Project Questions 1 - Modeling Under Uncertainty

1) Consider a product sold on Amazon. The users can rate it out of 5 stars (the website then also displays an aggregate metric - the average rating). Given that the product is relatively new and we don't have that much data, i.e we don't have many reviews, how can we model the reviews the product will receive in the future in order to understand its demand and manage the inventory. Specifically, what is the probability p_i that the product receives i stars (where i = 1,2,3,4,5)?

2) The sources of uncertainty are the future reviews the product will receive. Here, we can study how to model future demand given the probability of each review. Furthermore, supply uncertainty can be considered in order to take into account the possibility of an unreliable supplier.
3) A probability distribution can be used to model the uncertainty of ratings. A Bernoulli distribution can be used (a generalized version of it for 5 outcomes) in order to model the probability of obtaining each number of stars.
4) We can consider different models. Can model the final rating of the product given the probabilities described above using a maximum likelihood model. This can be seen as an optimization problem where we require the review probabilities to sum up to one. Another, more promising, but potentially challenging approach is the use of a bayesian model in order to incorporate some sort of prior belief about the probabilities. One can argue that reviews on Amazon tend to be polarized. Since this is a realistic assumption we can try to include it in the model. Will have to think of an appropriate distribution for the prior beliefs.