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

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Abstract

When establishing a hypothesis testing procedure to ensure its credibility, the most significant of all is unquestionably to select and/or compute the optimal Type-I and the Type-II error probabilities, namely Producer's and Consumer's Risks, α & β respectively. This article as opposed to the conventionally and judgmentally picking at best a subjective Type-I error probability, outlines a Game theoretic approach, i.e. that of von Neumann, to this historically unresolved paradigm to justify optimal choices for Type-I error probability (α) and Type-II error probability (β) when cost, utility and other market-centric factors are incorporated as input data. A game theory-based algorithmic methodology and several numerical examples of practical nature with specific emphasis to company-specific Acceptance Sampling plans for Quality Assurance are illustrated. A side benefit of this method in addition to improving the Acceptance Sampling plans is to transform the traditional Hypothesis Testing process in making sound engineering decisions from a "subjective" to "objective" stance, provided that the monetary cost and utility consequences of committing error and non-error combinations are available.

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