Control charts by Attributes

This form of inspection is where the items comprising the sample are classified into two factions:
- "Acceptable"
- "Non-acceptable"

control charts by attributes
- The fraction defective chart (p-char) which records the proportion of defective items in a sample.
- The number defective chart (np-chart) which records the no. of defective charts.
- The defects chart (c-chart)

Attributes:
(Binary ; Yes/No ; ho/No-go info)

Steps to construct p-chart

The data on sample-wise number of defectives are collected, entered in a data sheet and checked for its consistency. The average proportion defective $\bar{p}$ for all the samples together is calculated as

$$\bar{p} = \frac{\text{Total no. of defectives}}{\text{Total no. of pcs of inspected samples}}$$

Find $\bar{n}$ from Σn_i / Total no. of samples and replace n by $\bar{n}$ in the so formula

Find $CL_p = \bar{p}$

Find UCL_p & LCL_p deviations within 3σ deviation as

$$\bar{p} \pm .3\sqrt{\frac{\bar{p}(1-\bar{p})}{\bar{n}}}$$

$$\bar{p} = \frac{\text{Total no. of defectives}}{\text{Total no. of pcs of inspected samples}}$$

$$\bar{n} = \frac{\sum n_i}{\text{Total no. of sample}}$$

$$CL_{\bar{p}} = \bar{p}$$

problem

Q.

Samples	No. of defectives (p)	No. of item in each sample	Fraction defective
1	3	20	3/20 = 0.15
2	2	20	0.1
3	1	20	0.05
4	1	20	0.05
5	2	20	0.1

$$n =$$ $$\bar{p} = \frac{100}{9}$$ $$\bar{n} = 20$$

Ans.

$$\bar{p} = \frac{3+2+1+1+2}{20\times5} = \frac{9}{100}$$

$$\&\&\& \quad \bar{n} = \frac{100}{5} = 20$$

$$CL_p = \frac{9}{100}$$

$$LCL_p = \left[\frac{9}{100} - 3\sqrt{\frac{\frac{9}{100}\left(1-\frac{9}{100}\right)}{20}} \right] < 0$$

$$\therefore \quad LCL_p = 0$$

$$UCL_p = \left[\frac{9}{100} + 3\sqrt{\frac{\frac{9}{100}\left(1-\frac{9}{100}\right)}{20}} \right]$$

$$= 0.282$$

Q2. Six consecutive lots received from a vendor were inspected by sampling process, Incoming inspection of the buyer. Sample lot was varying as per the variation in the lot size. The inspection results are as follows :-

Construct ~~the~~ a control chart for fraction defective & no. of defectives :-

Sample no	1	2	3	4	5	6
Lot size	2850	1860	480	970	4385	2568
Sample size	125	125	50	80	200	125
No. of defectives	1	3	–	2	4	1
Fraction defective	0.008	0.024	0	0.025	0.02	0.008

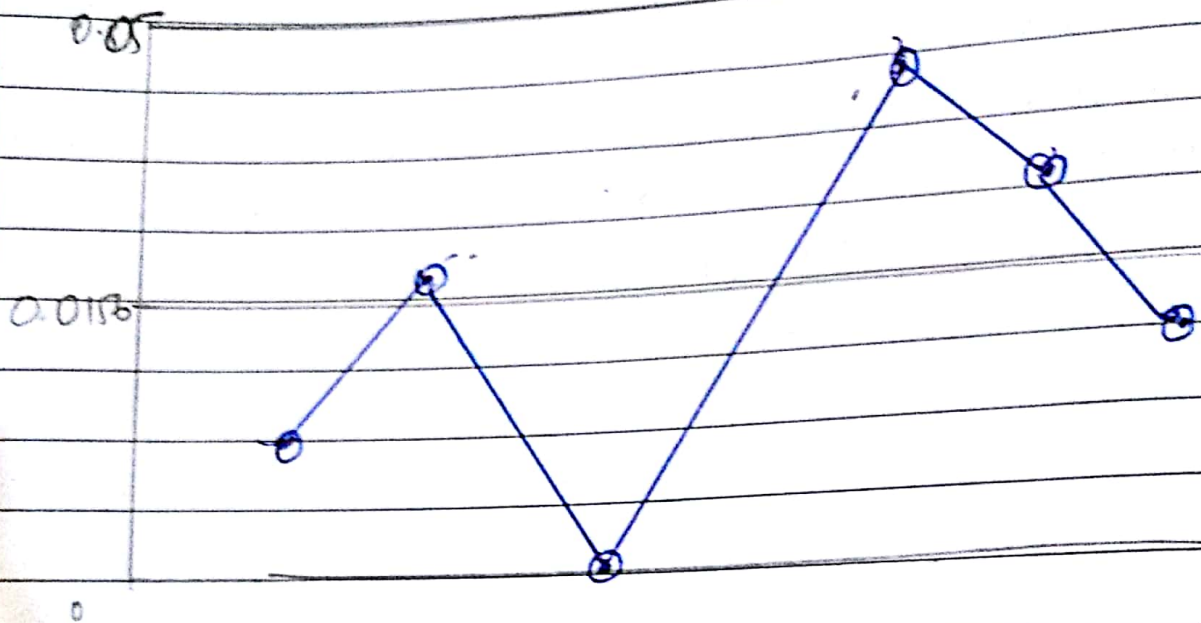$$\bar{P} = \frac{1+3+2+4+1}{125+125+50+80+200+125} = \frac{11}{705} = 0.0156$$

$$\bar{n} = \frac{705}{6} = 117.5$$

$$CL = 0.0156$$

$$UCL_p = \bar{P} + 3\sqrt{\frac{\bar{P}(1-\bar{P})}{\bar{n}}} = 0.0499$$

$$LCL = 0$$

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0.05

0.0156

0

np chart

$$CL_{np} = \bar{n}\cdot\bar{p} = 0.016 \times 117.5 = 1.88$$

$$UCL_{np} = \bar{n}\cdot\bar{p} + 3\sqrt{\bar{n}\bar{p}(1-\bar{p})}$$

$$= 1.88 + 3\sqrt{.016 \times 117.5(1.0 \times 0.016)}$$

$$= 5.96$$

$$LCL_{np} = 1.88 - 4.08 = 20$$

np - chart

Control limits of c-chart

Central line, $cl_c = \bar{c}$

since value of c can never be -ve, we take as ⊖ when
-ve

$$UCL_c = \bar{c} + 3\sqrt{\bar{c}}$$

$$LCL_c = \bar{c} - 3\sqrt{\bar{c}}$$

Q Ten wooden carpets were studied for total no of defects in
their texture. The details of defects are :-

Carpet No	No. of defects
1	2
2	4
3	3
4	5
5	1
6	3
7	2
8	3
9	4
10	3

All ten carpets are however were regarded as acceptable by
the QC of the company. Construct a control chart for no.
of defects and comment.

Central line $(\bar{c}) = \dfrac{\text{Total no. of defects}}{\text{Number of carpets}} = \dfrac{30}{10} = 3$

$UCL_c = \bar{c} + 3\sqrt{\bar{c}} = 3 + 3\sqrt{3} = 8.2$

$LCL_c = \bar{c} - 3\sqrt{\bar{c}} = 3 - 3\sqrt{3} = 0$