Bayteck Microchip International – Adventures in Bayesian Analysis

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Abstract

The automotive microchip market is projected to reach approximately $60 billion by 2022, which constitutes approximately twelve percent of the overall semiconductor sector. The demand for enhanced features such as emergency call systems, improving fuel economy, security, enriched driver experience, autonomous driving, and car sharing are the primary drivers behind this projected growth pattern. Bayteck provides customized microchips to the automotive industry. The purpose of this presentation is to illustrate how prescriptive analytics can be used to develop an optimal bidding strategy in response to a recently received RFP.

Keywords: Microchip Industry, Bayesian analysis, Decision-making under risk, Sensitivity Analysis

Overview

Bayteck Manufacture has recently received a request for proposal (RFP) from one of the major car manufacture companies to purchase 100,000 customized microchips. The microchips will be used in several new safety features including forward collision warning, emergency call systems, and adaptive headlights. The order will be given to the lowest bidder and will be delivered at a rate of 10,000/month over the next 10 months. Bayteck is considering bidding on this order and is sorting through a number of decision alternatives. The first is the unit bid price on this order and the second is how to manufacture the microchips. Bayteck management has decided on two candidate bid alternatives: $130/unit and $140/unit. There are two manufacturing processes that can be used to produce the microchips. Process A has a known unit cost of $100 while Process B has never been used before and therefore Bayteck only has "estimated" unit costs. Bayteck's chief engineer estimates for process B that there is a 60% chance that the production cost will be $90/unit and a 40% chance that it will be $110/unit. A $50,000 test of process B could be performed to establish "better" cost estimates that might help in the overall decision-making procedure. The test of process B will cost $50,000 regardless of the outcome of the bid. The chief engineer estimates that given an actual $90/unit cost the test will indicate a $90 cost 90% of the time and given an actual $110/unit cost the test will indicate a $110/unit cost 80% of the time. The chief engineer knows that they will need to use Bayesian analysis to compute the marginal and revised probabilities based on the test results. Bayteck's vice president for marketing estimates that there is a two-thirds chance of winning if the bid is $130/unit and a one-third chance of winning if the bid is $140/unit. The management team has decided to conduct the test prior to submitting the bid. The decision at hand is to decide the bid price and whether to conduct the test. This case embodies decision-making under risk with additional information.

Discussion Questions

1. Identify the basic decision alternatives.
2. Develop a decision tree.
3. Develop a Bayesian analysis tree for generated the marginal and revised probabilities.
4. Determine a payoff for each of the options.
5. Identify the optimal decision sequence and corresponding payoff.
6. Perform selected sensitivity analysis, e.g., cost of test and winning bid probabilities.