**Risk and Reliability Analysis**

**Bond Homework**

1. We discussed in class that the formulas given used a constant discount rate. If instead of using the constant rate over the 5 years you used a rate that varied over time your results should change.
   1. Calculation the value of a $1000 dollar face value bond with a $40 dollar coupon paid out every year. Assume no discount rate.
   2. Now, calculate the price of the bond assuming that after you buy the bond the Federal Reserve bank decreases the discount rate every year for the next five years, by 1% per year. Start at a 5% discount rate.
      1. You will need to modify the functions in the provided Jupyter Notebook to shift the sampling of the CDF from a fix term to one that changes each year.
   3. How does this compare to the to…
      1. The original calculated bond value?
      2. The value if the discount rate did not change.
      3. The value if the discount rate increased instead.
2. In class, it was shown that you could determine the cost of a bond assuming the discount rate change immediately after you bought the bond and then remain constant for the remainder of the bond. However, in reality the discount rate may vary from year to year (or realistically it may vary on any regular or irregular period).
   1. Using the provided data on historical interest rates (assume total) to generate a CDF.
   2. Determine the value of the bond by sampling this functionality 10 times.
   3. Repeat c. for 100, 1000, 100000 times.
   4. How does changing sample size modify the results.
3. Using the results from 2e. can you determine the exact coupon rate required to match the average value of the bond?
4. Extra Credit: In class we discussed another method for calculating the value of a bond compared to the stock market, by suggesting that the average rate of return for each of the stock exchanges in the US; DOW, SP500, and the NASDAQ. Which method do you think is the correct way to compare a bond to the stock market, varying the return rate year to year, or using the average value yearly return for the market. You will be graded on your reasoning.