

Assignment 3

A3 – 1. Listed below are the defects identified by 100% inspection of the first 19,986 plastic trim items produced at XYZ Automotive; a legend for the six defect codes is given at the right below the lists. The first day's production was 12,439 items and the second day's was 7,547 – there was a breakdown in the process at 11.34 a.m. on the second day.

January 5: A B C C E E A E A B A B C D B C A E A C C C E C C C C E C E
 E E D B A C C C C C D A C C E A D B C E B A D B D C B C C A
 E A A E D C D C C A B C
 (OPERATOR TEMPORARILY REPLACED)
 B E A E E E E D E E E C E E E E E E E C E D E E D D E C D E
 D E E E E E E E E E E D E E E E E E E E E E D D E E E E D
 E E E D E E E E E E E E E D E E D

January 6: E D C C C E A C E E C F C E E E B E E E E D A B E C E E C E
 B C E E E C E E E F E C E E E C E E E B F E B E E B E A E F
 E C B E E A E E D D E E E B E E E E E C C E C C A B E C C
 E E B E E E E

- (a) Carry out a Pareto analysis on each day's production.
- (b) Compare the two Pareto diagrams; comment briefly on important similarities and differences.
- (c) A replacement operator was called in at short notice just before noon on January 5, but on January 6 the regular operator returned; examine the January 5 data for evidence of an operator effect. Briefly explain your findings.
- A unfill on outer surface
 B unfill on inner surface
 C visual defect on outer surface
 D colour out of specification
 E surface scratch
 F other

A3 – 2. *Coffee doesn't taste the way it used to.* said one member of the coffee club. *The coffee is strong enough but it doesn't have the taste I like any more.* Using **brainstorming** (preferably with a group of up to four other members of the class), make a cause-and-effect diagram to properly display factors that might be responsible for these comments. Assume a domestic electric coffee maker is used, and add any relevant additional comments below your diagram.

NOTE: Clearly indicate either the names of the members of your group or that you worked alone.

A3 – 3. A sample of 200 braces is obtained by equiprobable selecting from a supplier's latest shipment and each brace is measured; the data are tabulated below. The print calls for 92-108 cm.

- (a) Suggest how *equiprobable* selecting might be implemented in practice in a situation like this.
- (b) Construct an appropriate histogram of the data.
- (c) On the basis of your histogram, comment briefly on the supplier's manufacturing process.

100.2	99.8	101.5	98.9	97.1	99.6	98.2	106.0	101.4	101.5	93.6	103.9	106.4	104.7	103.0	93.9	97.6	100.5	94.9	100.6
97.0	102.7	94.2	105.1	101.3	98.8	102.9	104.8	95.1	99.5	104.2	93.5	103.2	101.0	99.1	101.7	103.1	105.8	103.3	102.4
93.0	101.0	99.6	99.3	103.1	105.4	105.7	100.9	99.7	103.3	94.7	103.8	100.2	98.3	100.5	102.5	93.3	102.4	94.8	103.3
102.3	98.2	99.8	101.5	100.6	98.8	100.2	100.4	99.4	101.4	97.2	101.1	96.7	99.7	99.9	106.8	104.9	100.4	95.2	94.2
93.2	100.9	100.3	99.8	94.8	97.9	100.3	101.1	93.8	105.6	92.7	98.1	102.1	101.3	95.0	97.4	101.7	104.1	105.0	98.4
92.9	106.9	101.6	100.7	98.5	98.2	97.8	93.0	98.0	105.1	96.3	106.6	98.1	98.0	100.6	101.2	100.5	93.5	99.0	97.4
105.8	100.0	97.6	98.9	104.0	96.0	98.7	99.9	104.3	102.6	106.7	98.5	95.7	102.0	100.4	98.6	103.7	101.0	98.1	99.4
99.4	100.9	98.2	102.7	98.4	102.6	96.9	103.4	102.9	96.3	106.8	106.2	100.4	102.8	101.9	97.3	101.4	104.6	100.1	99.2
101.0	94.5	99.6	106.7	101.1	101.6	100.8	99.3	101.4	96.8	96.4	94.4	101.6	102.8	98.6	98.7	101.6	94.1	100.2	99.0
102.7	98.6	97.3	92.8	97.8	105.5	96.7	92.5	93.1	100.2	106.1	101.8	97.8	98.5	103.5	97.7	99.7	98.4	104.4	100.7

A3 – 4. The diameter of a production lot of rotor shafts has an average of 0.239 cm and a standard deviation of 0.003 cm. Calculate a specification such that 99.7% of production will fall within the specification limits. State clearly any assumption(s) underlying your calculations.

A3 – 5. Monitoring over time of the amount of swell of plastic rods coming from an extruder has found it is stable with an average of 13.9% and a standard deviation of 0.55%; histograms have shown that the pattern of variation of the percentage swell can be modelled by a normal distribution. The specification limits for the swell are 12.0-15.0%.

- (a) Find the proportion of the production that is out of specification. In a production run of 10,000 rods, how many would be expected to be out of specification?
- (b) Suppose that the average percentage swell could be altered from 13.9% to 13.5% by adjusting the process, what proportion of the production would be out of specification? State clearly any assumption(s) involved in your calculation. Give a simple graphical portrayal of the situation before and after adjustment.
- (c) Suppose that the *next* swell reading after the process has supposedly been adjusted as in (b) is 15.4%. What Answer can reasonably be given to the Question about the value of the process average? Show your reasoning clearly.