Game theoretic computing of producer's and consumer's risks, α & β, for acceptance sampling using cost and utility

Mehmet Sahinoglu[1]

[1]Troy University

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Abstract

When establishing a hypothesis testing procedure to ensure its credibility, the most significant step is unquestionably to select and/or compute the optimal type-I and type-II error probabilities, namely the producer's and consumer's risks, or α & β errors, respectively if the research hypothesis is set to be a good product vs bad. This article is fundamentally opposed to conventionally and judgmentally picking at best a subjective type-I error probability (α error) and it therefore outlines a game theoretic approach, i.e. that of von Neumann, to this historically century-old unresolved paradigm to justify optimal choices when relevant market-centric factors such as cost and utility are incorporated for input data. A game theory-based algorithmic methodology and several detailed numerical examples of practical nature with specific emphasis to company-specific acceptance sampling plans (including a simple hospital scenario) for quality control are studied. A side benefit of this method, in addition to improving the enterprise acceptance sampling plans, is to transform the traditional hypothesis testing procedure so as to make sound engineering decisions from a "subjective" to an "objective" stance, provided that the monetary cost and utility values as consequences to committing error and non-error combinations are available.

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