1.8. (a) The **individuals** are the cars.
(b) On each car, the following **variables** are measured:

- Vehicle type (compact, SUV, midsize, etc.) − categorical
- Transmission type (manual, automatic) − categorical
- Number of cylinders − quantitative
- City mpg − quantitative
- Highway mpg − quantitative

Quantitative variables have values that are numerical with a physical meaning. Categorical variables have values that simply indicate category membership.

1.12. The poll measured whether someone is in favor of the death penalty for a person convicted of murder (Yes/No)−a categorical variable. The **population** targeted is all American adults (aged 18 and over). The **sample** is the 1028 adults contacted.

1.15. (a) The sociologist contacted 12th graders from five high schools sampled from all high schools in the large city (this is called a **cluster sample**). If these five schools are representative of all high schools in the city, then the population would be all 12th grade students in the large city.
(b) The population is all former NFL players who are still alive.
(c) If this is a local radio talk show, then the potential audience is limited to only those who can tune in to hear the show (I am assuming the show is not streamed online). In this case, a reasonable answer for the population is "all actively religious people who are within the listening range of the broadcast."

As Exercise 1.15 shows, describing exactly what the population is in a given study might not always be clear cut. It may require making certain assumptions.

1.19. (a) The first study is an experiment because the researchers actively intervened to decide which diet each subject would eat. Each of the 58 subjects was proactively assigned to one of the diets. The second study is an observational study. None of the participants were "assigned" to a specific diet. Researchers just found 58 diabetes subjects who ate walnuts and matched them with others who did not.
(b) A properly designed experiment gives better information than an observational study. In an observational study, all we do is observe. People who eat walnuts in an observational study might just be naturally healthier to begin with. If this is true, one would expect these subjects to have better overall cholesterol levels. This makes doing the comparison (diet with walnuts/diet without) unfair because overall health is a **lurking variable**. On the other hand, if subjects are randomly assigned to the different diets,

then the effects of overall health will be "similar" for the two groups on average (we will discuss this in Chapters 5-6). This will allow us to assess the impact of eating walnuts on cholesterol levels more precisely.

1.23. (a) Observational study (but not a sample survey). We could simply observe the game statistics for home games and those for away games and compare them.
(b) Sample survey. We could select a sample of students and ask them about their satisfaction level.
(c) Experiment. We could actively assign certain students to take the course with easy access to video recordings. A second group of students would have no access. We could then compare the final course percentages between the two groups. This would allow us to assess the effect of having video recordings access.