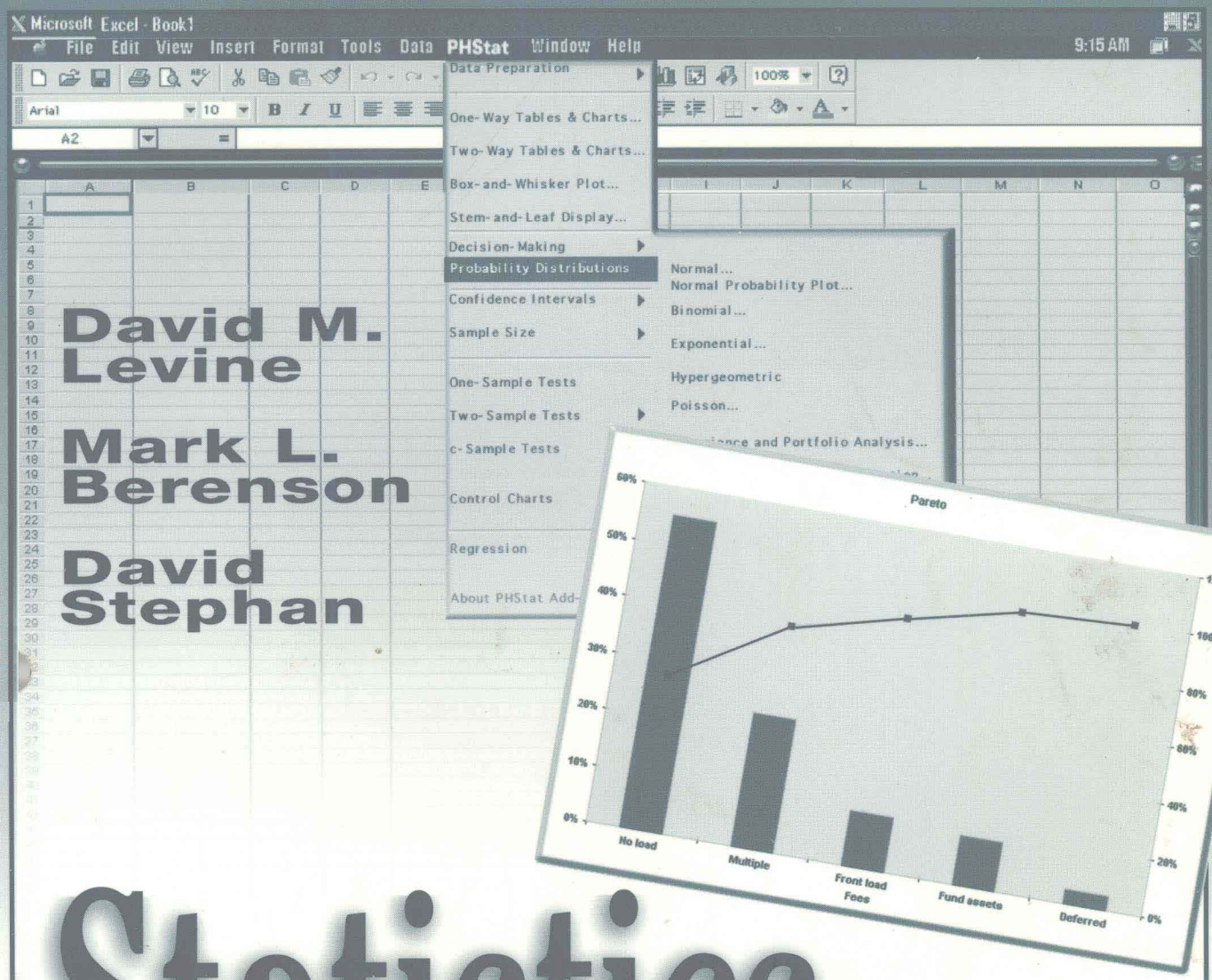
Student Solutions Manual

SECOND EDITION



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Statistics for Managers

USING MICROSOFT® EXCEL

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Note to Students

The ***Student's Solutions Manual*** contains the solutions to even-numbered End-of-Section Problems and Chapter Review Problems in each chapter of the text. Bulleted problems that appear in the text along with the answers in the back are again referenced as such here.

The ***Student's Solutions Manual*** contains many step-by-step, detailed solutions to problems in order to facilitate understanding. In addition, Microsoft Excel output is provided for a variety of problems throughout the text.

Other useful information can also be found on the following World Wide Web page

http://www.prenhall.com/Levine

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CHAPTER 1

1.2 Three sizes of soft drink are classified into distinct categories—small, medium, and large—in which order is implied.

•1.4

(a)	discrete numerical		(g)	categorical
(b)	categorical		(h)	discrete numerical
(c)	discrete numerical		(i)	continuous numerical
(d)	continuous numerical		(j)	categorical
(e)	categorical		(k)	categorical
(f)	continuous numerical			

1.6

(a)	categorical		(e)	discrete numerical
(b)	continuous numerical		(f)	discrete numerical
(c)	continuous numerical		(g)	categorical
(d)	categorical		(h)	categorical

1.8

(a)	categorical		(i)	continuous numerical *
(b)	categorical		(j)	continuous numerical *
(c)	continuous numerical		(k)	categorical
(d)	continuous numerical *		(l)	discrete numerical
(e)	categorical		(m)	continuous numerical *
(f)	categorical		(n)	continuous numerical
(g)	discrete numerical **		(o)	categorical
(h)	discrete numerical		(p)	continuous numerical *

*Some researchers consider money as a discrete numerical variable because it can be "counted."

**Some researchers would "measure" the time since starting the job and consider this a continuous numerical variable.

1.10 While it is theoretically true that ties cannot occur with continuous data, the grossness of the measuring instruments used often leads to the reporting of ties in practical applications. Hence two students may both score 90 on an exam—not because they possess identical ability but rather because the grossness of the scoring method used failed to detect a difference between them.

1.12 (a) 001 (b) 040 (c) 902

•1.14 (a) Row 29: 12 47 83 76 22 ~~99~~ 65 93 10 ~~65~~ ~~83~~ 61 36 ~~98~~ 89 58 86 92 71
Note: All sequences above 93 and all repeating sequences are discarded.

(b) Row 29: 12 47 83 76 22 ~~99~~ 65 93 10 65 83 61 36 ~~98~~ 89 58 86
Note: All sequences above 93 are discarded. Elements 65 and 83 are repeated.

1.16 This is a random sample because the selection is based on chance. It is not a simple random sample because A is more likely to be selected than B or C.

1.18 (a) Since a complete roster of full-time students exists, a simple random sample of 200 students could be taken. If student satisfaction with the quality of campus life randomly fluctuates across the student body, a systematic 1-in-20 sample could also be taken from the population frame. If student satisfaction with the quality of life may differ by gender and by experience/class level, a stratified sample using eight strata, female freshmen through female seniors and male freshmen through male seniors, could be selected. If student satisfaction with the quality of life is thought to fluctuate as much within clusters as between them, a cluster sample could be taken.

(b) A simple random sample is one of the simplest to select. The population frame is the registrar's file of 4,000 student names.

(c) A systematic sample is easier to select by hand from the registrar's records than a simple random sample, since an initial person at random is selected and then every 20th person thereafter would be sampled. The systematic sample would have the additional benefit that the alphabetic distribution of sampled students' names would be more comparable to the alphabetic distribution of student names in the campus population.

(d) If rosters by gender and class designations are readily available, a stratified sample should be taken. Since student satisfaction with the quality of life may indeed differ by gender and class level, the use of a stratified sampling design will not only ensure all strata are represented in the sample, it will generate a more representative sample and produce estimates of the population parameter that have greater precision.

(e) If all 4,000 full-time students reside in one of 20 on-campus residence halls which fully integrate students by gender and by class, a cluster sample should be taken. A cluster could be defined as an entire residence hall, and the students of a single randomly selected residence hall could be sampled. Since the dormitories are fully integrated by floor, a cluster could alternatively be defined as one floor of one of the 20 dormitories. Four floors could be randomly sampled to produce the required 200 student sample. Selection of an entire dormitory may make distribution and collection of the survey easier to accomplish. In contrast, if there is some variable other than gender or class that differs across dormitories, sampling by floor may produce a more representative sample.

1.20 (a) The proposed sample design is a nonprobability quota sample. Since the invoices are already separated into strata, a stratified sample should be used to reduce selection bias and improve generalizability of results.

(b) Sampling 4% of the invoices in each of the four strata would produce a sample with the same number of units.

(c) The proposed sample design is not a simple random sample because all invoices do not have an equal chance of being selected.

1.22 Before accepting the results of a survey of college students, you might want to know, for example:
Who funded the survey? Why was it conducted?
What was the population from which the sample was selected?
What sampling design was used?
What mode of response was used: a personal interview, a telephone interview, or a mail survey? Were interviewers trained? Were survey questions field-tested?
What questions were asked? Were they clear, accurate, unbiased, valid?
What operational definition of "the most 'in' clothing" was used?
What was the response rate?

1.24 A population contains all the items whereas a sample contains only a portion of the items in the population.

1.26 Descriptive methods deal with the collection, presentation, summarization, and analysis of data whereas inferential methods deal with decisions arising from the projection of sample information to the characteristics of a population.

1.48 (a) Population: Actual voters
(b) Sample: "Exit" poll enables an estimate based on actual voters
(c) This is superior to a prior telephone poll of registered voters because not all registered voters will actually vote.

1.50 (a) Population: Cat owners
(b) Sample frame: Households in the United States
(d) (1) categorical (3) numerical
(2) categorical (4) categorical

CHAPTER 2

•2.2 Stem-and-leaf of Finance Scores

5	34
6	9
7	4
8	0
9	38
	$n = 7$

2.4 Stem-and-leaf of Organizational Behavior Scores

6	38
7	66
8	77
9	5
	$n = 7$

2.6 Ordered array: 50 74 74 76 81 89 92

2.8 (a) Ordered array: 3 4 5 6 7 7 9 10 10 10
11 11 12 15 18 18 21 26 33 37

(b) Stem-and-leaf of Monthly Billing Records

0	3456778
10	000112588
20	16
30	37
	$n = 20$

(c) Amounts owed on monthly billing records are concentrated between \$10 and \$19.

•2.10 (a) Ordered array: 4 5 5 6 6 6 6 7 7 7 7 7 7 8 8
8 8 8 8 8 8 8 9 9 9 9 9 9 10 10
10 10 10 10 10 10 11 11 12 12 13 13 14 15 15
15 16 16 18 23

(b) Stem-and-leaf of Book Values

0	455666777777888888888999999
1	000000001122334555668
2	3
	$n = 50$

(c) Book values on the New York Stock Exchange are more likely to be low, since they are concentrated below \$10. Better than half of the stocks sampled had book values below \$10.
(d) You are much more likely to find a New York stock with a book value below \$10 than above \$20. In fact, 28 of the 50 stocks sampled had book values below \$10, compared to one stock with a book value above \$20.

2.12 (a) Ordered array: 170 170 170 180 180 190 190 200 200 210 220
220 250 250 265 270 300 300 320 340 350 450

(b) Stem-and-leaf of VCR Model Prices

	A	B	C	D	E	F
1				Stem-and-Leaf Display		
2				for Price ($)		
3				Stem unit:	100	
4						
5	Statistics			1	7778899	
6	Sample Size	22		2	0012255 67	
7	Mean	245.2273		3	0024 5	
8	Median	220		4	5	
9	Std. Deviation	73.26529				
10	Minimum	170				
11	Maximum	450				

(c) While you can find VCR models priced from $170 to $450, you are more likely to find models priced under $200 than over $300.

(d) Nine of the 22 models are priced from $200 through $290, which is the greatest concentration of VCR model prices.

2.14 (a) Width of interval $\cong \dfrac{247{,}000 - 62{,}000}{5} = 37{,}000 \cong 40{,}000$

Annual Salaries	Midpoint
$60,000 up to $100,000	$80,000
$100,000 up to $140,000	$120,000
$140,000 up to $180,000	$160,000
$180,000 up to $220,000	$200,000
$220,000 up to $260,000	$240,000

(b) Width of interval $\cong \dfrac{247{,}000 - 62{,}000}{6} = 30{,}833.3\overline{3} \cong 35{,}000$

Annual Salaries	Midpoint
$60,000 up to $95,000	$77,500
$95,000 up to $130,000	$112,500
$130,000 up to $165,000	$147,500
$165,000 up to $200,000	$182,500
$200,000 up to $235,000	$217,500
$235,000 up to $270,000	$252,500

2.14 (c) Width of interval $\cong \frac{247{,}000 - 62{,}000}{7} \cong 26{,}430 \cong 30{,}000$

Cont.

Annual Salaries	Midpoint
\$50,000 up to \$80,000	\$65,000
\$80,000 up to \$110,000	\$95,000
\$110,000 up to \$140,000	\$125,000
\$140,000 up to \$170,000	\$155,000
\$170,000 up to \$200,000	\$185,000
\$200,000 up to \$230,000	\$215,000
\$230,000 up to \$260,000	\$245,000

(d) Width of interval $\cong \frac{247{,}000 - 62{,}000}{8} \cong 23{,}125 \cong 25{,}000$

Annual Salaries	Midpoint
\$50,000 up to \$75,000	\$62,500
\$75,000 up to \$100,000	\$87,500
\$100,000 up to \$125,000	\$112,500
\$125,000 up to \$150,000	\$137,500
\$150,000 up to \$175,000	\$162,500
\$175,000 up to \$200,000	\$187,500
\$200,000 up to \$225,000	\$212,500
\$225,000 up to \$250,000	\$237,500

2.16 (a) The value appearing in a relative frequency distribution for a class containing 12 out of a total of 40 observations is 12/40 or 0.3.
(b) The value appearing in a percentage distribution for a class containing 12 out of a total of 40 observations is 12/40 • 100% or 30%.

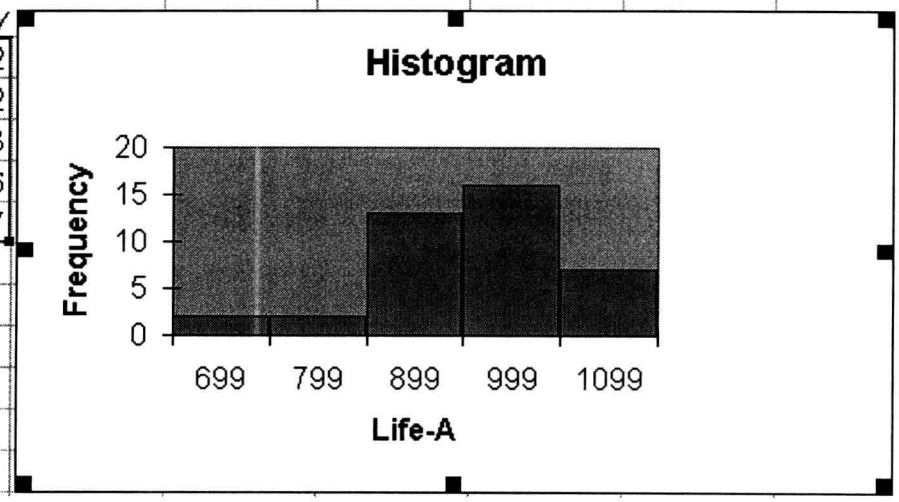
2.18 (a) The percentage polygon is plotted at the class midpoints from a frequency distribution.
(b) The histogram is plotted at the class boundaries from a frequency distribution.
(c) The histogram contains a series of vertical rectangular bars.
(d) The percentage polygon is formed by connecting a set of consecutive plotted points.
(e) The percentage polygon is used for comparing two or more sets of data that have been tallied into corresponding frequency distributions.

•2.20 In constructing an ogive, the vertical axis must show the true zero or "origin" so as not to distort or otherwise misrepresent the character of the data.

2.22 (a) 4% (b) 36% (c) 32% (d) 16 (e) 100%

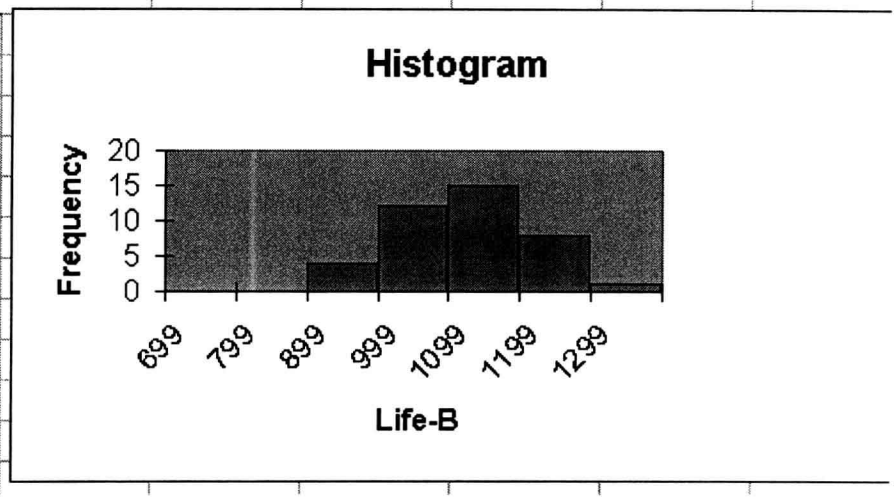
2.24 (a)

	A	B
1	*Bins*	*Frequency*
2	699	2
3	799	2
4	899	13
5	999	16
6	1099	7
7		
8		
9		
10		
11		
12		



(b)

	A	B
1	*Bin*	*Frequency*
2	699	0
3	799	0
4	899	4
5	999	12
6	1099	15
7	1199	8
8	1299	1
9		
10		
11		
12		
13		



2.24 cont.

(c)

Bulb Life (hrs)	Frequency, Mfgr A	Frequency, Mfgr B
650 – 699	2	0
700 – 749	1	0
750 – 799	1	0
800 – 849	4	2
850 – 899	9	2
900 – 949	11	6
950 – 999	5	6
1000 – 1049	4	10
1050 – 1099	3	5
1100 – 1149	0	4
1150 – 1199	0	4
1200 – 1249	0	1

(d)

Bulb Life (hrs)	Percentage, Mfgr A	Percentage, Mfgr B
650 – 749	7.5%	0.0%
750 – 849	12.5	5.0
850 – 949	50.0	20.0
950 – 1049	22.5	40.0
1050 – 1149	7.5	22.5
1150 – 1249	0.0	12.5

(g)

Bulb Life (hrs)	Frequency Less Than, Mfgr A	Frequency Less Than, Mfgr B
650 – 749	3	0
750 – 849	8	2
850 – 949	28	10
950 – 1049	37	26
1050 – 1149	40	35
1150 – 1249	40	40

(h)

Bulb Life (hrs)	Percentage Less Than, Mfgr A	Percentage Less Than, Mfgr B
650 – 749	7.5%	0.0%
750 – 849	20.0	5.0
850 – 949	70.0	25.0
950 – 1049	92.5	65.0
1050 – 1149	100.0	87.5
1150 – 1249	100.0	100.0

(j) Manufacturer B produces bulbs with longer lives than Manufacturer A. The cumulative percentage for Manufacturer B shows 65% of their bulbs lasted 1049 hours or less contrasted with 70% of Manufacturer A's bulbs which lasted 949 hours or less. None of Manufacturer A's bulbs lasted more than 1149 hours, but 12.5% of Manufacturer B's bulbs lasted between 1150 and 1249 hours. At the same time, 7.5% of Manufacturer A's bulbs lasted less than 750 hours, while all of Manufacturer B's bulbs lasted at least 750 hours.

2.26 (a)

Book Values	Frequency	Percentage
0 – 4	1	2%
5 – 9	27	54
10 – 14	15	30
15 – 19	6	12
20 – 24	1	2

(b)

Book Values	Frequency Less Than	Percentage Less Than
0 – 4	1	2%
5 – 9	28	56
10 – 14	43	86
15 – 19	49	98
20 – 24	50	100

(f) Better than half of the book values for the sampled stocks on the New York Stock Exchange had book values between \$5 and \$9.

2.28 (a) Stem-and-leaf of Amount of Soft Drink

1.8H 9
1.9L 03444
1.9H 555666777888999999
2.0L 0011111111222223334
2.0H 556678
2.1L 0

$n = 50$

Note: 1.8H are the "high 1.8s" such as 1.85, 1.86, 1.87, 1.88, or 1.89. 1.9L are the "low 1.9s" such as 1.90, 1.91, 1.92, 1.93, or 1.94. 1.9H are the "high 1.9s" such as 1.95, 1.96, 1.97, 1.98, or 1.99.

(b)

Amount of Soft Drink	Frequency	Percentage
1.85 – 1.89	1	2%
1.90 – 1.94	5	10
1.95 – 1.99	18	36
2.00 – 2.04	19	38
2.05 – 2.09	6	12
2.10 – 2.14	1	2

(c)

Amount of Soft Drink	Frequency Less Than	Percentage Less Than
1.85 – 1.89	1	2%
1.90 – 1.94	6	12
1.95 – 1.99	24	48
2.00 – 2.04	43	86
2.05 – 2.09	49	98
2.10 – 2.14	50	100

2.28
cont. (g) The amount of soft drink filled in the two liter bottles is most concentrated in two intervals on either side of the two-liter mark, from 1.95 to 1.99 and from 2.00 to 2.04 liters. Almost three-fourths of the 50 bottles sampled contained between 1.95 liters and 2.04 liters.
(h) You would predict that the amount of soft drink filled in the next bottle will be between 1.95 liters and 2.04 liters because 74% of the bottles sampled fell within those bounds. If the prediction is for a specific value, you would predict 2.00 liters because it is the midpoint of the combined interval.

2.32 (d) The bar chart does not facilitate comparison of the size of the various categories to the whole. The multiple divisions present in the pie chart are in some instances narrow and difficult to discern. The Pareto diagram is preferable here because it builds on the strength of the bar chart and conveys the relative sense of importance in sales of various food product groups through the cumulative polygon.
(e) Grocery, soy foods, and dairy represent 27.4% of the sales of organic foods purchased from natural food stores in the U.S. during 1995, while Produce represented an additional 21.5% of sales. Together they represent nearly 50% of the sales for that year.

•2.34 (e) Highway transportation accounted for better than half of the oil consumption in the United States in 1995.

2.36 (b) The number one area for residential water consumption in a suburban area during a recent summer was lawn watering, accounting for better than one-third of all water consumed by households that summer. When bathing/showering and toilet usage were added, better than 80% of all water consumed was accounted for. The suburban water district should target those three areas in developing a water reduction plan.

2.38 (b) Restaurants make up almost 24% of the commercial properties in the Times Square area of New York City. Quick-service (food) outlets and vacant stores made up additional 13.3% and 11% of the commercial properties, respectively.
(c) Restaurant-goers will find ample choice among the 232 food establishments serving this 32-block region of New York City, 149 of which afford a full dining experience and the remaining 83 provide quick food service.

•2.42 (a) Table based on column percentages

	Education Level			
Financial Conditions	H.S. Degree or Lower	Some College	College Degree or Higher	Totals
Worse off now	21.2%	24.4%	8.6%	18.5%
No difference	24.2%	45.6%	14.8%	26.0%
Better off now	54.7%	30.0%	76.7%	55.5%
Totals	100%	100%	100%	100%

(c) Financial conditions were rated as better now than before by a majority of the groups with the lowest and highest education levels. But the largest segment of the group with some college rated their financial conditions as no different now than before.

2.44 (d) The row percentages allow us to block the effect of disproportionate group size and show us that the pattern for day and evening tests among the nonconforming group is very different from the pattern for day and evening tests among the conforming group. Where 40% of the nonconforming group was tested during the day, 68% of the conforming group was tested during the day.

(e) The director of the lab may be able to cut the number of nonconforming tests by reducing the number of tests run in the evening, when there is a higher percent of tests run improperly.

•2.64 (f) There is a great deal of variation in the number of days it took to resolve customer complaints. Better than one-quarter of all complaints were resolved in less than 20 days, over half within 30 days. But the amount of time to resolution ranged from one day to 165 days, with over 40% of the complaints requiring more than 30 days to settle and 20% requiring more than 60 days to settle.

(g) You should tell the president of the company that over half of the complaints are resolved within a month, but point out that some complaints take as long as three or four months to settle.

2.66 (a) (1) Ordered arrays:

Weight:	5	6	6	6	6	6	7	7	7	7	7	10
	10	10	11	12	12	15	17	17	18	19	20	21
	21	22	22	22	24	25	26	26	27	29	29	29
	30	31	31	47								
Cost:	0.52	0.62	0.64	0.64	0.69	0.71	0.72	0.72	0.73	0.75	0.77	
	0.80	0.80	0.81	0.81	0.83	0.85	0.87	0.90	0.90	0.92	1.00	
	1.11	1.11	1.13	1.14	1.15	1.23	1.23	1.28	1.46	1.49	1.50	
	1.51	1.51	1.52	1.53	1.54	1.71	1.90					
Calories:	264	275	288	296	299	305	309	312	313	316	322	
	323	327	332	333	337	338	347	348	349	350	353	
	357	358	360	361	364	365	367	370	372	381	382	
	387	390	393	394	409	436	442					
Fat:	3	4	7	7	7	9	9	9	10	10	10	11
	11	12	12	13	13	13	14	14	14	15	15	16
	16	16	17	17	17	18	19	19	20	20	20	21
	21	22	25	26								

2.66
cont.

(2)

Stem-and-leaf for Weight	
0	56666677777
1	00012257789
2	01122245667999
3	011
4	7
	$n = 40$

Stem-and-leaf for Calories	
Hundreds	Tens
2H	67899
3L	001112223333444
3H	55556666677888999
4L	034
	$n = 40$

Stem-and-leaf for Cost	
0.5	2
0.6	2449
0.7	122357
0.8	0011357
0.9	002
1.0	0
1.1	11345
1.2	338
1.3	
1.4	69
1.5	011234
1.6	
1.7	1
1.8	
1.9	0
	$n = 40$

Stem-and-leaf for Fat	
0L	34
0H	777999
1L	0001122333444
1H	55666777899
2L	000112
2H	56
	$n = 40$

Note: L is "low" and H is "high" to create more stems.

(b) Ordered arrays by pizza type:

Weight:	Type 1:	21	25	26	29	31	31	47			
	Type 2:	6	6	6	7	7	7	10	10	17	17
		19	21	22	24	26	29	29			
	Type 3:	5	6	6	7	7	10	11	12	12	15
		18	20	22	22	27	30				
Cost:	Type 1:	1.23	1.23	1.28	1.51	1.51	1.53	1.90			
	Type 2:	0.52	0.64	0.69	0.72	0.72	0.75	0.80	0.81	0.85	
		0.90	0.90	0.92	1.00	1.15	1.49	1.50	1.54		
	Type 3:	0.62	0.64	0.71	0.73	0.77	0.80	0.81	0.83	0.87	
		1.11	1.11	1.13	1.14	1.46	1.52	1.71			
Calories:	Type 1:	305	309	313	327	338	349	382			
	Type 2:	275	288	296	299	316	322	323	332	333	
		337	347	350	353	357	358	364	393		
	Type 3:	264	312	348	360	361	365	367	370	372	
		381	387	390	394	409	436	442			
Fat:	Type 1:	9	9	10	11	13	14	16			
	Type 2:	4	7	7	9	10	10	12	12	13	13
		14	14	16	16	17	17	19			
	Type 3:	3	7	11	15	15	17	18	19	20	20
		20	21	21	22	25	26				