EdExcel Statistics 1

The Normal Distribution

Section 1: Introduction to the Normal distribution

Exercise

1. Assuming that the distribution of heights of girls at a particular age may be modelled by a Normal distribution with mean 144.0 cm and standard deviation 5.0 cm, find the probability that a girl selected at random is
   (i) under 150 cm
   (ii) over 146 cm
   (iii) at least 136 cm
   (iv) under 140 cm

2. The lengths of a machined component may be modelled by a Normal distribution with mean 12.7 cm and standard deviation 0.75 cm. Find
   (i) the proportion shorter than 12.0 cm
   (ii) the proportion within 0.4 cm of the mean
   (iii) the proportion between 12.5 cm and 13.5 cm.

3. The lifetime of an electrical component may be modelled by a Normal distribution with mean 2500 hours and variance 900 hour^2.
   (i) Find the probability that a component lasts
      (a) more than 2520 hours
      (b) less than 2470 hours
      (c) between 2488 and 2509 hours
   (ii) How long would you expect
      (a) 35% of the components to last
      (b) 50% of the components to last
      (c) 80% of the components to last.

4. The length of a component may be modelled by a Normal distribution with standard deviation 3 cm. 15% of the components are longer than 16 cm. Calculate the mean length and the percentage longer than 12 cm.

5. The weight of the contents of a jar may be modelled by a Normal distribution. 18% weigh more than 428g and 30% more than 416g. Find the mean and standard deviation of the weight.

6. Assume that the lifetime of a certain type of light bulb may be modelled by a Normal distribution. It is found that 7% of the bulbs last for more than 1230 hours and 12% for less than 1070 hours. What are the mean and standard deviation of the lifetime of these bulbs?

7. The quartiles of a Normal distribution are known to be 35 and 53. Find the mean and variance of the distribution.

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8. Packets of currants are nominally 500g in weight. The actual weights may be modelled by a Normal distribution with mean 508.3g and standard deviation 4.8g.
   What is the probability that a packet is underweight?
   If an adjustment can be made to the machine which alters the mean but leaves the standard deviation unchanged, what should be the new mean weight if less than $\frac{1}{2}$% of the packets are to be underweight?

9. A factory produces a very large number of rods. The lengths of these rods may be modelled by a Normal distribution with 30% of them measuring 30.6 cm or more and 15% of them measuring 29.2 cm or less.
   (i) Write down two simultaneous equations for the mean and standard deviation and solve them.
   (ii) Hence estimate the proportion of rods which measure 29.9 cm or more.
   (iii) The rods are acceptable if they measure between 29.8 cm and 30.5 cm. What percentage are rejected as being outside the acceptable range?