

Section 1: Using the Normal distribution

Exercise level 2

1. Packets of cereal are claimed to have a weight of 500 g. The standard deviation is known to be 5 g. An inspector wants to find out if the packets are underweight. She weighs 15 packets of cereal and finds that they have a total weight of 7458 g. Carry out a hypothesis test at the 2% level.
2. A machine is set to produce rods of length L cm, with the distribution $L \sim N(10.6, 0.8)$. A quality control check on 50 rods showed a mean length of 10.79 cm. Carry out a test at the 10% significance level to find out whether the machine should be recalibrated.
3. The lengths of metal rods produced by a particular machine have been Normally distributed with mean 65 cm and standard deviation 6 cm. A statistical test is conducted on a randomly chosen sample of 25 rods. What would be the critical regions in testing
 - (i) whether the rods are now shorter, using the 5% significance level?
 - (ii) whether the lengths of the rods have altered, using the 2% significance level?
4. A particular type of light bulb is supposed to last on average for 1050 hours. The manufacturer claims that he has improved the quality of the light bulbs so that on average they now last for more than 1050 hours. In order to test this claim, at the 5% significance level, the retailer takes a random sample of 50 bulbs, which gave a sample mean lifetime of 1065 hours. Assume that the lifetimes of the bulbs are Normally distributed with standard deviation 69 hours.
 - (i) State the null and alternative hypotheses.
 - (ii) Calculate the p -value.
 - (iii) State whether the manufacturer's claim is justified.
5. It has been found from experience that a particular type of thread has breaking strengths that are Normally distributed with mean 11.9 N and variance 4.3 N^2 . In a random sample of 40 threads, taken from a large batch of recently produced threads, the mean breaking strength was found to be 11.2 N. Test, at the 5% significance level, whether there has been a change in the breaking strength of this type of thread.