Valid and invalid measures NAMES:

1a. What makes a variable a **valid** way to measure a property?

1b. To illustrate validity, tell whether the following variables would be a valid, mostly valid, or invalid way to measure "potential college performance".

a.) SAT score of student

b.) number of children in student's family

c.) high school performance of student

d.) height to weight ratio of student

e.) high school performance along with SAT and ACT scores

2. “Intelligence” means something like “general problem-solving ability”. Explain why it is NOT valid to measure intelligence by a test that asks questions such as “Who wrote the Star Spangled Banner?”.

3. A friend tells you, “In American History, 20 students failed. Only 11 students failed Russian History. That American History teacher must be a tougher grader than the Russian History teacher.” Explain why this conclusion may not be true. What additional information would you need to know to compare the courses.

4a. What makes a variable a **reliable** measure of a property?

4b. I want to measure the potential success of employees in sales. Give a reliable but invalid way to measure this. Explain why it is reliable but invalid.

5. An **accurate measure** is both non-biased and reliable. Give an example of a variable that would be an accurate measure of your physical fitness. Explain why it is non-biased and reliable.

6. Consider the following information concerning the number of motor vehicle deaths in California and Alaska. The number of million vehicle-miles is a common measurement that counts the total miles driven by all vehicles combined. For instance, all vehicles in Alaska drove a total of 3,900,000,000 miles in 1993. (source: *1996 Information Please Almanac*)

	Number of motor vehicle traffic deaths in 1993	Number of million vehicle-miles driven in 1993
California	3,903	260,200
Alaska	117	3,900

a.) If you wanted to convince people that California was more dangerous than Alaska, which numbers would you use. Why?

b.) Find the number of deaths per million vehicle-miles for each state. What happens to the conclusion that California is more dangerous?

7. A common measurement of the lifetime smoking habits of subjects in observational studies dealing with heart disease is the number called “Pack Years”. This number is computed by multiplying the lifetime average number of packs smoked per day times the number of years the person smoked. A critic gives three reasons why “Pack years” is not a perfect measurement. Answer the following questions about reliability, bias, and validity.

Reason 1 – Often, subjects will give you two different answers, when you ask them twice, about how much they smoked at various times in their lives.

Reason 2 – The average number of cigarettes smoked per day is not the only facet of a subject’s smoking habits that is of interest. For example, some researchers believe that it is worse to smoke a half-pack a day for a year followed by a pack-and-a-half a day for another year than to smoke a pack a day for two years.

Reason 3 – Subjects often lie about how much they have smoked, almost always tending to downplay the true amount.

Which of these criticisms argue about the **validity** of the Pack Years number?

Which one argues about the **reliability**?

Which one argues about **bias** in the measurement?