3. Assuming a value of 7.3 [mm] for σ, use the Normal table to predict the proportion of clips whose gaps fail to meet the specification limits of 50[mm] to 90[mm]

   - when the process mean is 74[mm],
   - when the process mean is 67[mm].

   Solution:

   - *The process to meet the specification means that* $(50-74)/7.3 < (X-74)/7.3 < (90-74)/7.3$, *so that we need to find frequencies at which standardized date* Z *are between* -3.287671 *and* 2.191781 *which from the tables can be found as* $0.9857 - 0.0005 = 0.9852$. *So the percentage of items that will fail is* 1.48%.
   - *We process similarily and take* $(50-67)/7.3 < (X-67)/7.3 < (90-67)/7.3$, *so that we need to find frequencies at which standardized date* Z *are between* -2.3287 *and* 3.1506 *which from the tables can be found as* $0.9992 - 1 + 0.9901 = 0.9893$. *So the percentage of items that will fail is* 1.07%.

Full Workings

- The mean is 74 and the standard deviation 7.3. We want to work out the non-conformance rate if the control limits are set at 50 and 90. Firstly we determine the standardised control limits for the process will therefore be given by:

$$SLL = \frac{50-74}{7.3} \qquad SUL = \frac{90-74}{7.3}$$

$$SLL = -3.29 \qquad SUL = 2.19$$

The area of the blue "tails" in the graph on the following page that occur outside the specification limits are given by the following equation:

$$Area = [1 - Z(2.19)] + [1 - Z(3.29)]$$

$$Area = [1 - 0.9857] + [1 - 0.9995]$$

$$Area = [0.0142] + [0.0005]$$

$$Area = 0.0147$$

So the non-conformance rate is 1.47%. This translates to around 147 items per 10,000.

- The mean is 67 and the standard deviation 7.3. We want to work out the non-conformance rate if the control limits are set at 50 and 90. Firstly we determine the standardised control limits for the process will therefore be given by:

$$SLL = \frac{50 - 67}{7.3} \qquad SUL = \frac{90 - 67}{7.3}$$

$$SLL = -2.33 \qquad SUL = 3.15$$

The area of the red "tails" in the graph on the following page that occur outside the specification limits are given by the following equation:

$$Area = [1 - Z(2.33)] + [1 - Z(3.15)]$$

$$Area = [1 - 0.9901] + [1 - 0.9992]$$

$$Area = [0.0099] + [0.0008]$$

$$Area = 0.0107$$

So the non-conformance rate is 1.07%. This translates to around 107 items per 10,000.