

## Chapter 8

8-1.  $\bar{x} = 131.30$ ,  $s^2 = 113.85$ ,  $s = 10.67$ .

8-2. Descriptive Statistics for  $Y$

Mean = 34.767  
 Variance = 1.828  
 Standard Dev = 1.352  
 Skewness = 0.420  
 Kurtosis = 2.765  
 Minimum = 32.100  
 Maximum = 37.900

$n = 64$

Lower Limit	Cell Count	
32.1000	1	X
32.4625	4	XXXX
32.8250	3	XXX
33.1875	2	XX
33.5500	7	XXXXXXXX
33.9125	6	XXXXXX
34.2750	9	XXXXXXXXXX
34.6375	7	XXXXXX
35.0000	7	XXXXXX
35.3625	5	XXXXX
35.7250	2	XX
36.0875	2	XX
36.4500	4	XXXX
36.8125	1	X
37.1750	1	X
37.5375	3	XXX

8-3. Descriptive Statistics for  $X$ 

Mean	=	89.476
Variance	=	17.287
Standard Dev	=	4.158
Skewness	=	0.251
Kurtosis	=	1.988
Minimum	=	82.600
Maximum	=	98.000

$n = 90$

Lower Limit	Cell Count	
82.60	4	XXXX
83.37	6	XXXXXX
84.14	4	XXXX
84.91	6	XXXXXX
85.68	7	XXXXXXXX
86.45	3	XXX
87.22	8	XXXXXXXXXX
87.99	4	XXXX
88.76	4	XXXX
89.53	7	XXXXXXXX
90.30	6	XXXXXX
91.07	4	XXXX
91.84	3	XXX
92.61	4	XXXX
93.38	4	XXXX
94.15	5	XXXXX
94.92	4	XXXX
95.69	3	XXX
96.46	1	X
97.23	3	XXX

8-4.

Number of Defects	Frequency	Relative Freq
1	1	0.0067
2	14	0.0933
3	11	0.0733
4	21	0.1400
5	10	0.0667
6	18	0.1200
7	15	0.1000
8	14	0.0933
9	9	0.0600
10	15	0.1000
11	4	0.0267
12	4	0.0267
13	6	0.0400
14	5	0.0333
15	1	0.0067
16	1	0.0067
17	1	0.0067
	150	1.0000

$\bar{x} = 6.9334$ ,  $s^2 = 12.5056$ ,  $R = 16$ ,  $\tilde{x} = 6.5$ ,  $MO = 4$ . The data appear to follow a Poisson distribution, though  $s^2$  seems to be somewhat greater than  $\bar{x}$ .

8-5.  $\bar{x} = 131.30$ ,  $s^2 = 113.85$ ,  $s = 10.67$ .

8-6.

Class Interval	Frequency	Relative Freq
$32 \leq X < 33$	6	0.094
$33 \leq X < 34$	11	0.172
$34 \leq X < 35$	22	0.344
$35 \leq X < 36$	14	0.219
$36 \leq X < 37$	6	0.094
$37 \leq X < 38$	5	0.077
	64	1.000

$\bar{x} = 34.7672$ ,  $s^2 = 1.828$ ,  $\tilde{x} = (34.6 + 34.7)/2 = 34.65$ . The data appear to follow a normal distribution.

8-7.

Class Interval	Frequency	Relative Freq
$82 \leq X < 84$	6	0.067
$84 \leq X < 86$	14	0.156
$86 \leq X < 88$	18	0.200
$88 \leq X < 90$	11	0.122
$90 \leq X < 92$	14	0.156
$92 \leq X < 94$	8	0.088
$94 \leq X < 96$	12	0.133
$96 \leq X < 98$	6	0.067
$98 \leq X < 100$	1	0.011

$\bar{x} = 89.4755$ ,  $s^2 = 17.2870$ . The data appear to follow either a gamma or a Weibull distribution.

8-8. (a) Descriptive Statistics for Time

Mean	=	14.355
Variance	=	356.577
Standard Dev	=	18.883
Skewness	=	1.809
Kurtosis	=	5.785
Minimum	=	0.190
Maximum	=	72.890

$$n = 19$$

Lower Limit	Cell Count	
0.1900	13	XXXXXXXXXXXXXXXX
10.5757	1	X
20.9614	0	
31.3471	4	XXXX
41.7329	0	
52.1186	0	
62.5043	1	X

(b)  $\bar{x} = 14.355$ ,  $s^2 = 356.577$ ,  $s = 18.88$ ,  $\tilde{x} = 6.5$ .

8-9.  $\bar{x} = 126.875$ ,  $s^2 = 660.12$ ,  $s = 25.693$

8–10. (a,b)

83		4
84		3
85		3
86		7 7
87		7 5 8 6 9 4
88		5 6 3 2 3 5 3 6 7 4 9
89		8 2 0 9 8 6 3 8 3 7
90		8 3 1 9 4 1 4 6 4 3 5 0 7
91		5 1 0 0 8 2 8 6 1 1 6 2 0
92		7 3 7 6 7 2 2 2
93		3 2 4 3 0 7
94		7 2 2 4
95		6
96		1
97		
98		8
99		
100		3

(c)  $\bar{x} = 90.6425$ ,  $s^2 = 7.837$ ,  $s = 2.799$ (d)  $\tilde{x} = \text{median} = 90.45$ . There are several modes, e.g., 91.0, 919.1, 92.7.

8-12. (a)

		Frequency
32	5 6 9 8 1 7	6
33	1 6 6 8 4 6 8 1 6 5 6	11
34	2 5 3 7 7 2 7 6 9 7 1 6 0 1 6 7 6 5 6 1 7 3	22
35	6 1 0 4 1 3 2 0 1 4 9 8 5 7	14
36	2 8 8 4 6 8	6
37	9 8 1 6 3	5

(b)  $\bar{x} = 34.7672$ ,  $s^2 = 1.828$ 

(c)

		Frequency
32	1 5 6 7 8 9	6
33	1 1 4 5 6 6 6 6 8 8	11
34	0 1 1 1 2 2 3 3 5 5 6 6 6 6 6 7 7 7 7 7 9	22
35	0 0 1 1 1 2 3 4 4 5 6 7 8 9	14
36	2 4 6 8 8 8	6
37	1 3 6 8 9	5

(d)  $\tilde{x} = 34.65$ 

8-13. (a)

		Frequency
82	6 9	2
83	0 1 6 7	4
84	0 1 1 1 2 5 6 9	8
85	0 1 1 1 4 4	6
86	1 1 1 4 4 4 4 6 7 7	10
87	3 3 3 3 5 6 6 7	8
88	2 2 3 6 8	5
89	1 1 4 6 6 7	6
90	0 0 1 1 3 4 5 6 6 6	10
91	1 2 4 7	4
92	1 4 4	3
93	1 1 2 2 7	5
94	1 1 1 3 3 4 6 7	8
95	1 2 3 6	4
96	1 3 4 8	4
97	3 8	2
98	0	1

(b)  $\bar{x} = 89.25$ ,  $Q1 = 86.1$ ,  $Q3 = 93.1$ .

(c)  $IQR = Q3 - Q1 = 7.0$

8-14.  $\min = 82.6$ ,  $Q1 = 86.1$ ,  $\bar{x} = 89.25$ ,  $Q3 = 93.1$ ,  $\max = 98.1$

8-15.  $\min = 32.1$ ,  $Q1 = 33.8$ ,  $\bar{x} = 34.65$ ,  $Q3 = 35.45$ ,  $\max = 37.9$

8-16.  $\min = 1$ ,  $Q1 = 4$ ,  $\bar{x} = 7$ ,  $Q3 = 10$ ,  $\max = 17$

8-18. The descriptive measures developed in this chapter are for numerical data only. The mode, however, does have some meaning. For these data, the mode is the letter e.

8-19. (a)

$$\begin{aligned} \sum_{i=1}^n (X_i - \bar{X}) &= \sum_{i=1}^n X_i - \sum_{i=1}^n \bar{X} = \sum_{i=1}^n X_i - n\bar{X} \\ &= \sum_{i=1}^n X_i - \sum_{i=1}^n X_i = 0 \end{aligned}$$

(b)

$$\begin{aligned} \sum_{i=1}^n (X_i - \bar{X})^2 &= \sum_{i=1}^n (X_i^2 + \bar{X}^2 - 2X_i\bar{X}) \\ &= \sum_{i=1}^n X_i^2 + n\bar{X}^2 - 2\bar{X} \sum_{i=1}^n X_i \\ &= \sum_{i=1}^n X_i^2 + n\bar{X}^2 - 2n\bar{X}^2 \\ &= \sum_{i=1}^n X_i^2 - n\bar{X}^2 \end{aligned}$$

8-20.  $\bar{x} = 1.1933$ ,  $s^2 = 0.000266$ ,  $s = 0.016329$ ,  $\tilde{x} = \text{median} = (1.19 + 1.20)/2 = 1.195$ ,  
mode = 1.21.

8-21.  $\bar{x} = 74.0020$ ,  $s = 0.0026$ ,  $s^2 = 6.875 \times 10^{-6}$

8-22.  $\bar{x} = 62.75$ ,  $s = 2.12$ ,  $s^2 = 4.5$

8-23. (a) Sample average will be reduced by 63.

(b) Sample mean and standard deviation will be 100 units larger; the sample variance will be 10000 units larger.

8-24.  $\bar{y} = a + b\bar{x}$ ,  $s_y = bs_x$

8-25.  $a = \bar{x}$

8-26. (a) 89.336

(b) 89.237

8-27. There is no guarantee that LN is an integer. For example, if we want a 10% trimmed mean with 23 observations, then we would have to trim 2.3 observations from each end. Since we cannot do this, some other procedure must be used. A reasonable alternative is to calculate the trimmed mean with two observations trimmed from each end, then to repeat this procedure with three observations trimmed from each end, and finally to interpolate between the two different values of the trimmed mean.

8-29. (a)  $\bar{x} = 120.22481$ ,  $s^2 = 5.66001$

(b) median = 120, mode = 121

8-30. (a)  $\bar{x} = -0.20472$ ,  $s^2 = 3.96119$

(b) median = mode = 0

8-31. For 8-29,  $cv = 2.379/120.225 = 0.01979$ .

For 8-30,  $cv = 1.990/(-0.205) = -9.722$ .

8-32.  $\bar{x} \approx 51.124$ ,  $s^2 \approx 586.603$ ,  $\tilde{x} \approx 48.208$ , mode  $\approx 36.334$

8-33.  $\bar{x} \approx 22.407$ ,  $s^2 \approx 208.246$ ,  $\tilde{x} \approx 22.813$ , mode  $\approx 23.64$

8-34.  $\bar{x} \approx 847.885$ ,  $s^2 \approx 15987.81$ ,  $s \approx 126.44$ ,  $\tilde{x} \approx 858.98$ , mode  $\approx 1050$