

7B Hypothesis Test for the Mean of a Normal Distribution with Unknown Variance

Test statistic and its distribution under H_0 :

Formulae for $\bar{X}$ and s^2 :

Steps for the test:

- 1
- 2
- 3
- 4
- 5
- 6
- 7

1. A shopkeeper sells jars of jam. The weights of the jars of jam are normally distributed with a mean of 150 g. A customer complains that the mean weight of 8 jars she had bought was only 147 g. An estimate for the standard deviation of the weights of the 8 jars of jam calculated from the 8 observations was 2 g.
 - a) Test, at the 5% significance level, whether 147 g is significantly less than the quoted mean.

- b) Discuss whether the customer has cause for complaint.

2. The temperatures ($^{\circ}\text{C}$) were measured at noon on 10 days during the month of March in West Cumbria. The readings were:

12.8 11.4 12.9 15.1 15.4 13.5 14.9 15.0 16.0 15.8

Using a 5% significance level, test whether or not this is an increase over the previous year when the average noon day temperature was 13.5°C .

3. A concrete manufacturer tests cubes of its concrete at regular intervals, and their compressive strengths in N m^{-1} are determined. The mean value of the strengths is required to be 0.47 N m^{-1} . A new supplier of cement offers to supply the firm at a cheaper rate than the present supplier, and a trial bag of cement is used to make 12 concrete cubes. Upon testing, these cubes are found to have strengths (x) such that $\sum x = 5.52$ and $\sum x^2 = 2.542$. Assume that the strengths are normally distributed.

- a) Stating your hypotheses clearly, test, at the 5% level of significance, whether or not the use of the new cement has altered the mean strength of the concrete.

- b) In the light of your conclusion to the test in part a, what would you recommend the manufacturer to do?