Answer on Question #80468 – Math – Statistics and Probability

Question

Automatic machinery is used to fill and seal 10kg bottles of a certain liquid soap. The process standard deviation is 0.20kg. To ensure that every bottle meets or exceeds this 10.0kg minimum, the company has set a target value of the process of 11.0kg.

(i) At this process average of 11kg, what percent of the bottles will have less than 10.5kg of the soap? Assume contained weights are normally distributed.

(ii) If the quality control section samples these bottles in subgroups of four, what will 3 control limits be for the charts?

(iii) Assuming that natural tolerances limits on the process cover virtually all of the filled bottles of soap, what is the minimum value to which the process average may be lowered in order to ensure that virtually no bottle are filled with less than a minimum of 10kg?

Solution

(i) $P(X < 10.5) = P\left(Z < \frac{10.5-11}{0.2}\right) = P(Z < -2.5) = 0.0062.$

(ii) $LCL = \mu - 3\frac{\sigma}{\sqrt{n}} = 11 - 3 * \frac{0.2}{\sqrt{4}} = 10.7.$

$UCL = \mu + 3\frac{\sigma}{\sqrt{n}} = 11 + 3 * \frac{0.2}{\sqrt{4}} = 11.3.$

(iii) $X - \mu < -3\sigma \;\rightarrow\; \mu > X + 3\sigma = 10 + 3 * 0.2 = 10.6.$