Rectifying Inspection Plans

Semester IV

STAT CC410

Unit 3

- Rectifying Inspection Plan
- Average Outgoing Quality Limit (AOQL)

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Rectifying Inspection Plan

Definition: In this method, lot by lot sampling is done in which a specified quality objective is attained through corrective inspection of rejected lots.

- The inspection of the rejected lots and replacing the defective pieces found by the good ones eliminates the number of defectives in the lot to a great extent and thus improving the lot quality.
- These plans are called Rectifying Inspection Plans and it was given by Harold F. Dodge and Harry G. Romig of the Bell Telephone Laboratories before World War II.
- These plans enables the manufacturer to have an idea about the average quality of the product at a given stage of manufacture through the combination of production, sampling inspection and rectification of the rejected lot.
- Most of the rectifying inspection plans for lot by lot sampling call for 100% inspection of rejected lots and replacing the defective pieces by good ones.

- The two important points related to rectifying inspection plans are:

(i) The average quality of the product after sampling and 100% inspection of rejected lots, called **Average Outgoing Quality (AOQ)** and

(ii) The average amount of inspection required for the rectifying inspection plan, called **Average Total Inspection (ATI)**.

Average Outgoing Quality Limit (AOQL)

- Sometimes the consumer is guaranteed a certain quality level after inspection – regardless of what quality level is being maintained by the producer.
- Let the producer's fraction defective, i.e., the lot quality before inspection is '*p*'. This is known as <u>incoming quality</u>. The fraction defective of a lot after inspection is known as <u>outgoing quality</u> of the lot.
- The expected fraction defective remaining in the lot after the application of the sampling inspection plans is known as Average Outgoing Quality (AOQ) $\tilde{p}$ Thus, it is function of the incoming quality '*p*'.
- For rectifying inspection single sampling plan calling for 100% inspection of the rejected lots, the AOQ values are given by the formula:

$$\tilde{p} = AOQ = \frac{p(N-n)P_a}{N} \qquad \text{................ (1)}$$

where N is the lot size, n is sample size and P_a is the probability of acceptance of the lot.

- Here, it is assumes that all defectives found are repaired or replaced by good pieces.

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- Since, we look for defective pieces in the uninspected portion of the accepted lots involving (*N*-*n*) items and *p* is the probability of finding a defective, there will on average be *p*(*N*-*n*) defective items.
- Since P_a is the probability of acceptance of the lot, the sampling plan will on the average turn out lots that contain $pP_a\,(N\text{-}n)$ defective items. This on dividing by *N*, will get A.O.Q. as a fraction defective given by (1).
- If *n* is small compared to *N*, then a good approximation of the outgoing quality is given by

$$\tilde{p} = AOQ = pP_a \qquad \text{.................. (2)}$$

- If the defective pieces found are not repaired or replaced by good one, then the formula must be modified as

$$A.O.Q. = \frac{p(N-n)P_a}{N - np - p(1-P_a)(N-n)} = \frac{p(N-n)P_a}{N - p\left[n + (1-P_a)(N-n)\right]}$$

$$= \frac{p(N-n)P_a}{N - p\left[nP_a + N(1-P_a)\right]} \qquad \text{.................. (3)}$$

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- This formula is not generally used and if *p* is small, there is not much difference between (2) and (3).
- In general, if *p* is the incoming quality and a rectifying inspection plan calling for 100% inspection of the rejected lots used, then the *AOQ* of the lot will be given by

$$A.O.Q. = p.P_a(p) + 0.[1 - P_a(p)] = p.P_a(p) \qquad \text{.................. (4)}$$

because

(i) $P_a(p)$ is the probability of accepting the lot of quality '*p*' and when the lot is accepted on the basis of the inspection plan, the outgoing quality of the lot will be approximating same as the incoming lot quality '*p*' and

(ii) 1- $P_a(p)$ is the probability of rejection of the lot and when the lot is rejected after sampling inspection and subjected to 100% screening and rectification, the *AOQ* is zero.

- For a given sampling plan, the value of *AOQ* can be plotted for different values of *p* to obtain the *AOQ* curve as shown in the figure.

- From (4), we find that if $p = 0$. i.e., the lot is 100% O.K., then $AOQ = 0$ and if $p = 1$, i.e., the lot is 100% defective then $P_a(p) = 0$ and so $A.O.Q. = 0$.
- For other value of p lying between 0 and 1, the AOQ will be positive and will have a maximum value for some value of the incoming quality p. The maximum value of $\tilde{p}$ subject to variation in p is called the Average Outgoing Quality Limit ($\tilde{p}_L$). If p_M is the value of p which maximizes $\tilde{p}$ in (1) then

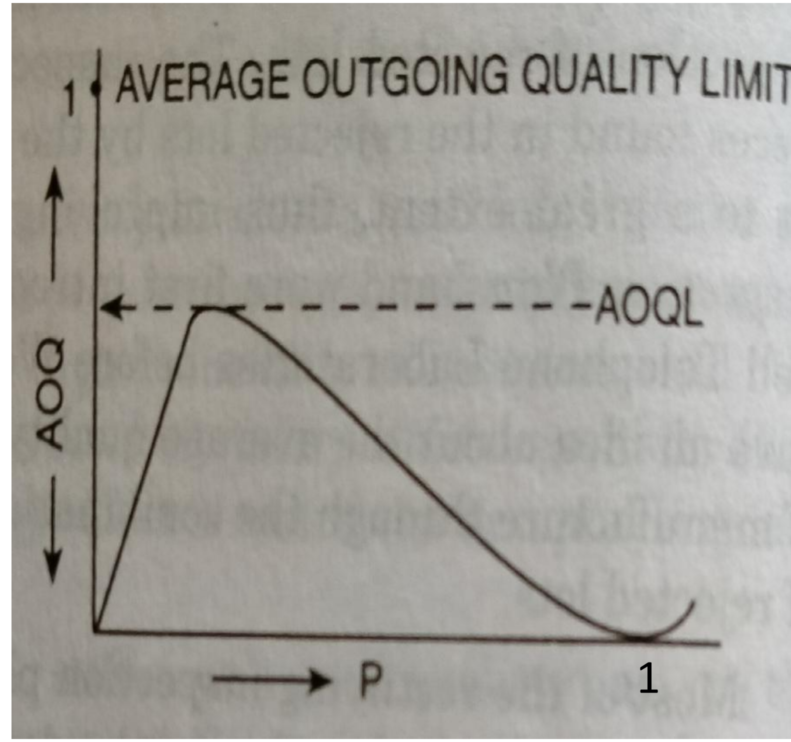

Figure: 1

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$$\tilde{p}_L = A.O.Q.L. = \frac{p_M P_a (N-n)}{N} \qquad \text{.................. (5)}$$

where it should remembered that P_a is to be computed for $p = p_M$. Rewriting (5) we have

$$A.O.Q.L. = \frac{y}{n}\left(1 - \frac{n}{N}\right) \qquad \text{.................. (6)}$$

where $y = np_M P_a$, has been tabulate by Dodge and Romig for various value of n (sample size) and c (acceptance number of sampling plan, i.e., allowable number of defective in the sample).

- The *A.O.Q.L.* measures the long term protection given by the plan to the user in the worst situation.
- It is to be noted that *A.O.Q.L.* curve ($\tilde{p}_L$ plotted against p) will reach a maximum value and then recede, since the poorer the quality of the incoming product (i.e., larger the value of p), the fewer lots will be accepted and more will be inspected 100% and made acceptable.