Test Your Understanding 0

The following table shows counts of vehicles passing a particular point on a road, grouped by day (columns) and hour (rows). There is something wrong with the table. Can you tell what it is?

	Day						
Hours	Mon	Tue	Wed	Thu	Fri	Sat	Sun
0000-0100	41	10	12	5	15	19	35
0100-0200	29	4	5	5	3	8	10
0200-0300	17	3	3	0	4	6	9
0300-0400	7	5	5	3	5	3	4
0400-0500	10	24	20	20	20	26	18
0500-0600	20	60	63	62	70	68	50
0600-0700	42	219	232	220	225	222	89
0700-0800	91	429	425	473	447	446	207
0800-0900	163	270	274	272	285	281	314
0900-1000	222	201	206	190	210	227	391
1000-1100	276	224	227	233	235	236	395
1100-1200	280	261	240	262	281	272	398
1200-1300	321	350	337	309	321	372	389
1300-1400	193	234	231	251	232	293	404
1400-1500	202	240	299	282	317	313	353
1500-1600	226	315	316	299	322	402	320
1600-1700	203	286	309	293	339	381	301
1700-1800	220	405	377	393	386	362	281
1800-1900	206	303	295	270	302	299	213
1900-2000	193	257	238	242	254	242	219
2000-2100	123	128	170	153	177	156	122
2100-2200	99	106	111	109	102	98	79
2200-2300	74	66	95	85	82	86	66
2300-2400	54	39	54	50	59	86	80

Test Your Understanding 1

A process that produces audiotapes is monitored for the thickness of magnetic coating on the tapes. In Figure 1, the thicknesses of 150 thickness measurements (in microns) are plotted versus the order in which they were taken. Your boss asks you how the process is performing. What do you say?

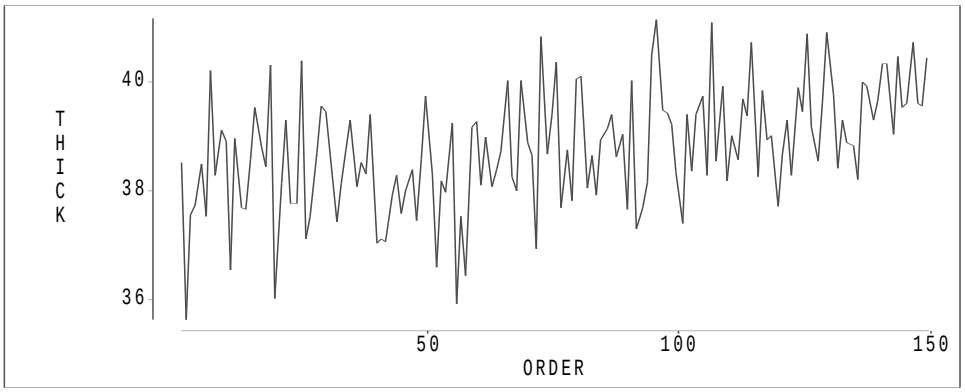

Figure 1: *One-hundred fifty consecutive measurements of the thickness of magnetic coating on audio tape*

Test Your Understanding 2

Figure 2 shows a time series plot. What is the simplest moving average that will remove the cycles in the plot? Apply the moving average to the first 5 data values: $-0.95,\ 0.79,\ -0.99,\ 1.20,\ -1.03$. Plot the moving average values on the graph to demonstrate the cycles have been removed.

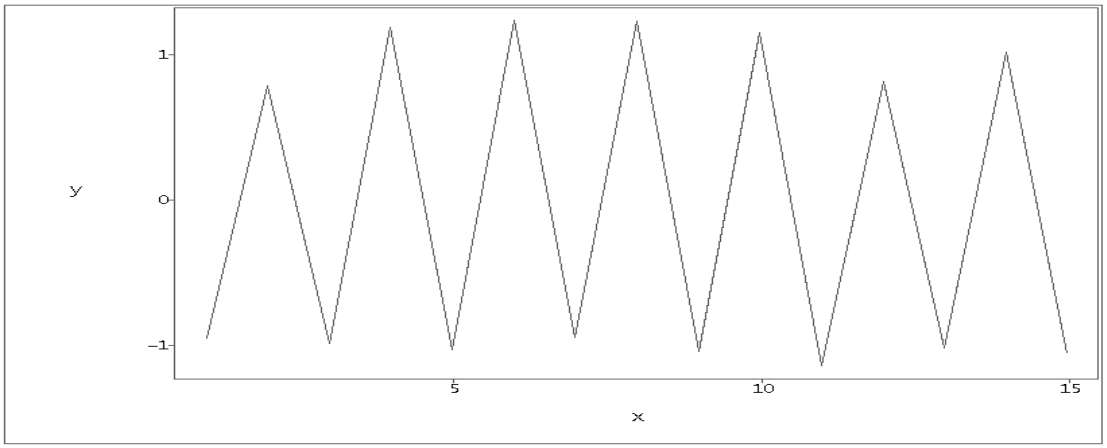

Figure 2: *Time series plot*

Test Your Understanding 3

A microhardness tester is a machine designed to test the hardness of material. In order to test the repeatability and reproducibility of the measuring process using a particular microhardness tester, four operators each took 20 measurements of the hardness of the same metal piece. Time series plots showed that the measuring process was stationary for each of them. Summarize what the stratified plot in Figure 3 tells about the R&R of the measuring process.

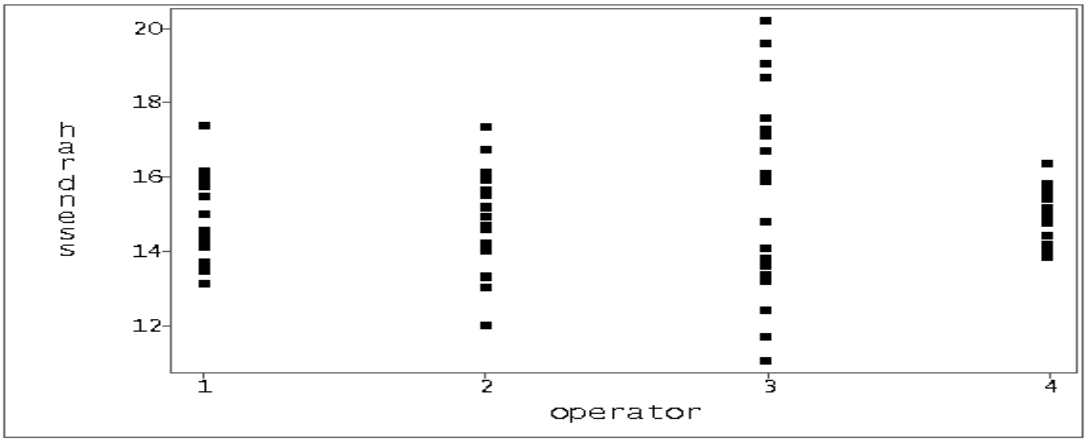

Figure 3: *Force measurements from a microhardness tester*

Test Your Understanding 4

Figure 3 shows four frequency histograms.

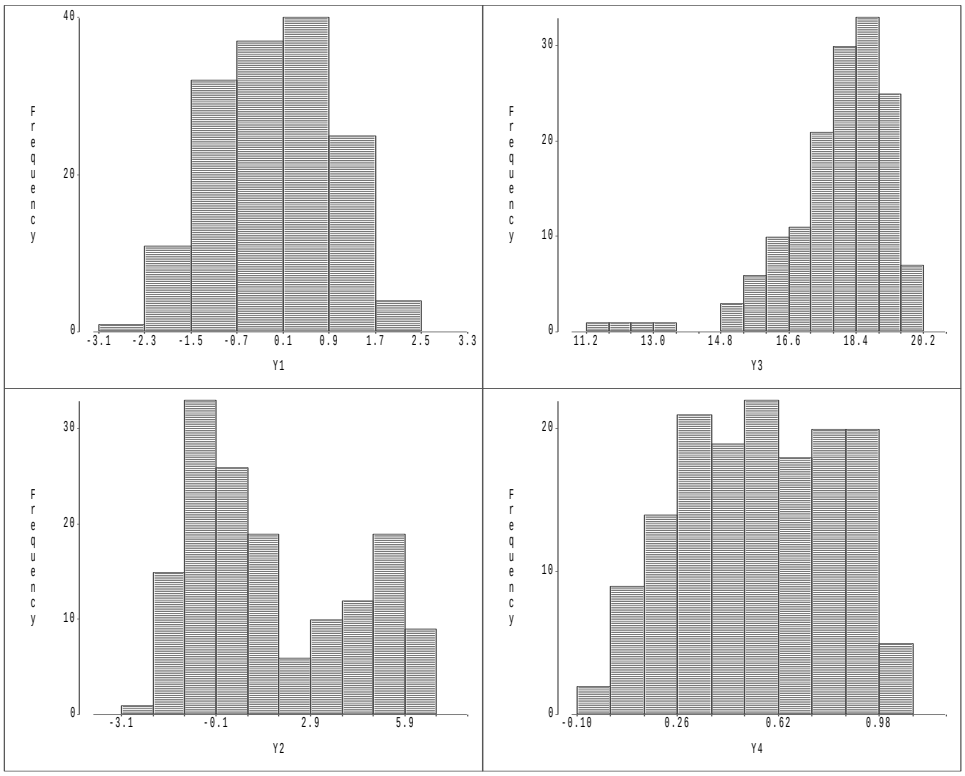

Figure 4: *Four frequency histograms*

Briefly describe the main features of each histogram.

Test Your Understanding 5

Figure 3 shows four frequency histograms.

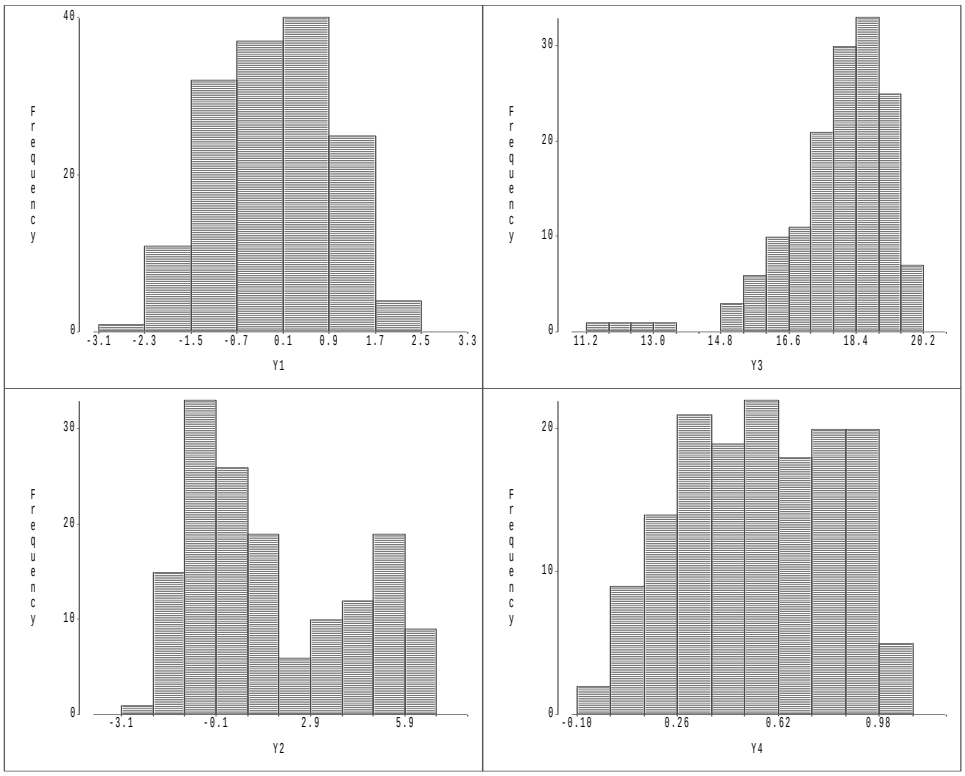

Figure 5: *Four frequency histograms*

For each histogram, describe the summary measures you would use to back up your description.

Test Your Understanding 6

The lengths of seven telephone calls, in minutes, are 17, 7, 1, 4, 39, 2, 11. Generate a boxplot for these data. Does the boxplot identify any outliers?

Test Your Understanding 7

Compute a 1-time trimmed mean and a 1-time Winsorized mean for the data from the last TYU: 17, 7, 1, 4, 39, 2, 11

Test Your Understanding 8

Suppose you want to estimate the number of figures in a 10 chapter textbook, but that you can only sample 20 pages.

1. If you believe all chapters have roughly the same distribution of figures, how would you choose the 20 pages?

2. If you believe that chapters 3, 4, 7 and 9 have many more figures per page than the others, how might you choose the 20 pages?

Test Your Understanding 9

To compare the efficacy of mosquito repellant, volunteers have an arm coated with a prescribed amount of the product. The arm is then inserted into a chamber filled with mosquitoes for a fixed amount of time and the number of bites counted (YUCK!). To compare the efficacies of two different repellants, volunteers are randomly divided into two groups. One group is given repellant 1 and the other repellant 2 and the test described above is conducted for each.

1. Is this a controlled experiment? Why?

2. If it is a controlled experiment, describe the
   (a) Experimental units

   (b) Response

   (c) Experimental factor(s)

   (d) Possible nuisance factors

   (e) Factor levels

   (f) Treatments

   (g) Effect

Test Your Understanding 10

Recall the experiment described in TYU 9:

To compare the efficacy of mosquito repellant, volunteers have an arm coated with a prescribed amount of the product. The arm is then inserted into a chamber filled with mosquitoes for a fixed amount of time and the number of bites counted (YUCK!). To compare the efficacies of two different repellants, volunteers are randomly divided into two groups. One group is given repellant 1 and the other repellant 2 and the test described above is conducted for each.

How could blocking be used to improve the design?

Test Your Understanding 11

In order to identify risk factors for juvenile crimimal behavior, researchers compared a large group of juvenile offenders with a group of their peers who were not offenders. These groups were compared with respect to a large number of factors.

1. What kind of a study is this? Be as specific as you can.

2. Suppose the researchers find a number of factors that are quite different for the two groups. Do you think the researchers can conclude these factors cause juvenile crime? Explain.