



MATHEMATICS 709

DATA, STATISTICS, AND GRAPHS

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DATA, STATISTICS, AND GRAPHS

What are data, statistics, and graphs? Data are bits of information. What you had for breakfast, your name, the number of students in your school, and your preferences in sports are all data items. Statistics is a way of arranging data so that they become meaningful for some particular purpose. Data are

not always numbers; statistics are numbers.

Graphs, then, are pictures of data and statistics. Using data, statistics, and graphs are important skills. The goal of this LIFEPAC® is to introduce these interesting concepts to you and to improve your skills in using them.

OBJECTIVES

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC.

When you have finished this LIFEPAC, you should be able to:

1. Define a random sample.
2. Make a frequency distribution from a given set of data.
3. Define and calculate the mean, median, and mode of a set of data.
4. Find the range and average of the range of a set of data.
5. Sketch a bar graph, a line graph, a picture graph, and a comparison graph.
6. Plot points and sets of points on the Cartesian plane.

Survey the LIFEPAC. Ask yourself some questions about this study. Write your questions here.

I. DATA

OBJECTIVES

When you have completed this section, you should be able to:

1. Define a random sample.
2. Make a frequency distribution from a given set of data.

As we go through life, we use our senses to gather information. We notice what color a flower is. We smell warm bread fresh from the oven. We feel the softness of a kitten's fur and taste the saltiness of a potato chip. We hear a voice and identify it by its sound so that we know who is speaking. We call this information data. When the data we gather are numerical, we sometimes call them statistics. We can also refer to people who work with data and statistics as statisticians.

DEFINITIONS

Data: information from which conclusions can be drawn.

Statistics: numerical information.

Statistician: an expert in statistics.

In this section, however, we shall focus on data. We shall learn how data can be gathered and organized for use in statistics.

GATHERING DATA

Where do we get data? That is, where do we get the numbers to take statistical measures? For a statistician to know what to do with numbers once he has them gathered is not enough; he must also know how to gather them.

Suppose you wanted to find how many hours the students in your school studied each day. You could question every student, but that would take a long time even if your school is relatively small. What a statistician would do is select a small group from among the students and question them. The small group is called a *sample*. If the sample is selected correctly, the answers of the people in the sample will be like answers of the group as a whole.

Think of some ways you could select a sample from the students in your school to question about the study habits of the whole school.

You could question all the first graders.

You could question only those students who make good grades.

You could ask the teachers to name the seven worst students in each grade and question them.

You could question only those whose last names begin with *M*.

None of these methods of sampling would give you a true picture of the whole school. These sampling methods yield what is known as a *biased sample*. If a sample is to truly represent the large group from which it comes, it must be a *random sample*. The actual meaning of *random* is *by chance*.

DEFINITIONS

A *random sample* is a sample in which each element of the large group has an equal chance of being chosen.

A *biased sample* is one that is not random.

The samples described are not random because they eliminate whole pieces of the large group before the sampling ever starts.

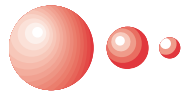
The principle of random sampling is best illustrated by thinking of putting all the names of all the students in a large bowl and then drawing them out, one at a time, until you have enough for your sample. Each time you draw a name out, you must write it down, put it back in the bowl, and stir the names up again before you draw another name. If you happen to choose the same person twice, just put his name back in the bowl. Do not write him down more than once. When you have drawn the



number of names you need for your sample, proceed to question the ones whose names you have drawn. In this way the answers given by the sample can be considered to represent the statistics of the whole group.

One way of getting a random sample is to use a table of random numbers generated by a computer. To use such a table, number the people in the large group, starting with 1. Then, starting somewhere in the random table (close your eyes and point to some number; then start there), read the numbers that follow in a row. Each time you read a number, select the student to whom the number belongs. If you come to the same number twice, ignore it the second time. Keep reading numbers and selecting students until you have enough for your sample. When you get to the end of a row in the table of random numbers, start at the beginning of the next row.

Suppose 700 students were in your school. You would need three-digit numbers through 700. Consider the random number table on page 5. Suppose you decided to start on the second small column, the fourth row. Now, read the random numbers in that row, dividing them into three-digit numbers. The first five in the list would be 568, 599, 269, 696, 682. Do you see where these numbers came from? If you find a number greater than 700, just skip it and go on. This method will give you a random sample from the 700 students.



Complete these activities

- 1.1 Start with the number in the tenth column, seventh row.
List the first 5 three-digit numbers.

- 1.2 Start at the same place and list the first 5 five-digit numbers.

- 1.3 Start with the number in the sixth column, sixteenth row.
List the first 10 one-digit numbers.
