

### CIMT Further Statistics p150 Activity 3

a)  $X$  = mass of cereal in packet

$$E(X) = 500 \text{ and } \text{Var}(X) = 3^2$$

Samples of size  $n = 4$

We assume that  $X$  is distributed normally

$$X \sim N(500, 3^2)$$

$$\bar{X} \sim N\left(500, \frac{3^2}{4}\right) \text{ where } \bar{X} = \text{mean of percentages from sample of size 4}$$

$$UCL = 500 + 3\sqrt{\frac{3^2}{4}} = 504.5$$

$$UWL = 500 + 2\sqrt{\frac{3^2}{4}} = 503.0$$

$$LWL = 500 - 2\sqrt{\frac{3^2}{4}} = 497.0$$

$$LCL = 500 - 3\sqrt{\frac{3^2}{4}} = 495.5$$

b)

We bear in mind the following Western Electric Company Rules for Control Charts:

- Any single data point falls outside a  $3\sigma$  limit
- Two out of three consecutive points fall beyond the same  $2\sigma$  limit
- Four out of five consecutive points fall beyond the same  $1\sigma$  limit
- Eight consecutive points fall on the same side of the centre line

i) sample mean = 498.75

This value is between the two  $2\sigma$  limits, so no action is required

ii) sample mean = 494

This value is below the  $-3\sigma$  limit, so the process is now out of control and production should be halted and the problem investigated.

iii) sample mean = 503.5

This value is between the  $+2\sigma$  and  $+3\sigma$  limit, so watch with caution the next mean sample. If it is also between the  $+2\sigma$  and  $+3\sigma$  limit, then by WECO rules, production should be halted and the problem investigated.

iv) sample mean = 500.75

This value is very close to the target value, and not outwith an prescribed limited.

No action is required.