5%).