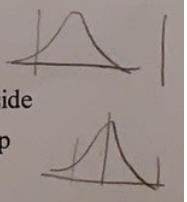
2019品質管制 第一次期中考

1. (20%) Control charts are to be constructed for a process turning the outside diameter of a cylinder. The diameter has specifications of 4.500 ± 0.050 centimeters.
   (a) If $\Sigma\bar{X} = 157.85175$ centimeters and $\Sigma R = 2.18750$ centimeters for 35 samples of size $n = 5$, calculate the centerlines and control limits for the control charts.
   (b) Assume that the charts show that the process is in good statistical control. What percent of the parts produced will be within tolerances if this process continues under a constant system of common causes and can be approximated by the normal distribution?
   (c) What percent will be within the specifications if the process were to be centered at the prescribed nominal?
   (d) Graphically show the situations in parts (b) and (c) in terms of the distributions of the individual measurements.

2. (15%) Control charts for $\bar{X}$ and s are maintained on the shear strength in pounds of test spot welds. The subgroup size is 4 (spot welds). Values of $\bar{X}$ and s are computed and plotted for each subgroup. After 25 subgroups, $\Sigma\bar{X} = 13{,}050.00$ and $\Sigma s = 660.00$.
   (a) Compute the values of 3-sigma limits for the $\bar{X}$ and s charts, and estimate the value of σ on the assumption that the process is in statistical control.
   (b) If the process generates a normal distribution of shear strengths, what proportion of the spot welds do not meet a minimum shear strength of 450?

3. (15%) $\bar{X}$ and R charts have been maintained on a certain quality characteristic. All points have fallen within control limits on both charts. A sudden change in the process occurs that decreases μ by 1.0σ but does not change σ. In answering the following questions, assume that the quality characteristic is normally distributed both before and after the change and that the control limits are based on observations made before the shift in process centering.
   (a) Approximately what percentage of points would you expect to fall outside control limits on the $\bar{X}$ chart because of the change in μ if the subgroup size is 2?
   (b) Answer the same question assuming that the subgroup size is 4, and 8.
   (c) Relate the answers to the above questions to Type II error and the effect of subgroup size on the detection of shifts in μ on the $\bar{X}$ chart.



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