ABSTRACT

Dependent State Attribute Acceptance Sampling (August 1969)

Jackie M. Mogg, B.S., Oklahoma State University

M.S., Oklahoma State University;

Directed by: Dr. A. W. Wortham

The major objective of this research is the development of attribute acceptance sampling plans involving a dependency on historical results in the decision to accept or reject inspection sampling lots. Two dependent stage concepts are developed in addition to an exponential smoothing concept which involves a transformation on the lot decision criteria to obtain a quality index. The two dependent stage concepts can be categorized as fixed dependent stage sampling and sequential dependent stage sampling.

The fixed dependent stage acceptance sampling concept presents a plan where the probability of acceptance of each lot is dependent on the probability of acceptance of all prior lots submitted. The appeal of fixed dependent stage sampling lies in the simplicity of implementation and understanding of the typical plan. Implementation of one particular plan would require that a sampled lot be accepted if either the sample contained zero defectives or if the sample contained one defective and the prior lot were accepted. The lot would be rejected for all other outcomes. The desirable traits of both single and chain sampling are embodied in this concept, without it being overly encumbered by their undesirable features.

The application of the dependent stage technique to sequential sampling produces acceptance sampling plans that will terminate in a fewer number of trials than the associated conventional sequential sampling plans. The dependent stage concept is appended to a conventional sequential plan by placing one or more historical barriers in the continue test region. When an accept historical barrier is penetrated, the dependent stage concept is invoked and the test will be terminated in acceptance if the referenced lot were accepted. If the referenced lot were rejected, the historical barrier is withdrawn and the test continues from that point as a conventional sequential test. When a reject historical barrier is penetrated, a similar dependent stage action is invoked with the exception that the test is terminated in rejection if the referenced lot were rejected, and the test continues if the referenced lot were accepted. For an accept history appendage, good quality is accepted in significantly fewer trials than for the conventional test, with no significant difference in the average number of trials to reject bad quality. For a reject history appendage, the above results reverse themselves. With both historical barriers present, the average number of trials to termination is significantly less than for the conventional plan, for all quality levels.

The exponential smoothing concept, as applied to acceptance sampling procedures, determines a quality index for each lot submitted for inspection. This quality index is generated by single exponential smoothing on the observed number of defectives from the

ordered sampled lots, and the current lot is accepted or rejected by comparing its quality index to a predetermined threshold value. This parallels the procedure for conventional plans where each lot is accepted or rejected by comparing the observed number of defectives with a predetermined number. The quality index can be considered as the weighted average number of defectives per lot for all lots up to and including the current one. The weight for each lot is a function of the smoothing constant, α, utilized in the exponential smoothing method. Large values of α give more weight to current lots and small values of α give more weight to past lots. The total historical information to be utilized in the decision on a lot is contained in the quality index of the prior lot, which precludes the necessity for elaborate bookkeeping of past results. The appeal of this technique of plan definition is that a threshold value, defining the accept-reject regions for the quality index, can be determined such that the probability of accepting a specified percent defective can be set at any desired value.

Acceptance sampling concepts, where historical dependency can be invoked, offer a wide range of applicability and are particularly useful when sampling conditions restrict the plans to small sample sizes. The concepts emanating from this research were developed such that simplicity of application would pervade the resulting techniques, and mathematical sophistication was sometimes sacrificed to achieve this end.