Acceptance Sampling Inspection Plans

Semester IV **STAT CC410**

Unit 3

- Acceptance Sampling Inspection Plans
- Acceptance Quality Level (A.Q.L.)
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Acceptance Sampling Inspection Plans

- In many a manufacturing process, the producer, in order to ensure that the manufactured goods are according to specifications of the customer, gets his lot checked at strategic stages.
- On the other hand, the customer is anxious to satisfy himself about the quality of goods he accepts. An ideal way of doing this seems to inspect each and every item presented for acceptance, i.e., to resort to 100% inspection, 100% inspection should be taken recourse to under the following conditions:

  (i) the occurrence of a defect may cause loss of life or serious casualty to personnel.

  (ii) a defect may cause serious malfunction of equipment.
- We may also wish to examine all the items of the product under the following conditions:

  (i) N. the lot size is small, and

  (ii) the incoming quality is poor or unknown.

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- If testing is destructive such as crackers, shells, bulbs, etc. it is absolutely non-sensical to talk of 100% inspection. Even in those cases, where 100% inspection is possible, it may not be desirable because

  (i) it is costly, and

  (ii) due to fatigue, impossibility of proper check and variation in efficiencies of inspection in time, persons, and place however careful one may be, the inspected lot is likely to contain a small percentage of defectives.

- So from practical and economic point of view, sampling procedures are adopted, i.e., a lot is accepted or rejected, on the basis of the samples drawn at random from the lot.
- It has been found that if a scientifically designed inspection plan is used, it provides adequate protection to producer as well as consumer very economically.

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- The main objective of inspection is to control the quality of the product by critical examination at strategic points.
- Sampling inspection, besides keeping down the cost of production, also ensures that the quality of a lot accepted is according to the specifications of the consumer.
- The guidelines of a sampling procedure are:

(i) It should give a definite assurance against passing any unsatisfactory lot, and

(ii) The inspection expenses should be as low as possible subject to the degree of protection afforded by (i) above.

Acceptance Quality Level (A.Q.L.)

- This is the quality level of a good lot. It is the percent defective that can be considered satisfactory as a process average, and represents a level of quality which the producer wants accepted with a high probability of acceptance.
- In other words, if α is the producer's risk, then the level of quality which results in $100(1-\alpha)\%$ acceptance of the good lots submitted for inspection is called the acceptance quality level.
- A lot with relatively small fraction defective (i.e., sufficiently good quality), say p_1 that we do not wish to reject more often than a small proportion of time is sometimes referred to as a good lot.
- Usually,

$$P[\text{Rejecting a lot of quality } p_1] = 0.05$$

$$P_a = P[\text{Accepting a lot of quality } p_1] = 0.95$$

Here p_1 is known as acceptance quality level and a lot of this quality is considered as satisfactory by the consumer.

Lot Tolerance Proportion or Percentage Defective (LTPD)

- The lot tolerance proportion defective, denoted by p_t is the lot quality which is considered to be bad by the consumer.
- The consumer is not willing to accept lots having proportion defective p_t or greater. $100p_t$ is called the Lot Tolerance Percentage Defective.
- In other words, this is the quality level which the consumer regards as rejectable and is usually abbreviated as R.Q.L. (Rejecting Quality Level) and the Limiting Quality Level (L.Q.L.).
- A lot of quality p_t stands to be accepted some arbitrary and small fraction of time, usually 10%.
- It is possible to design acceptance sampling plans that give specified probabilities of acceptance at the LTPD point.
- Subsequently, we will see how to design sampling plans that have specified performance at the AOQ and LTPD points.

Process Average Fraction Defective ($\bar{p}$)

- $\bar{p}$ represents the quality turned out by the manufacturing process over a long period of time.
- In industry, the quality of any process tends to settle down to some level which may be expected to be more or less the same everyday for a particular machine.
- If this level could be maintained and if the process is working free from assignable causes of variation, the inspection could often be dispensed with.
- But in practice, as a result of failure of machine and men, the quality of the product may suddenly deteriorate.
- The process average of any manufactured product is obtained by finding the percentage of defects in the product over a fairly long time.

Consumer's Risk

- Any sampling scheme would involve certain risk on the part of consumer – in the sense that he has to accept certain percentage of bad lots, i.e., lots of quality p_t or greater fraction defective.
- More precisely, the probability of accepting a lot with fraction defective p_t is termed as consumer's risk and is written as P_c.
- Usually, it is denoted by β. It is taken by Dodge and Romig as 10% or 0.10.
- Thus,

Consumer's Risk, P_c = P[Accepting a lot of quality p_t] = β

Producer's Risk

- The producer has also to take the situation that some good lots will rejected.
- He might demand adequate protection against such contingencies happening too frequently just as the consumer can claim reasonable protection against accepting too many bad lots.
- The probability of rejecting a lot with $100\bar{p}$ as the process average percent defective is called the producer's risk P_p and is usually denoted by α.
- Thus,

Producer's Risk, P_p = P[of rejecting a lot of size $\bar{p}$] = α