**Final Project Proposal**

**MAE 298 (Introduction to Bayesian Statistics for Data-Driven Science and Engineering)**

**Alex Flemming & Ari Niknia**

For our final project, we would like to use existing data taken from ASME safety valve testing and apply it to predict the number of valves from a new vendor, in a specific service medium, that will fail subsequent testing. We plan on using a multi-level model to make inferences about a specific vendor while also considering the entire population of sampled valves. The dataset under consideration consists of the results of 560 valves from 19 different vendors tested per ASME BPVC Section VIII, taken from an SRS-PEVT Study by ASME. The overall goal of this would be to try to narrow down the minimum amount of purchased valves required to use on a specific system, assuming a specified vendor and specified service medium (e.g. if 10 working valves are required, we would like to predict how many valves are needed to be bought based on the failure data). The tabulated is shown below, for reference.



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| --- | --- |
| Vendor a | Vendor c |

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The above graphs show normalized posterior distributions where the x axis the success rate for a valve given the vendor. We grouped each set of valves by the vendor and service medium. We then used a beta function with parameters four and two to represent the mean and an exponential function with a lambda of 0.1 for the standard deviation. These were then used in a normal distribution to model our probability of a valve passing a preinstallation pressure test. We had some success using MCMC to obtain a posterior distribution for each vendor. We only tried it on the steam service medium but plan to expand it to air and liquid service mediums.

We are having trouble finding a good way to set up our model using a binomial distribution since it seemed to be applicable to pass/fail testing. We had problems with our probability of success parameter because when using our hyperparameters we were getting probabilities less than zero and greater than one. Our probabilities between vendors seem to be very similar which is not what we would expect. We attached our code for further information.