

# Budget Simulation

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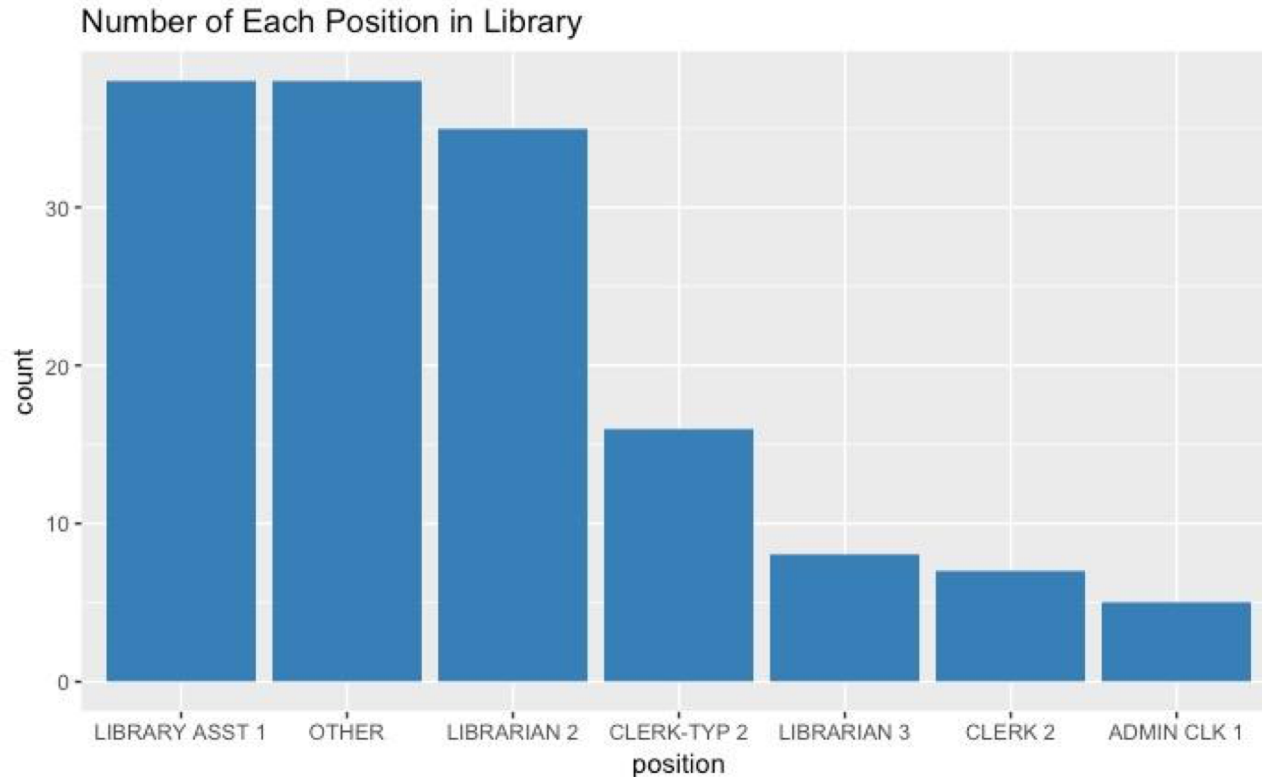
A dark blue diagonal gradient bar that starts from the bottom left corner and extends towards the top right corner, covering the lower half of the slide.

# Libraries

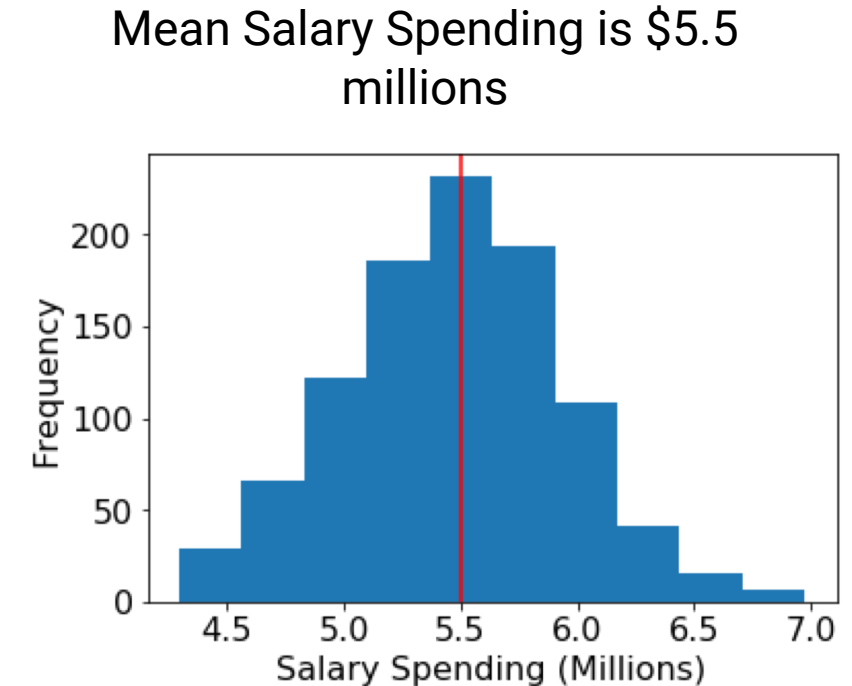
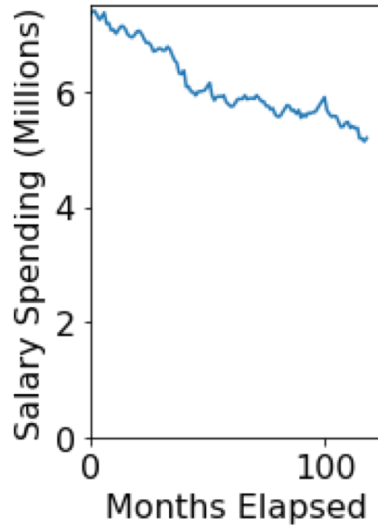
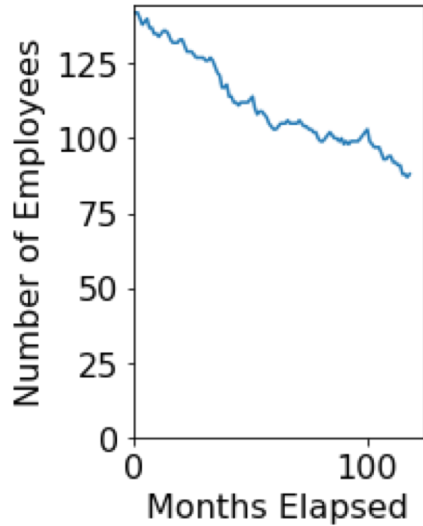
- ❖ 10 years simulations starting from 2019 February to 2029 February
- ❖ Salary Distribution
- ❖ Trend of Salary Spending



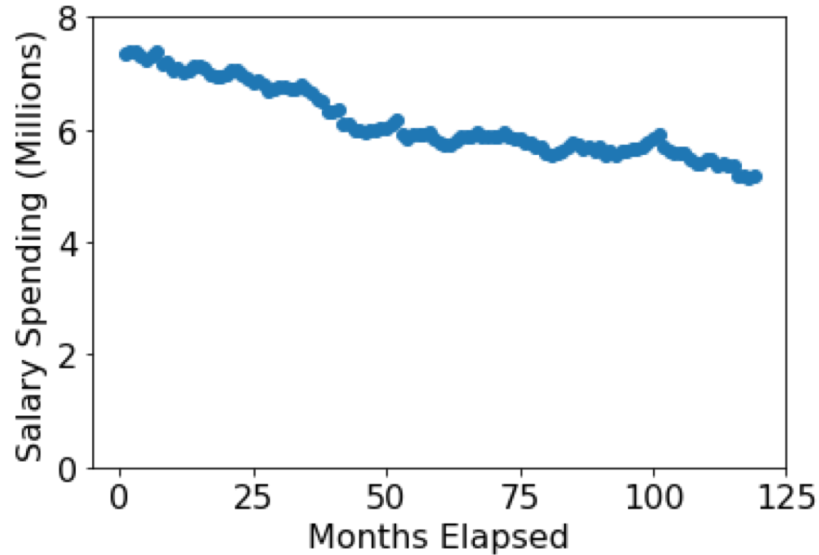
# Number of People in Different Positions in Library



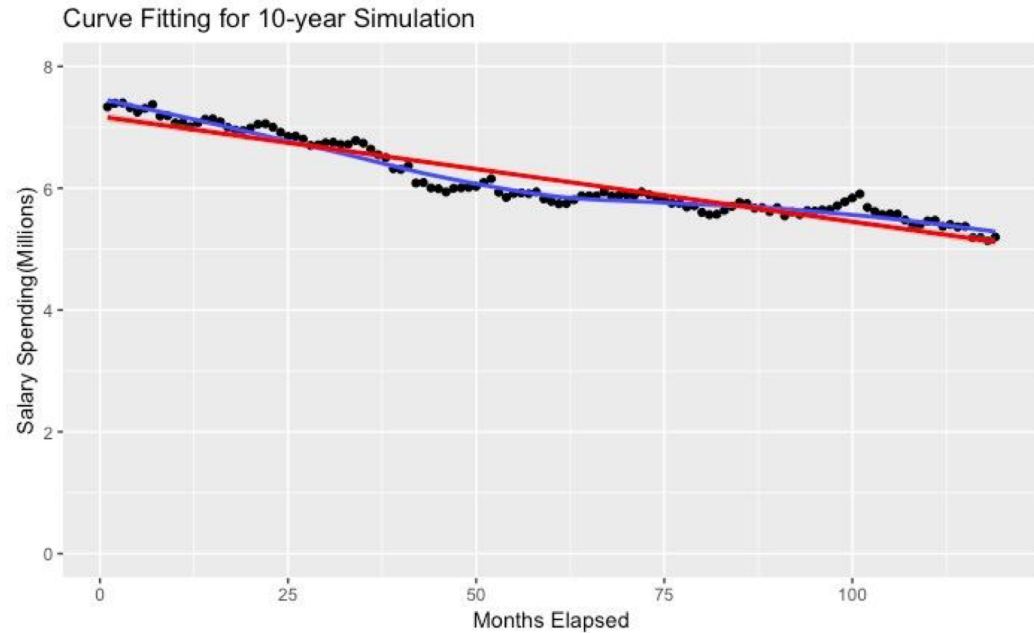
# Simulation of Data for 10 years



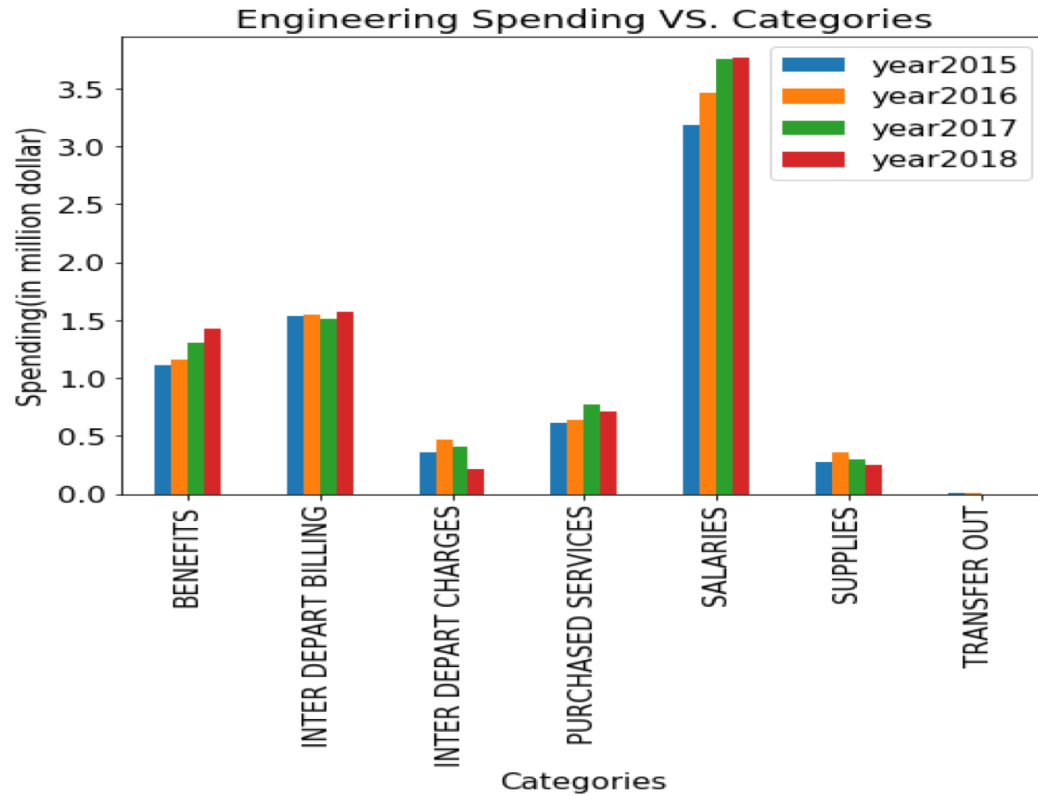
# Curve Fitting for Salary Trending



$$\text{Salary Spending} = -0.017 * \text{Months} + 7.178$$

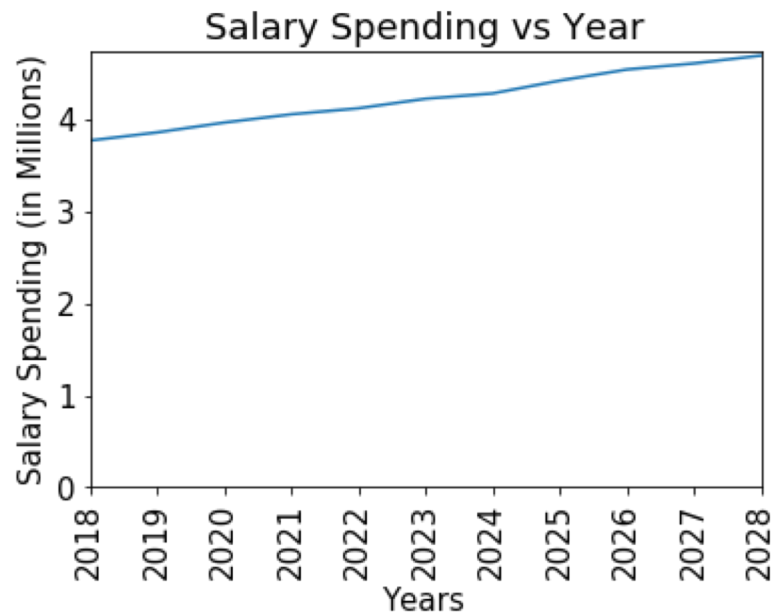
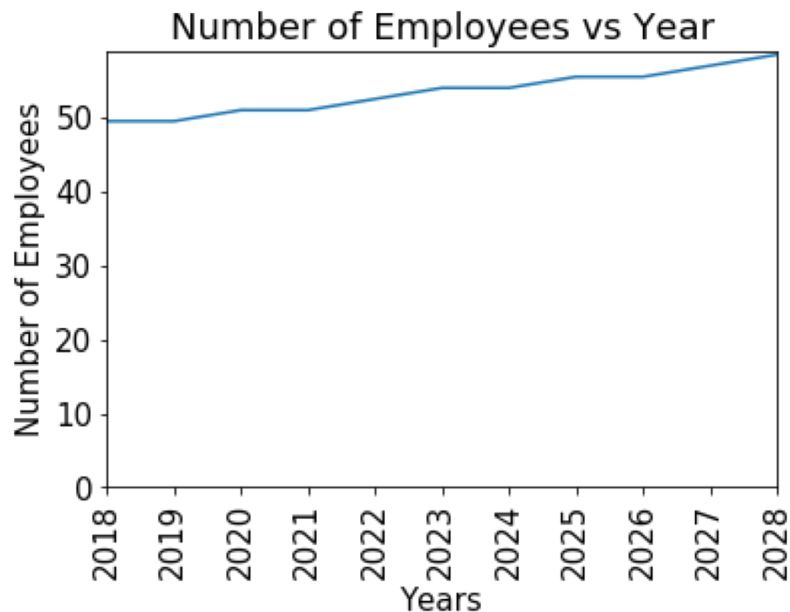


# Engineering



# One single simulation

Number of Employees: Increasing  
Salary Spending: Increasing



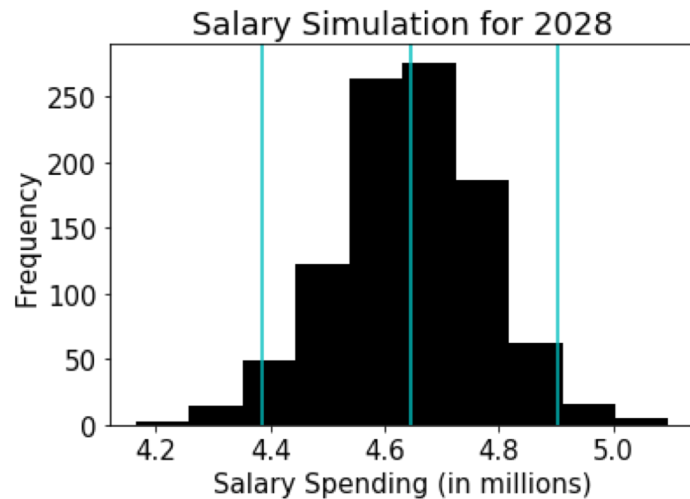
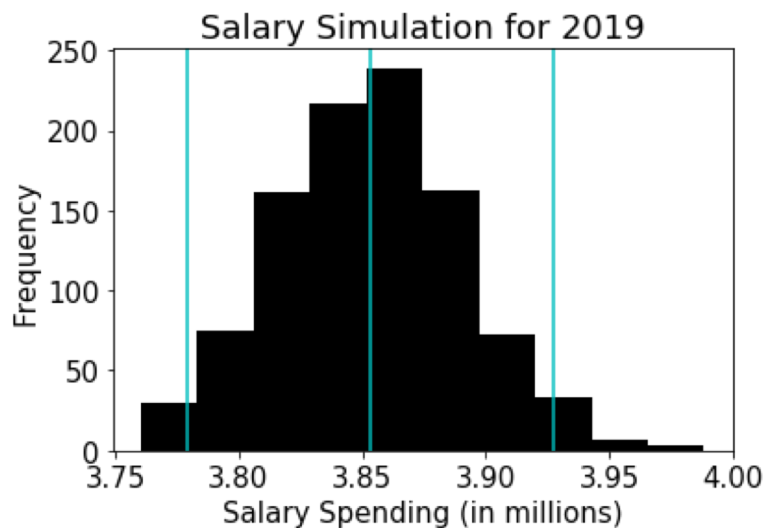
# 1000 Simulations

## ❖ 2019:

- mean: \$3.85M
- lower: \$3.78M
- Upper: \$3.93M

## ❖ 2028:

- Mean: \$4.6M
- lower: \$4.4M
- Upper: \$4.9M



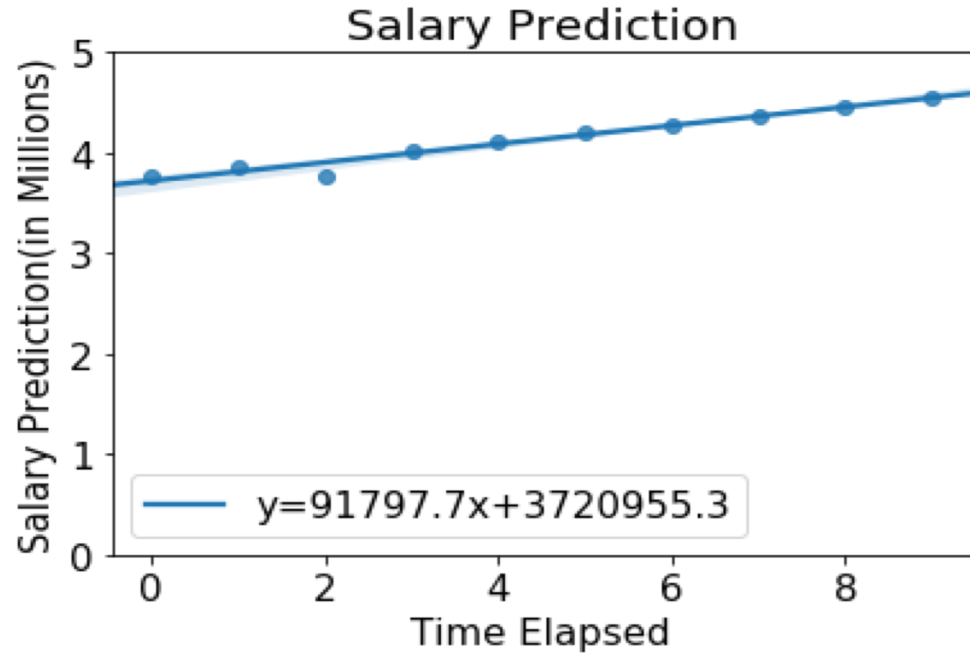


# Regression

❖  $Y = 91797.7x + 3720955.3$

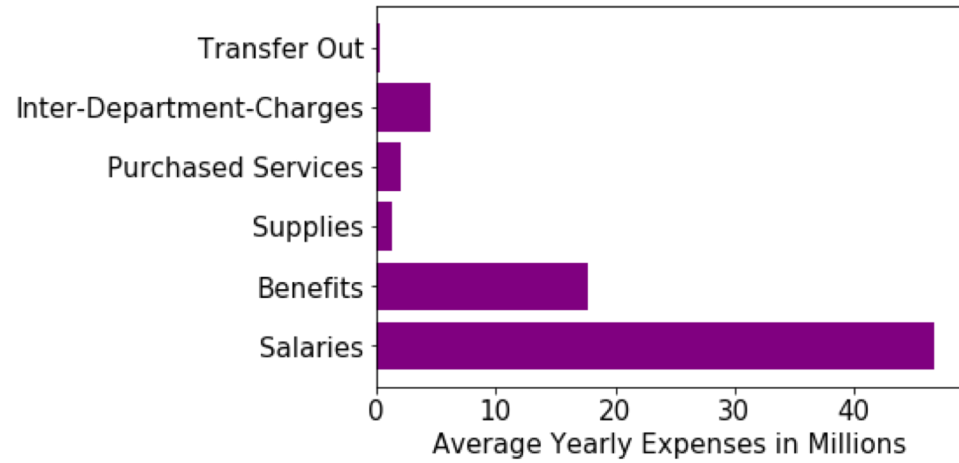
❖ Ex: 20 years later

$$Y = 83452.4 * 20 + 3382686.6$$
$$= \$5.5M$$



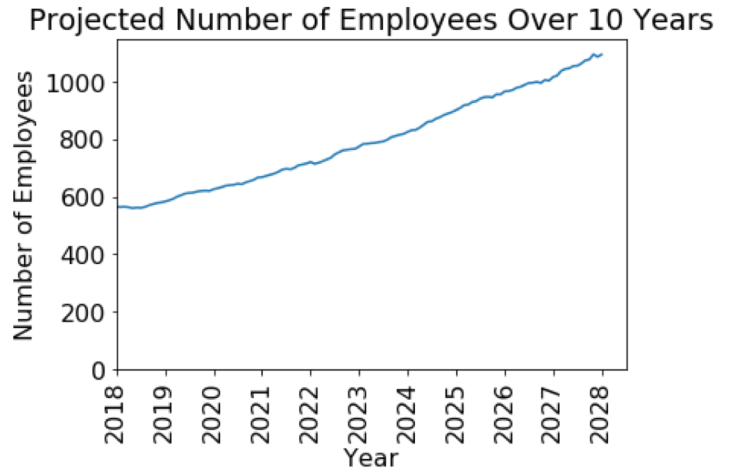
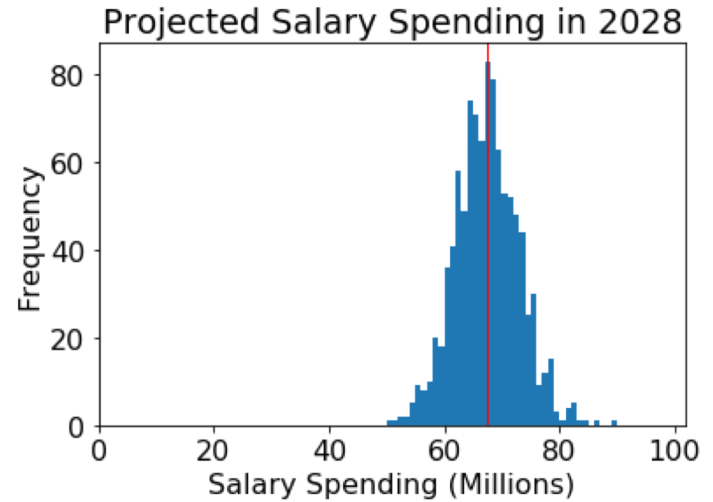
# Madison Police

- ❖ Police spending dominates the budget
- ❖ Majority of the Police expenses stem from salaries



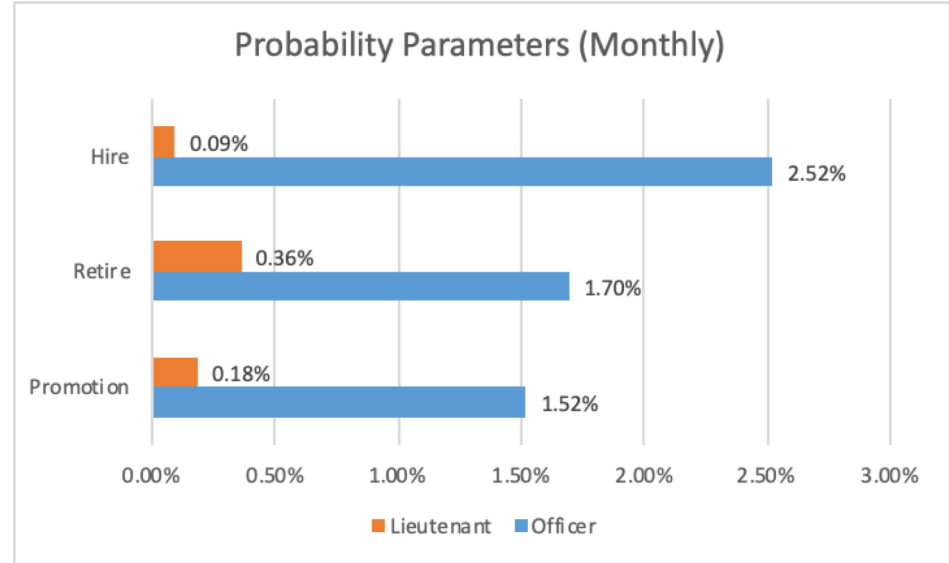
# 10 Year Simulation

- ❖ Salary Spending in 2028 increased by 141% since 2018
- ❖ Number of Employees increased by 128% since 2018



# Parameters

- ❖ Analyzed monthly changes for each position
- ❖ These numbers likely change over time
- ❖ Other factors could be taken into account



# Main Takeaways

- ❖ Police Salaries will continue to increase. The budget going forward should recognize this
- ❖ Retiring in higher positions will increase, thus creating more promotions
- ❖ Library Salary is increasing and decreasing among each months but overall is decreasing
- ❖ Engineering Salary will continue to increase. The budget for 2020 is very likely to be increased

# Looking Forward

- ❖ Treated parameters as independent of each other, but in reality they very much are not
- ❖ Fix some of the bugs and errors
- ❖ Try different simulation methods to be more precise
- ❖ Not compatible enough with other datasets
- ❖ Create better parameters from a more extensive dataset
  - Ex. Incorporate an employee's age into the model