

## 1.2 PROJECT

### ESTIMATING TUNERS AND TOILETS

The physicist Enrico Fermi once asked a class of students to estimate the number of piano tuners in Chicago. We'll walk through the same estimating process that he used to solve this problem. For each step, explain your thought process for the estimate or calculation. Do not look up any values during this project. Use your reasoning skills to estimate at each step along the way.

1. Suppose the city of Chicago has approximately 3 million people living in it. From this value, estimate how many households are in Chicago. (**Hint:** First estimate how many people are in a household.)
2. Estimate how many households in Chicago own a piano. Using this estimate, determine how many pianos are likely to exist in Chicago.
3. Next, estimate how often the average piano owner has their piano tuned per year.
4. Now, consider how many pianos a single piano tuner can tune per year. Assume that it takes an hour to an hour and a half to tune a piano. (**Hint:** Would the piano tuner work every day of the year? How much travel time might the tuner need between appointments?)
5. Use the estimates and educated guesses you've made so far to make one final estimate: how many piano tuners are in Chicago?
6. Now, use a similar thought process to estimate the number of restrooms the Pentagon has knowing the following information: the Pentagon has 7 floors and houses approximately 27,000 employees. Explain your entire thought process and how you arrived at the final number.
7. Compare your estimates to the estimates of other people in your class. Are the estimates similar? What assumptions might have resulted in answers that are not similar?