Continuous Hypothesis Testing

1. Over the last 500 years the average IQ at a school has been 123, with a standard deviation of 8. A new teacher has been at the school for a week and has a suspicion that current IQs have dropped. A sample of 40 students is selected and the mean of their IQs is 121.2. Carry out a test at the 10% level to see if the new teacher's suspicions are valid.

2. A machine produces metal bolts. The length of these bolts is normally distributed with mean length 12cm and variance 0.25cm^2. The factory foreman has a hunch that the machine is no longer producing bolts of the right length. A sample of 10 is taken and their mean length is found to be 12.3cm. Carry out a test at the 5% level to test whether the foreman is correct in his hunch.

3. A farmer has tended to pigs for years. He has noted that over time the average mass of a grown pig is 130kg with standard deviation 10kg. This year the farmer has used a new feed for the pigs and he believes that this has increased the mass of his pigs. A sample of 35 pigs is taken and their average mass is found to be 134.9kg. Carry out a test at the 1% level to test if the farmer is right.

4. A factory produces resistors. The output is supposed to produce resistors with mean resistance 18Ω and standard deviation 0.5Ω. It may be assumed that the resistances follow a normal distribution. There is a concern that the factory is now producing resistors which have too little resistance. A sample of 14 resistors is taken and the mean resistance found to be 17.7Ω. Carry out a hypothesis test at the $2\frac{1}{2}$% level to see if this concern is valid.