**Bayesian Probabilities in Decision Analysis**

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| A company is testing the release of a new software product. The company expects the product to be a success if 30% of the market is captured after five years but a failure if only 10% of the market is captured after five years. The company conservatively places a probability of 0.5 of success after five years.  To test the market, a survey was administered to a target market of 20 subjects resulting in 5 indicating a strong preference to purchase the product. Although the results were not a favorable as hoped, a Bayesian probability analysis was chosen to determine the probability of success after five years based on the survey results.  The evidence was obtained from an experiment with the following design. A total of 20 subjects were measured, each subject (i.e., a trial) resulted in only one of two outcomes, each trial had a constant proportion of success and each trial was independent. This defines a binomial sampling distribution.   |  | | --- | | Assuming a uniform prior and a binomial conditional sampling distribution, the probability of capturing 30% of the market after five years is 0.84. |   . . . |

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| To further analyze the market, an ad was placed on a website introducing the product with a click through for the subject to indicate an intention to pre-purchase the product. Out of 100 views over one hour, 18 clicked through indicating an intention to pre-purchase the product. To refine market success, the company modifies the percentages to 20% for a good market, 15% for a fair market and 10% for a bad market. Since this was the first data collected online, the company initially places a 1/3 chance for each type of market. Again, a Bayesian probability analysis was chosen to determine the probability of success after five years based on the online results.  The number of occurrences of an event (i.e., a subject) over a defined interval (i.e., one hour and 100 views) was observed with the outcome of each event based on each event being independent, unique and possessing a constant rate of success. This describes a Poisson process.   |  | | --- | | Assuming a uniform prior and a Poisson conditional sampling distribution, the probability of capturing a good market after five years is 0.52, a fair market is 0.44 and a bad market 0.04. |   . . . |

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| To continue the online analysis, the company wishes to accelerate obtaining probabilities by observing the time between events instead of the number of events occurring during a defined interval. The time between events in a Poisson process follows an exponential distribution. Based on product performance of capturing 20%, 15% and 10% for a good, fair and bad market after five years, the expected time between events during the one hour considered becomes 3 minutes (60 minutes/(100\*0.20)), 4 minutes (60 minutes/(100\*0.15)) and 6 minutes (60 minutes/(100\*0.10)) for the percentages respectively. Based on using the posterior probabilities from the Poisson process as prior probabilities for the exponential analysis, the company wishes to determine the probability of observing events in less than 3 minutes in the foreseeable future?   |  | | --- | | Assuming the probabilities from the Poisson process, the probability of observing an event in less than 3 minutes is 0.57. |   . . . |





