1. X and Y are discrete random variables whose expectations exist. Present a proof for the law of iterated expectation \( E[Y] = E[E[Y|X]] \).

2. Give an intuitive explanation of why the law of iterated expectations is sensible when X is age and Y is height.

3. Prove that OLS gets you the MMSE linear approximation to the CEF (hint see the proof in your notes that it is the best linear predictor).

4. Use the attendance and final exam score I provided to describe the relationship between class attendance and grades. Please provide your R or Stata code.
   a. Plot the relationship between the two variables (total_attendance and final) – please manipulate the plot so as to make it as informative as possible (scale, labels, jitter discrete variables). Final is final exam score and total_attendance is the number of classes attended. Please carefully label the plot.
   b. Estimate the conditional expectation function and superimpose the estimate over the data you plotted in part A.
   c. What functional form did you choose for the conditional expectation function and why?
   d. Does your estimate of the CEF have a causal interpretation (estimate the impact of coming to one more class)? Why or why not? What does the estimate tell you?