Single Sampling Vs. Double Sampling

Semester IV **STAT CC410**

Unit 3

- Single Sampling Vs. Double Sampling
- Multiple Sampling Plan
- Sequential Sampling Plan

Dr. Vijay Kumar
(Assistant Professor)
Department of Statistics
Patna Women's College, Patna

Single Sampling Vs. Double Sampling

1) Single sampling plans are simple, easy to design and administer, and since sample can be plotted on a control chart, maximum information concerning the lot can be obtained.
2) A very important advantage of double sampling over single sample seems to be psychological. To a layman, it is unfair to reject a lot on the basis of one sample alone and it is more convincing to say that the lot was rejected after inspecting two samples.
3) Moreover, in double sampling no lot can be rejected without finding at least two defectives in the sample taken from it. Thus, the border line lots (lot of marginal quality) always get a second chance of being accepted.
4) In the manufacturing firm where sampling schemes are generally operated it has been found that the double sampling scheme involves on the average less amount of inspection than the single sampling scheme for the same quality assurance.

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5) Under the double sampling scheme the good quality lot will generally be accepted and bad lots will usually be rejected on the basis of the first sample. Thus, in all the cases, where a decision to accept or reject is taken on the basis of the first sample, there is considerable saving in the amount of inspection than required by a comparable (with respect to O.C. curve) single sampling plan.
6) Moreover, whenever a second sample is taken it may be possible to reject the lot without completely inspecting the entire second sample.
7) Usually, double sample requires 25% to 33% less inspection on the average, than single sampling.

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8) In general, the reduction in the amount of inspection afforded by double sampling is one of the strongest advantages. This does not necessarily mean, however, that a double sampling scheme could be less costlier than the single sampling scheme.
9) The double sampling schemes being more complicated and the necessity of inspecting second sample being unpredictable, the unit cost of inspection for the double sampling procedure may be higher than that for single sampling procedure.
10) The operating characteristics of double sampling schemes are generally steeper than those of corresponding single sampling procedure i.e., the discriminatory power of double sampling procedures is a bit higher than that of single sampling procedures.

Multiple Sampling Plan

Definition: A multiple sampling plan is an extension of the double sampling concept, in which more than two samples may be required in order to reach a decision regarding the acceptance or rejection of the lot.

- Sample sizes in multiple sampling are usually smaller than they are in either single or double sampling.
- The ultimate extension of double sampling is **sequential sampling**, in which units are selected from the lot one at a time, and following inspection of each unit, a decision is made either to accept the lot, reject the lot, or select another unit.
- Single, double, multiple and sequential sampling plans can be designed so that they produce equivalent results. That is, these procedures can be designed so that a lot of specified quality has exactly the same probability of acceptance under all four types of sampling plans.
- Consequently, when selecting the type of sampling procedure, one must consider factors such as the administrative efficiency, the type of information produced by the plan, the average amount of inspection required by the procedure, and the impact that a given procedure may have on the material flow in the manufacturing organization.

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Example: An example of a multiple sampling plan with five stages is as follows.

Cumulative Sample Size	Acceptance Number	Rejection Number
20	0	3
40	1	4
60	3	5
80	5	7
100	8	9

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Procedures: This plan will operate as follows:

- If, at the completion of any stage of sampling, the number of defective items is less than or equal to the acceptance number, the lot is accepted.
- If, during any stage, the number of defective items equals or exceeds the rejection number, the lot s rejected; otherwise the next sample is taken.
- The multiple sampling procedure continues until the fifth sample is taken, at which time a lot deposition decision must be made.
- The first sample is usually inspected 100%, although subsequent samples are usually subject to curtailment.
- The construction of OC curves for multiple sampling is a straightforward extension of the approach used in double sampling.
- Similarly, it is also possible to compute the average sample number (ASN) curve of multiple sampling plans. One may also design a multiple sampling plan for specified values of p_1 , (1- α), p_2 , and β.

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Advantages: The principal advantage of multiple sampling plans is that the samples required at each stage are usually smaller than those in single or double sampling plans. Thus, some economic efficiency is concerned with the use of this procedure. However, multiple sampling plan is much more complex to administer.

Sequential Sampling Plan

Definition: Sequential sampling plan is an extension of the double sampling and multiple sampling concept.

- In sequential sampling, we take a sequence of samples from the lot and allow the number of samples to be determined entirely by the results of the sampling process.
- In practice, sequential sampling plan can theoretically continue indefinitely, until the lot is inspected 100%.
- In practice, sequential sampling plans are usually truncated after the number inspected is equal to three times the number that would have inspected using a corresponding single sampling plan.
- If the sample size selected at each stage is greater than one, the process is usually called ***group sequential sampling plan***.
- If the sample size inspected at each stage is one, the procedure is usually called ***item-by-item sequential sampling plan***.
- Item-by-item sequential sampling plan is based on the ***sequential probability ratio test (SPRT)***, developed by Abraham Wald (1947).