CHAPTER 2

Descriptive Statistics I: Elementary Data Presentation and Description

ASSIGNMENT CLASSIFICATION TABLE (BY LEARNING OBJECTIVE)

	Level of Difficulty (Moderate to Challenging)		
Learning Objectives	1	2	3
1. Compute and interpret the three main measures of central tendency.	1,2,3,4	5,6,7,11,12,13,14	
2. Compute and interpret the four main measures of dispersion.	8,9,10,50,53	11,12,13,14,51,52, 54,55,56,	57,58
3. Summarize data in a frequency distribution.	15,16,17	18,19,20,21,22,23, 24,25,26,59,60,61	62,63
4. Summarize data in a relative frequency distribution.	27,28,29,32, 33,64,	30,31,34,35,36,65	
5. Build and interpret a cumulative frequency distribution.	37,38,66	39,40,41,67,68,69	70
6. Analyze grouped data and show that data in a histogram.	42,43,44,45	46,47,48,49,71,72, 73,74,75,76	77,78

CHAPTER 2

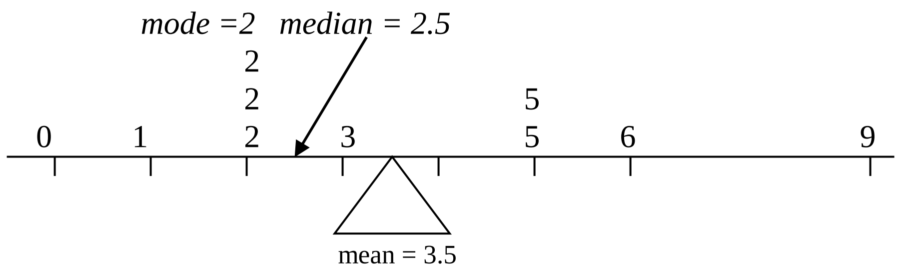
1. **Mean** (μ) = $\frac{2+6+2+0+2+3+5+9+1+5}{10}$ = 3.5. This is the center of the data set insofar as it represents the balance point for the data.

The ordered list is 0, 1, 2, 2, 2, 3, 5, 5, 6, 9.

The **median** is the middle value; in this case, it's 2.5, the value in position $\left(\frac{10+1}{2}\right)$ = 5.5—or halfway between the 5th and 6th values— in the ordered list.) At least half the values in the data set are at or above 2.5; at least half of the values are at or below 2.5.

Mode = 2. This is the most frequently occurring value.

c)



The high value, 9, exerts a great deal of leverage in setting the balance point (that is, the *mean*) because it sits so far to the right.

2.

Mean (μ) = $\frac{471+300+...+267}{12}$ = \$533.25 million. This is the center of the data set insofar as it represents the balance point for the data.

The ordered list is

1	2	3	4	5	6	7	8	9	10	11	12
\$267,	\$300,	\$333,	\$384,	\$471,	\$479,	\$495,	\$592,	\$614,	\$757,	\$787,	\$920

The **median** is the middle value. It's the value in position $\left(\frac{12+1}{2}\right)$ = 6.5 in the ordered list, halfway between the 6th and the 7th value: 479 and 495. We can calculate its value as $\left(\dfrac{479+495}{2}\right)$ = \$487. Interpretation: At least half the movies had revenues of \$487 million or more; at least half had revenues of \$487 million or less.

There's no **mode**, since no value appears more than once.

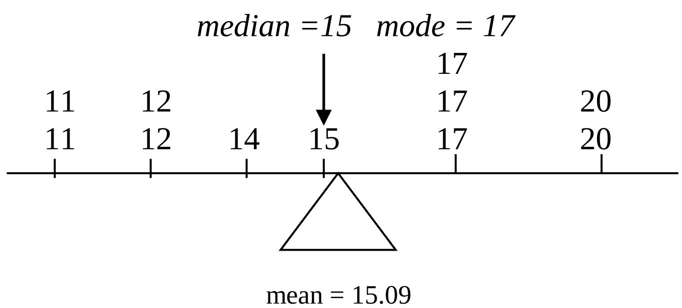
3. a) **Mean** (μ) =15.09 This is the center of the data set insofar as it represents the balance point for the data.

The ordered list is 11, 11, 12, 12, 14, 15, 17, 17, 17, 20, 20.

The **median** is the middle value; in this case, 15 (the value in position $\left(\dfrac{11+1}{2}\right)$ = 6 in the ordered list) At least half the months had 15 or more bankruptcies; at least half had 15 or less.

The mode (or modal value) is 17, the most frequently occurring value.

c)



4. **Mean** ($\bar{x}$) =142. This is the center of the data set insofar as it represents the balance point for the data.

The ordered list is 40, 99, 115, 130, 130, 190, 290.

The **median** is the middle value—here, 130 (the value in position $\left(\dfrac{7+1}{2}\right)$ = 4 in the ordered list) At least half the scores were 130 or more; at least half the scores were 130 or less.

The **mode** is 130—the most frequent score.

b) A "typical" or "representative" score is about 130. There's a chance for an occasional great game and an occasional dismal performance. (For purposes of comparison, a professional bowler will average above 230.)

5. **Mean** (μ) =1.411. This is the center of the data set insofar as it represents the balance point for the data.

The ordered list is:

0 0.21 0.23 0.60 1.43 1.64 2.24 2.52 2.69 3.06

The **median** is the middle value—here, 1.535 (the value in position $\left(\frac{10+1}{2}\right)$ = 5.5 in the ordered list, or halfway between the 5th and 6th value: $\left(\frac{1.43+1.64}{2}\right)$ = 1.535.) At least half the values were 1.535% or more; at least half the scores were 1.535% or less.

There is no **mode** here.

6. **Mean** (μ) =\$60,010. This is the center of the data set insofar as it represents the balance point for the data.

The ordered list is:

55,430 57,118 60,055 60,451 60,946 63,011 63,057

The **median** is the middle value—here, 60,451 (the value in position $\left(\frac{7+1}{2}\right)$ = 4 in the ordered list, 60,451. At least half the values were \$60,451 or more; at least half the scores were \$60,451 or less.

There is no **mode**.

7. This suggests that there are a relatively few very high volume texters, pulling the average well to the right of (that is, above) the median. The mean is generally more sensitive to extreme values than is the median.

8. **Range**: 22 – 2 = 20

Interpretation: The difference between the largest value and the smallest value is 20.

MAD: Given that the mean of the data is 9,

$$\text{MAD} = \frac{|2 - 9| + |12 - 9| + |6 - 9| + |4 - 9| + |8 - 9| + |12 - 9|}{6} = \frac{32}{6} \approx 5.33$$

Interpretation: The average difference between the individual values and the overall average for the data is 5.33.

Variance: $\sigma^2 = \frac{(2 - 9)^2 + (12 - 9)^2 + (6 - 9)^2 + \ldots + (12 - 9)^2}{6}$

$$= \frac{262}{6} \approx 43.667$$

Standard Deviation: $\sigma = \sqrt{43.667} \approx 6.61$

Interpretation: Roughly speaking, the individual values are, on average, about 6.61 units away from the overall mean for the data. As is typically the case, the standard deviation here, 6.61, is greater than the MAD, 5.33.

9. **Range**: 116 – 111 = 5 yen

Interpretation: The difference between the highest exchange rate and the lowest exchange rate was 5 yen.

MAD: Given that the mean of the data is 114,

$$\text{MAD} = \frac{|112 - 114| + |115 - 114| + |111 - 114| + \ldots + |112 - 114|}{7} = \frac{14}{7} = 2 \text{ yen}$$

Interpretation: The average difference between the daily exchange rate and the overall average exchange rate for the week was 2 yen.

Variance: $\sigma^2 = \frac{(112 - 114)^2 + (115 - 114)^2 + (111 - 114)^2 + \ldots + (112 - 114)^2}{7}$

$$= \frac{30}{7} = 4.286$$

Interpretation: The average *squared* difference between the daily exchange rate and the overall average exchange rate for the week was 4.286 (yen^2).

Standard Deviation: $\sigma = \sqrt{4.286} = 2.07$

Interpretation: Roughly speaking, the daily exchange rate is, on average, about 2.07 yen away from the overall mean exchange rate for the week (114 yen/dollar). As is typically the case, the standard deviation here, 2.07, is slightly greater than the MAD, 2.0.

10. **Range**: 146 – 122 = $24

Interpretation: The difference between the highest price and the lowest price is $24.

MAD: Given that the mean of the data is $128,

$$\text{MAD} = \frac{|122-128| + |124-128| + |127-128| + \ldots + |134-128|}{12} = \frac{60}{12} = \$5$$

Interpretation: The average difference between the individual competitor prices and the overall average competitor price is $5.

Variance: $$\sigma^2 = \frac{(122-128)^2 + (124-128)^2 + (127-128)^2 + \ldots + (134-128)^2}{12}$$

$$= \frac{532}{12} \approx 44.33$$

Interpretation: The average *squared* difference between the individual competitor prices and the overall average competitor price is 44.33 (squared dollars).

Standard Deviation: $\sigma = \sqrt{44.33} \approx \$6.66$

Interpretation: Roughly speaking, the price charged by individual competitors is, on average, about $6.66 away from the overall average price charged by the group.

11.

YEAR	2003	2004	2005	2006	2007
UNITS	7.56	7.48	7.66	7.76	7.56

YEAR	2008	2009	2010	2011	2012
UNITS	6.77	5.40	5.64	6.09	7.24

Mean: 6.916

Range: 7.76 – 5.40 = 2.36 million cars sold.

Interpretation: The difference between the highest sales year and the lowest sales year was 2.36 million cars.

MAD: Given that the mean is 6.916 million cars,

$$\text{MAD} = \frac{|7.56 - 6.916| + |7.48 - 6.916| + |7.66 - 6.916| + \ldots + |7.24 - 6.916|}{10}$$

$$= \frac{7.528}{10} = .7528 \text{ million cars} \quad (= 752{,}800 \text{ cars})$$

Interpretation: The average difference between individual year sales and the overall average sales level for the 10-year period is approximately .753 million cars.

Variance: $\sigma^2 = \dfrac{(7.56 - 6.916)^2 + (7.48 - 6.916)^2 + (7.66 - 6.916)^2 + \ldots + (7.24 - 6.916)^2}{10}$

$$= \frac{7.148}{10} = .715$$

Interpretation: The average *squared* difference between individual year sales and the overall average sales level is .715 million cars^2.

Standard Deviation: $\sigma = \sqrt{.7148} \approx .845$ million cars. (845,000 cars)

Interpretation: : Roughly speaking, individual year sales are, on average, about 845,000 cars away from overall average car sales for the 10-year period.

12. a) **Range**: 290 – 40 = 250 pins

Interpretation: The difference between the highest score and the lowest score rate is 250.

MAD: Given that the mean score is 142 pins,

$$\text{MAD} = \frac{|130 - 142| + |99 - 142| + |190 - 142| + \ldots + |115 - 142|}{7} = \frac{392}{7} = 56 \text{ pins.}$$

Interpretation: The average difference between the individual scores and the overall average score for the sample is 56 pins.

Variance: $$s^2 = \frac{(130-142)^2 + (99-142)^2 + (190-142)^2 + \ldots + (115-142)^2}{7-1}$$

$$= \frac{37478}{6} = 6246.33$$

Interpretation: If we looked at the population being represented here, the average *squared* difference between the individual scores and the overall average score in that population would be about 6246 (pins^2).

Standard Deviation: $s = \sqrt{6246.33} \approx 79.0$ pins.

Interpretation: Roughly speaking, the scores in the sample suggest that if we looked at the population being represented here, the individual scores in that population would be, on average, about 79 pins away from the overall population average score.

b) Your bowling looks to be pretty erratic.

13. a) **Range**: 3927 – 0 = 3927 megawatts

Interpretation: The difference between the highest capacity and the lowest is 3927 megawatts.

MAD: Given that the mean is 1234,

$$\text{MAD} = \frac{|10-1234| + |138-1234| + |3927-1234| + \ldots + |2573-1234|}{8} = \frac{10622}{8} =$$

1327.75 megawatts.

Interpretation: The average difference between the individual capacities and the overall average capacity is 1327.75 megawatts.

Variance: $$\sigma^2 = \frac{(10-1234)^2 + (138-1234)^2 + (3927-1234)^2 + \ldots + (2573-1234)^2}{8}$$

$$= \frac{16584496}{8} = 2073062$$

Interpretation: The average *squared* difference between the individual values and the overall average value is about 2,073,062 (megawatts^2).

Standard Deviation: $\sigma = \sqrt{2073062} \approx 1439.8$ megawatts.

Interpretation: Roughly speaking, the individual state capacities are, on average, about 1440 megawatts away from the overall average capacity of 1234 megawatts.

14. a) **Range**: 40.5 – .6 = 39.9 $billion

Interpretation: The difference between the highest assets and the lowest is 39.9 $billion.

MAD: Given that the mean is 9.07 $billion,

$$\text{MAD} = \frac{|40.5 - 9.07| + |25.1 - 9.07| + |9.9 - 9.07| + \ldots + |.6 - 9.07|}{10} = \frac{96.58}{10} = 9.658$$

$billion.

Interpretation: The average difference between the individual assets and the overall average asset value is 9.658 $billion.

Variance: $$\sigma^2 = \frac{(40.5 - 9.07)^2 + (40.5 - 9.07)^2 + (40.5 - 9.07)^2 + \ldots + (40.5 - 9.07)^2}{10}$$

$$= \frac{1588.52}{10} \approx 158.852$$

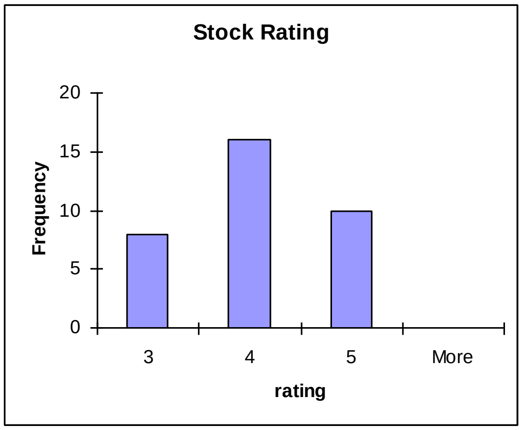
Interpretation: The average *squared* difference between the individual asset values and the overall average asset value is 158.852 $billion.

Standard Deviation: $\sigma = \sqrt{158.852} \approx 12.604$ $billion.

Interpretation: Roughly speaking, the individual asset values are, on average, about 12.604 $billion away from the overall average asset value of 9.07 $billion.

15.

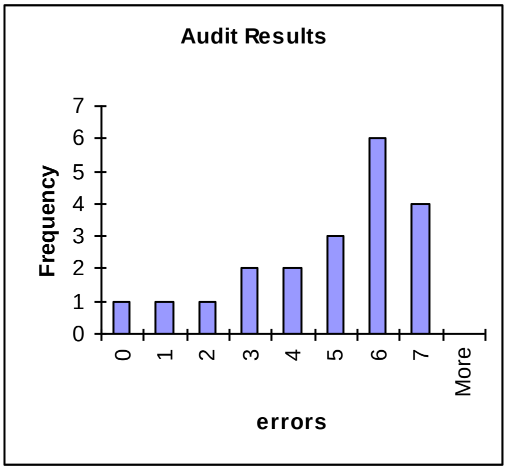
Rating *x*	Frequency *f(x)*
3	8
4	16
5	10



16. a)

errors *x*	frequency *f(x)*
0	1
1	1
2	1
3	2
4	2
5	3
6	6
7	4

b)

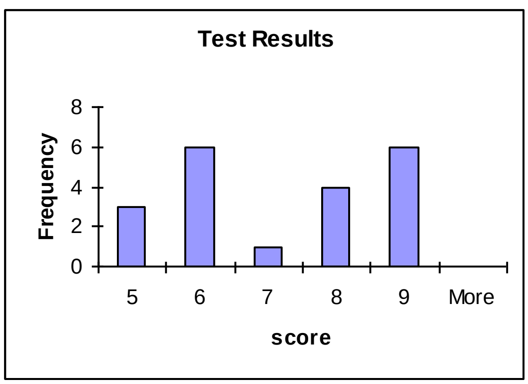


c) The distribution is negatively skewed and unimodal.

17. a)

score *x*	frequency *f*(*x*)
5	3
6	6
7	1
8	4
9	6

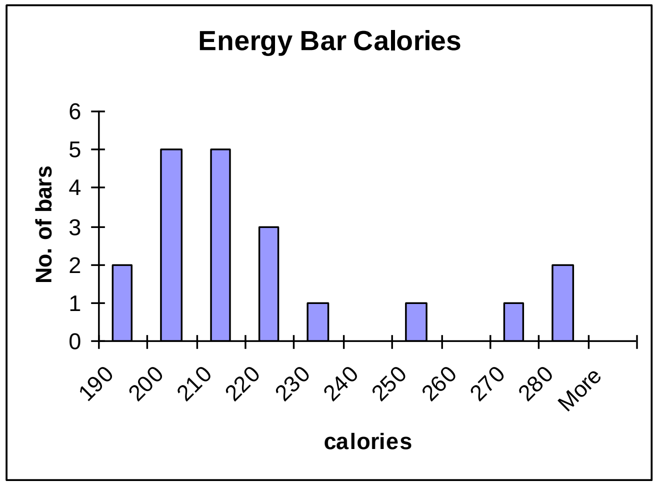
b)



c) The distribution is bi-modal.

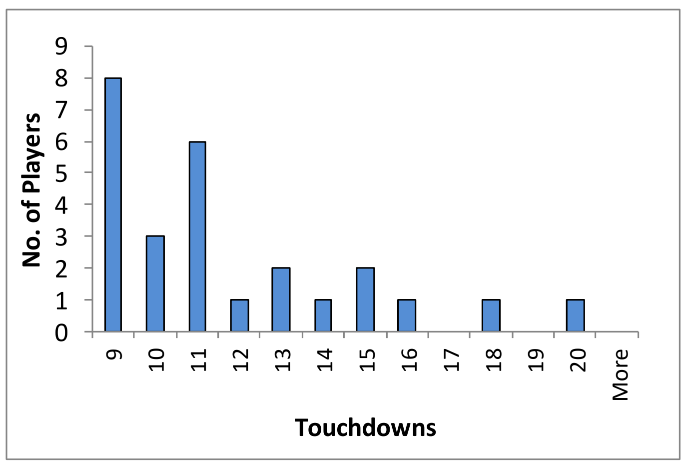
18.

calories x	frequency f(x)
190	2
200	5
210	5
220	3
230	1
240	0
250	1
260	0
270	1
280	2



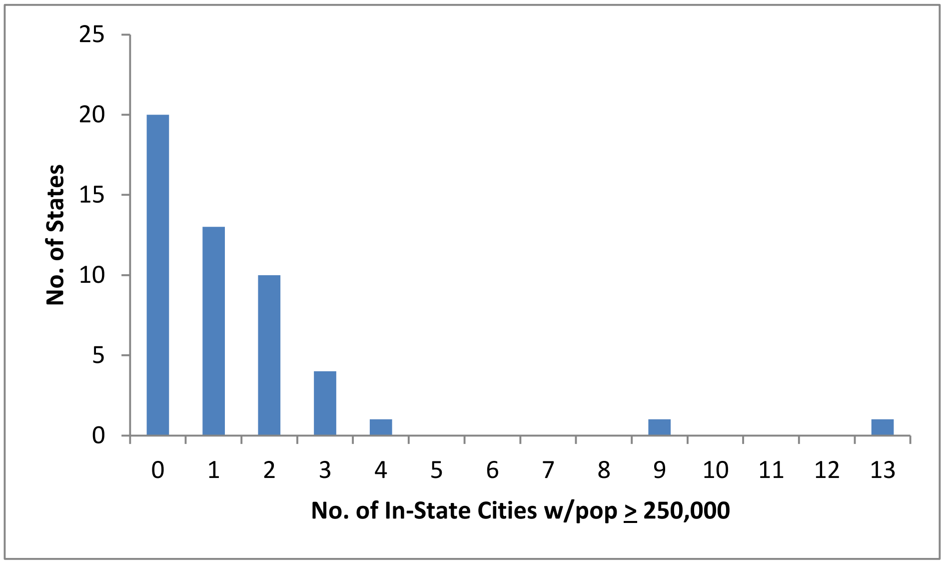
19.

touchdowns x	No. of Players f(x)
9	8
10	3
11	6
12	1
13	2
14	1
15	2
16	1
17	0
18	1
19	0
20	1



20.

No. of In-State Cities w/pop ≥ 250,000 *x*	No. of States *f(x)*
0	20
1	13
2	10
3	4
4	1
5	0
6	0
7	0
8	0
9	1
10	0
11	0
12	0
13	1
Total =	50



21. a) $\mu \approx 1.29$ defectives
 b) median = value halfway between the 12th and 13th value in the ordered list = 1
 c) $\sigma^2 = 1.71$; $\sigma = \sqrt{1.71} = 1.31$ defectives

The detailed calculations are shown below:

x	*f(x)*	*xf(x)*	*x−μ*	*(x−μ)2*	*(x−μ)2 f(x)*
0	9	0	−1.29	1.66	14.97
1	6	6	−0.29	0.08	0.50
2	4	8	0.71	0.50	2.02
3	3	9	1.71	2.92	8.77
4	2	8	2.71	7.3441	14.69
totals	24	31			40.96
		μ =31/24 =1.29			σ² = 1.71

22. a) $\mu = 2.56$ household members
 b) median = approximately the 52 millionth ((104.6 million +1)/2) value in the ordered list = 2
 c) $\sigma^2 = 1.99$; $\sigma = \sqrt{1.99} \approx 1.41$ household members

The detailed calculations are shown below:

x	*f(x) (millions)*	*xf(x)*	*x−μ*	*(x−μ)2*	*(x−μ)2 f(x)*
1	26.7	26.7	−1.56	2.43	64.98
2	34.7	69.4	−0.56	0.31	10.88
3	17.2	51.6	0.44	0.19	3.33
4	15.3	61.2	1.44	2.07	31.73
5	6.9	34.5	2.44	5.95	41.08
6	2.4	14.4	3.44	11.83	28.40
7	1.4	9.8	4.44	19.71	27.60
totals	104.6	267.6			208
		μ = 267.6/104.6 = 2.56			σ² = 208/104.6 = 1.99

23. a) $\bar{x}$ = 6.2 calls
b) median = the value halfway between the 7th and 8th value ((14+1)/2) in the ordered list = 6
c) s^2 = 1.41; s = $\sqrt{1.41} \approx$ 1.19 calls

The detailed calculations are shown below:

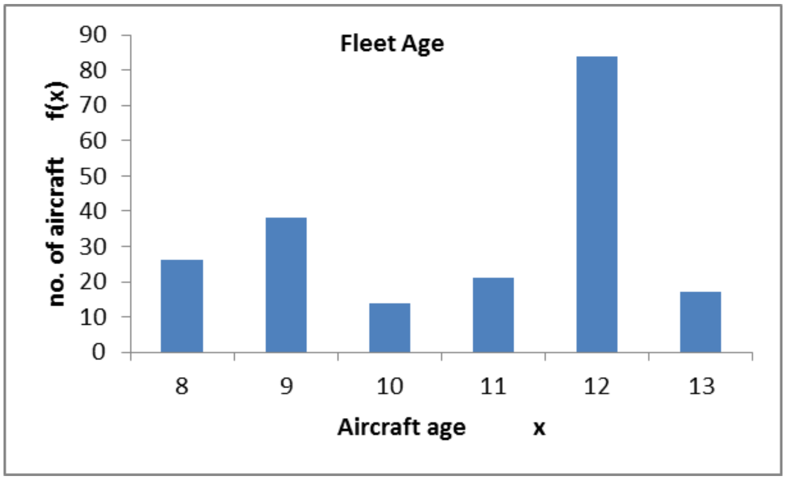
x	*f(x)*	*xf(x)*	$x-\bar{x}$	$(x-\bar{x})^2$	$(x-\bar{x})^2 f(x)$
4	1	4	−2.2	4.84	4.84
5	3	15	−1.2	1.44	4.32
6	4	24	−0.2	0.04	0.16
7	4	28	0.8	0.64	2.56
8	2	16	1.8	3.24	6.48
totals	14	87 $\bar{x}$ = 87/14 = 6.2			18.36 s^2 = 18.36/(14-1) =1.41

24. a) μ = 2.8 ships
b) median = 183rd value ((365+1)/2 = 183) in the ordered list = 3.
c) σ^2 = 1.55; σ = $\sqrt{1.55} \approx$ 1.24 ships

The detailed calculations are shown below:

x	*f(x)*	*xf(x)*	*x−μ*	*(x−μ)2*	*(x−μ)2 f(x)*	
0	14	0	−2.8	7.84	109.76	
1	47	47	−1.8	3.24	152.28	
2	71	142	−0.8	0.64	45.44	
3	123	369	0.2	0.04	4.92	
4	82	328	1.2	1.44	118.08	
5	28	140	2.2	4.84	135.52	
totals	365	1026 μ = 1026/365 = 2.8			566.00 σ^2 = 566/365 = 1.55	

25. a)



b) μ = 10.75 years

c) median = 101.5th value ((200+1)/2 = 100.5) in the ordered list, halfway between the 100^{th} and the 101^{st} value = 12 years.

d) $\sigma^2 = 2.72$; $\sigma = \sqrt{2.72} \approx 1.65$ years

The detailed calculations are shown below:

x (age)	f(x) (no. of aircraft)	xf(x)	x−μ	(x−μ)2	(x−μ)2 f(x)
8	27	216	−2.75	7.5625	204.188
9	37	333	−1.75	3.0625	113.313
10	14	140	−0.75	0.5625	7.875
11	21	231	0.25	0.0625	1.3125
12	84	1008	1.25	1.5625	131.25
13	17	221	2.25	5.0625	86.0625
totals	200	2149			544.00
		μ = 2147/200 = 10.75			σ^2 = 544/200 = 2.72

26.

b) μ = \$13.20

c) median = 5.5th value ((10+1)/2 = 5.5) in the ordered list, halfway between the 5th and the 6th value = \$12.

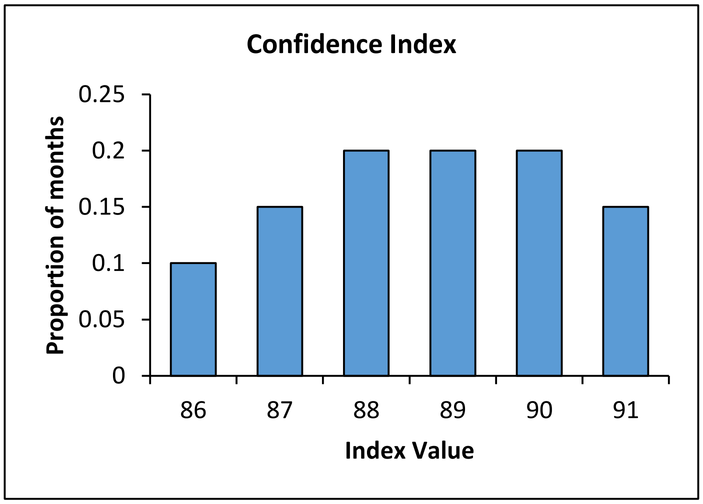
d) $\sigma^2 = 10.96$; $\sigma = \sqrt{10.96} \approx \$3.31$

x (price)	*f(x)* no. of IPOs	*xf(x)*	*x−μ*	*(x−μ)2*	*(x−μ)2 f(x)*
9	1	9	−4.2	17.64	17.64
10	2	20	−3.2	10.24	20.48
11	1	11	−2.2	4.84	4.84
12	2	24	−1.2	1.44	2.88
16	2	32	2.8	7.84	15.68
17	1	17	3.8	14.44	14.44
19	1	19	5.8	33.64	33.64
totals	10	132			109.6
		μ = 132/10 = 13.2			σ^2 = 109.6/10 = 10.96

27. a)

Index value x	*proportion of months p(x)*
86	2/20 = 0.10
87	3/20 = 0.15
88	4/20 = 0.2
89	4/20 = 0.2
90	4/20 = 0.2
91	3/20 = 0.15

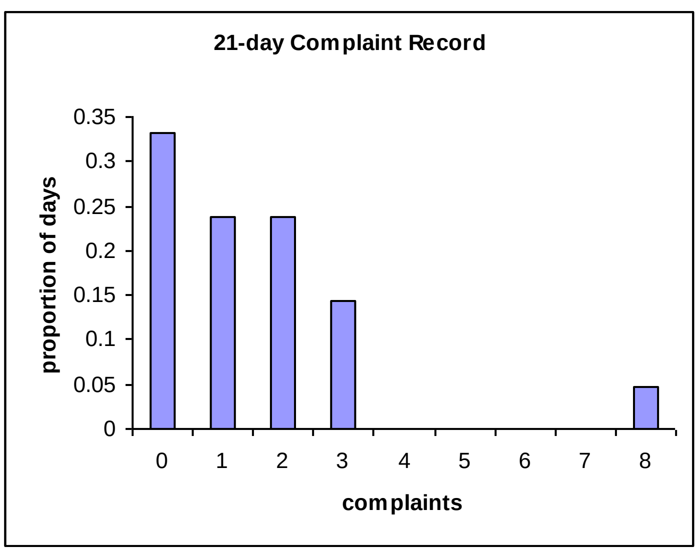
b)



28. a)

complaints *x*	proportion of days *p(x)*
0	0.333
1	0.238
2	0.238
3	0.143
8	0.048

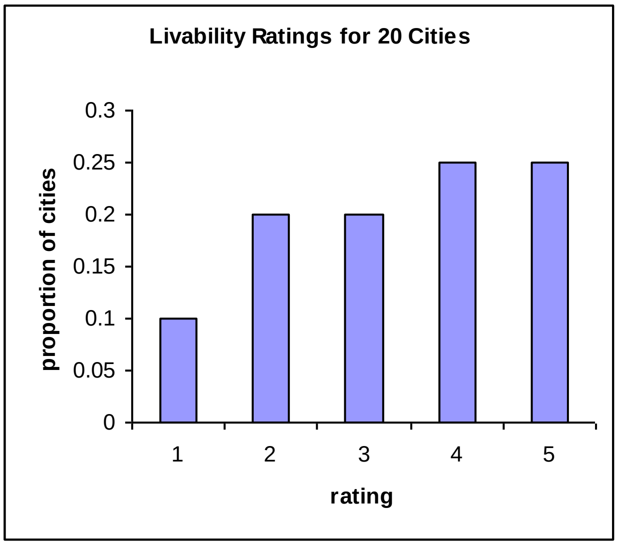
b)



29. a)

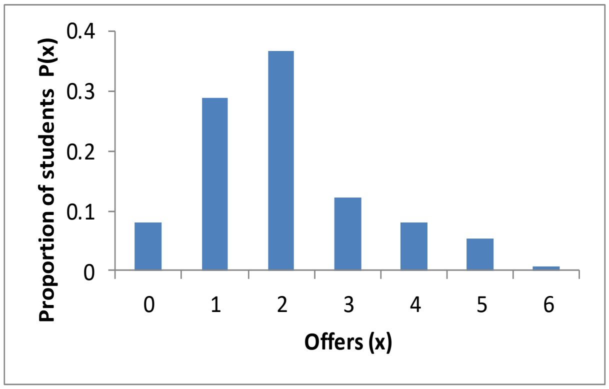
rating *x*	proportion of cities *p*(*x*)
1	0.1
2	0.2
3	0.2
4	0.25
5	0.25

b)



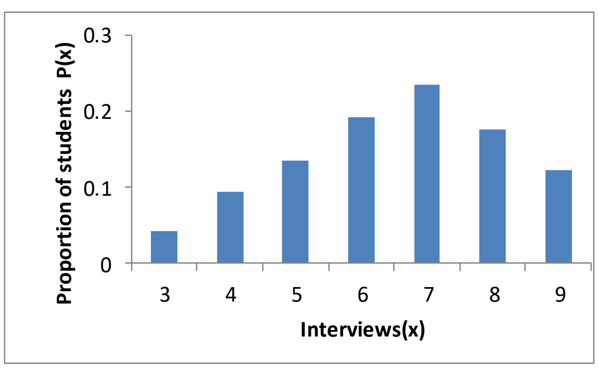
30.

Offers *x*	No. of Students *f(x)*	Proportion of Students *p(x)*
0	80	0.08
1	288	0.288
2	367	0.367
3	122	0.122
4	81	0.081
5	54	0.054
6	8	0.008
	1000	1.000



31.

Interviews x	No. of Students x	Proportion of Students p(x)
3	43	0.043
4	95	0.095
5	136	0.136
6	192	0.192
7	235	0.235
8	177	0.177
9	122	0.122
	1000	1.000



32. median = 7. Summing down the relative frequency (proportion) column, we reach a sum of .50 part way through the 7s (.22 + part of .36). The median, then, is 7).

x	*p(x)*
6	0.22
7	0.36
8	0.20
9	0.12
10	0.10
	1.00

33. a) μ = 2.25 days (See detailed calculations below.)
b) median = 2 days (Summing down the relative frequency (proportion) column, we reach a sum of .50 part way through the 2s (.39 + part of .27). The median, then, is 2.
c) σ^2 = 1.908; $\sigma = \sqrt{1.908} \approx 1.38$ days

x	*p(x)*	*xp(x)*	*(x−μ)*	*(x−μ)2*	*(x−μ)²p(x)*
1	0.39	0.39	−1.25	1.563	0.609
2	0.27	0.54	−0.25	0.063	0.017
3	0.17	0.51	0.75	0.563	0.096
4	0.08	0.32	1.75	3.063	0.245
5	0.05	0.25	2.75	7.563	0.378
6	0.04	0.24	3.75	14.063	0.563
		μ =2.25			σ^2=1.908

34. a)

Games Won	Proportion of Award Winning Pitchers
17	4/50= 0.08
18	7/50= 0.14
19	9/50= 0.18
20	11/50= 0.22
21	8/50= 0.16
22	5/50= 0.1
23	4/50= 0.08
24	2/50= 0.04

b) μ = 20.06 games

x	$p(x)$	$xp(x)$
17	0.08	1.36
18	0.14	2.52
19	0.18	3.42
20	0.22	4.40
21	0.16	3.36
22	0.1	2.20
23	0.08	1.84
24	0.04	0.96
		μ = 20.06

c) Median = 20 games (Summing down the relative frequency (proportion) column, we reach a sum of .50 part way through the 20s (.08 + .14 + +.18 + part of .22). The median, then, is 20.)

35. a) μ = 2.03 offers

b) Median = 2 offers (Summing down the relative frequency (proportion) column, we reach a sum of .50 part way through the 2s (.08 + .288 + part of .367). The median, then, is 2.)

c) $\sigma^2 = 1.667$. $\sigma = \sqrt{1.667} \approx 1.291$ offers

x	$p(x)$	$xp(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2p(x)$
0	0.08	0	−2.03	4.1209	0.329672
1	0.288	0.288	−1.03	1.0609	0.305539
2	0.367	0.734	−0.03	0.0009	0.00033
3	0.122	0.366	0.97	0.9409	0.11479
4	0.081	0.324	1.97	3.8809	0.314353
5	0.054	0.27	2.97	8.8209	0.476329
6	0.008	0.048	3.97	15.7609	0.126087
		μ = 2.03 mean			1.6671 variance

36. a) μ = 6.5 interviews

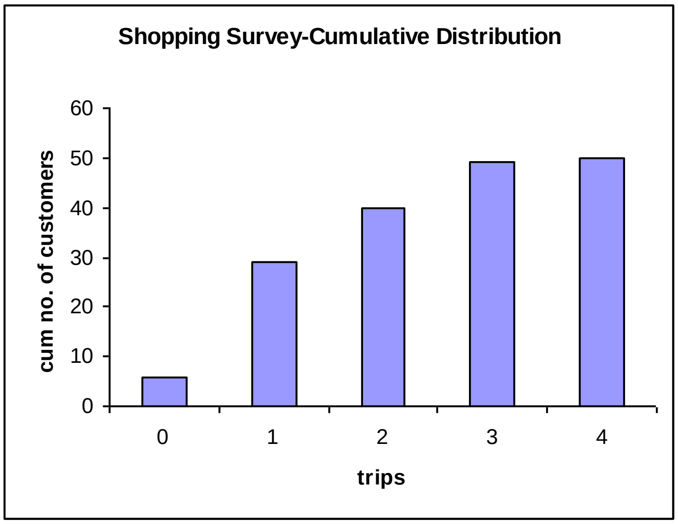
b) Median = 7 interviews (Summing down the relative frequency (proportion) column, we reach a sum of .50 part way through the 7s (.043 + .095 + .136 +.192 + part of .235). The median, then, is 7.)

c) σ^2 = 2.694. $\sigma = \sqrt{2.694} \approx 1.641$ interviews

x	*p(x)*	*xp(x)*	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 p(x)$
3	0.043	0.129	−3.5	12.25	0.52675
4	0.095	0.38	−2.5	6.25	0.59375
5	0.136	0.68	−1.5	2.25	0.306
6	0.192	1.152	−0.5	0.25	0.048
7	0.235	1.645	0.5	0.25	0.05875
8	0.177	1.416	1.5	2.25	0.39825
9	0.122	1.098	2.5	6.25	0.7625
		μ = 6.5 mean			σ^2 =2.694 variance

37.

x	*No. of customers who made x or fewer trips/ week. f(trips ≤ x)*
0	6
1	29
2	40
3	49
4	50

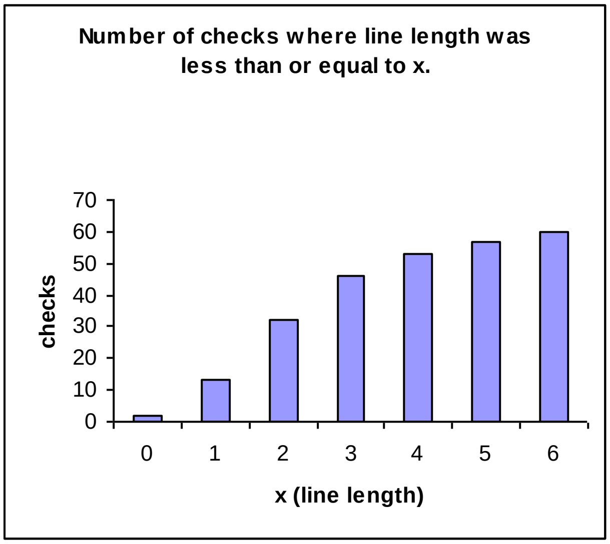


38. Just divide cumulative frequencies by 50, the total number of customers in the survey.

x	*Proportion of customers who made x or fewer trips/ week. f(trips ≤ x)*
0	6/50=.12
1	29/50 =.58
2	40/50= .80
3	49/50=.98
4	50/50 = 1.00

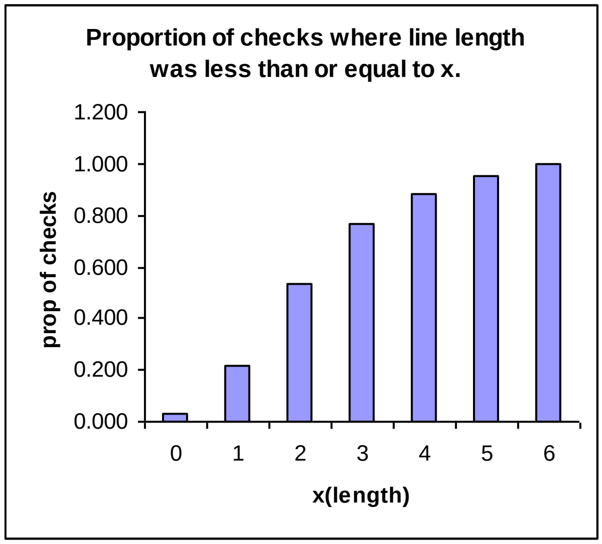
39. a)

x	*No. of checks where line length was less than or equal to x. Cum. f(line length ≤ x)*
0	2
1	13
2	32
3	46
4	53
5	57
6	60



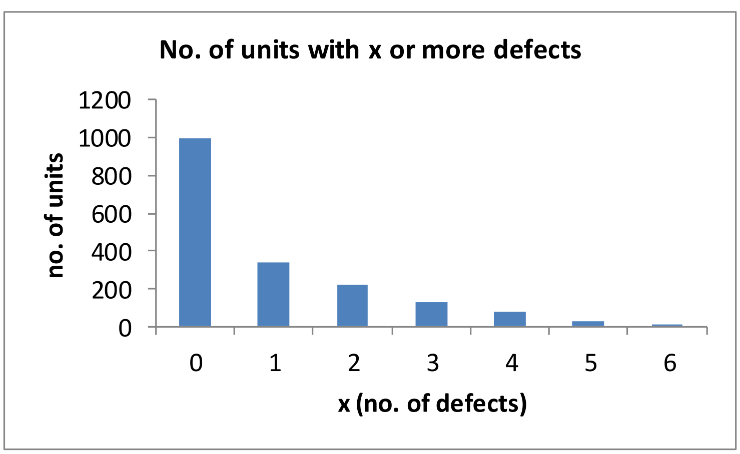
b) To produce relative frequencies here, divide cumulative frequencies by 60.

x	*Proportion of checks where line length was less than or equal to x. Cum. p(line length ≤ x)*
0	0.033
1	0.217
2	0.533
3	0.767
4	0.883
5	0.950
6	1.000



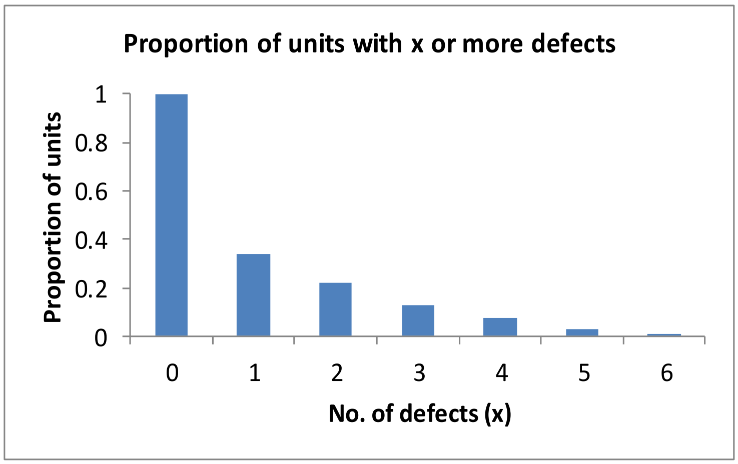
40. a)

Number of Defects x	No of Units f(x)	No of units that had x or more defects f(defects ≥x)
0	660	1000
1	120	340
2	94	220
3	52	126
4	45	74
5	23	29
6	6	6
	1000	



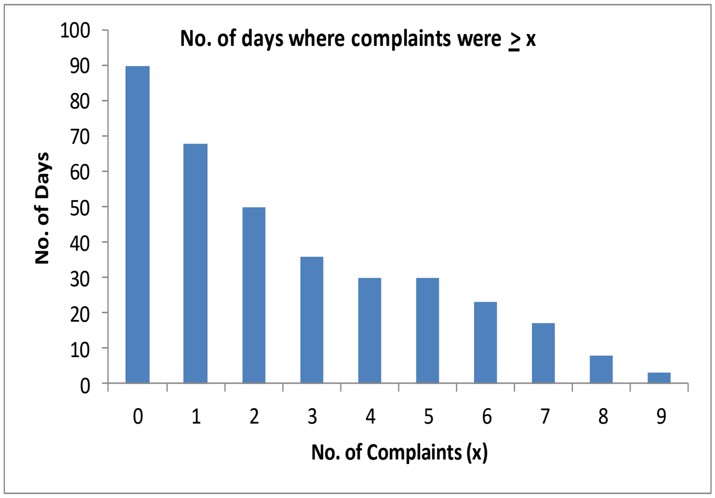
b)

Number of Defects x	*No of Units f(x)*	*No of units that had x or more defects f(defects ≥x)*	*Proportion of units that had x or more defects p(defects ≥x)*
0	660	1000	1.00
1	120	340	0.34
2	94	220	0.22
3	52	126	0.126
4	45	74	0.074
5	23	29	0.029
6	6	6	0.006
	1000		



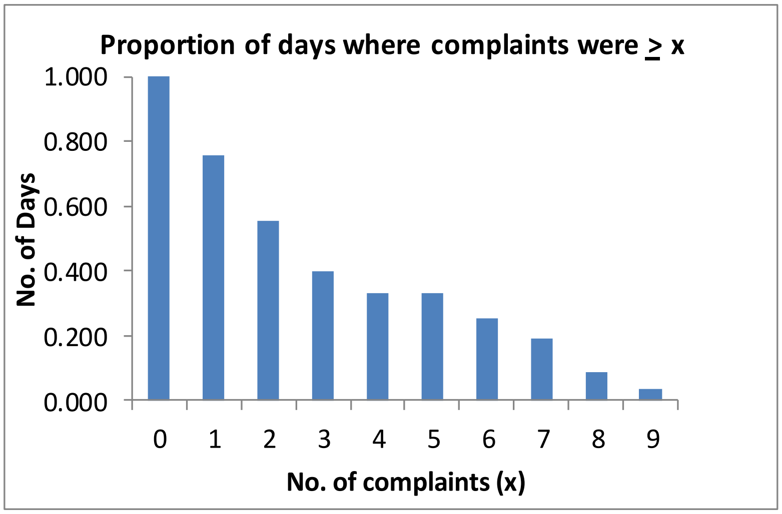
41. a)

Number of Complaints (x)	*No. of Days f(x)*	*No. of days that had x or more complaints f(complaints ≥x)*
0	22	90
1	18	68
2	14	50
3	6	36
4	0	30
5	7	30
6	6	23
7	9	17
8	5	8
9	3	3
Total =	90	



b)

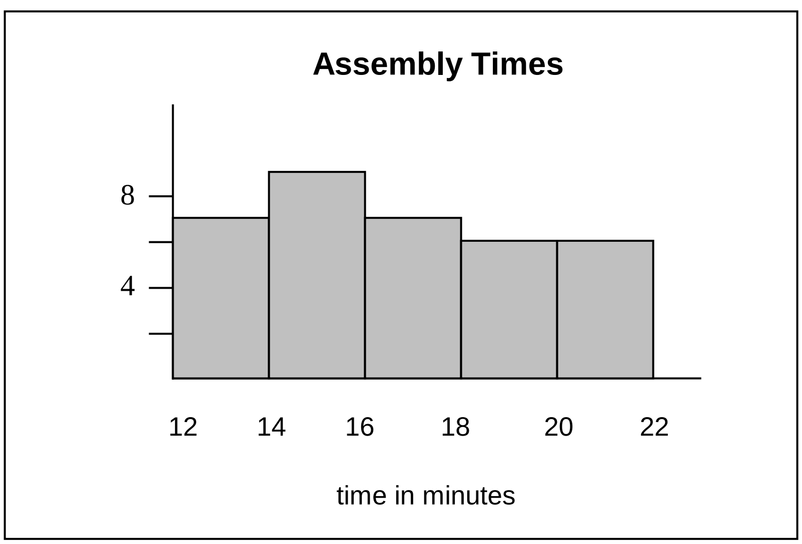
Number of Complaints (x)	*No. of Days f(x)*	*No. of days that had x or more complaints f(complaints ≥x)*	*Proportion. of days that had x or more complaints p(complaints ≥x)*
0	22	90	1.000
1	18	68	0.756
2	14	50	0.556
3	6	36	0.400
4	0	30	0.333
5	7	30	0.333
6	6	23	0.256
7	9	17	0.189
8	5	8	0.089
9	3	3	0.033
Total = 90			



42. a)

Class	*Midpoint*	*Frequency*
12 to under 14	13	7
14 to under 16	15	9
16 to under 18	17	7
18 to under 20	19	6
20 to under 22	21	6

b)



c) Estimated Mean = 16.7
Estimated Variance = 7.58
Estimated Standard Deviation = $\sqrt{\text{Variance}} \approx 2.75$

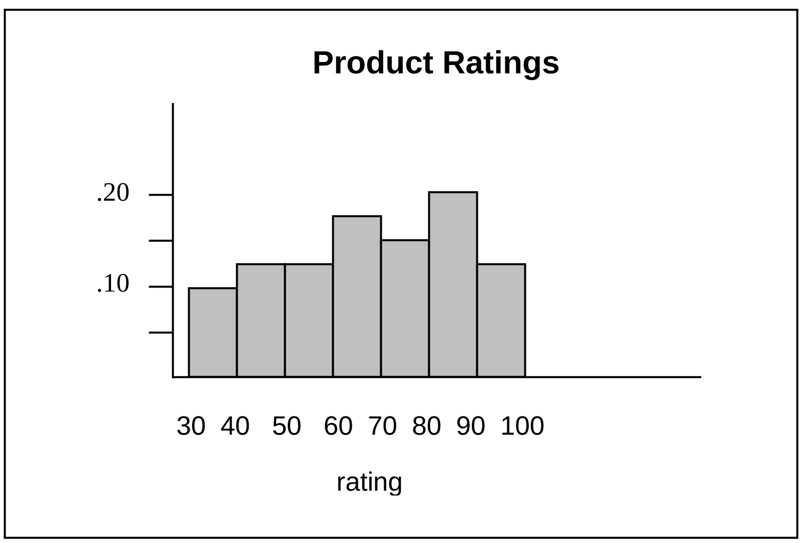
m (midpoint)	f(x)	mf(x)	$m - \mu$	$(m-\mu)^2$	$(m-\mu)^2 f(x)$
13	7	91	−3.7	13.69	95.83
15	9	135	−1.7	2.89	26.01
17	7	119	0.3	0.09	0.63
19	6	114	2.3	5.29	31.74
21	6	126	4.3	18.49	110.94
totals	35	585			265.15

$\mu = 585/35 = 16.7$

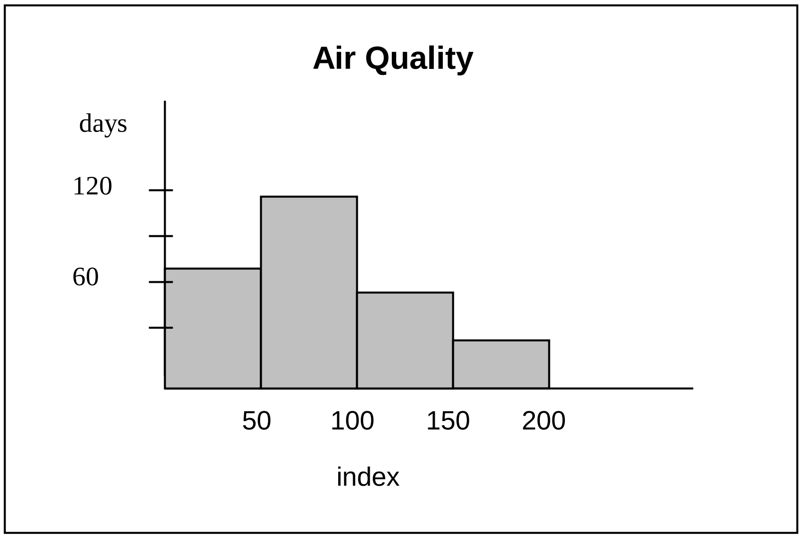
$\sigma^2 = 265.15/35 = 7.58$

43. a)

rating	midpoint	frequency	relative freq
30 to under 40	35	4	.10
40 to under 50	45	5	.125
50 to under 60	55	5	.125
60 to under 70	65	7	.175
70 to under 80	75	6	.15
80 to under 90	85	8	.20
90 to 100	95	5	.125
		40	1.00



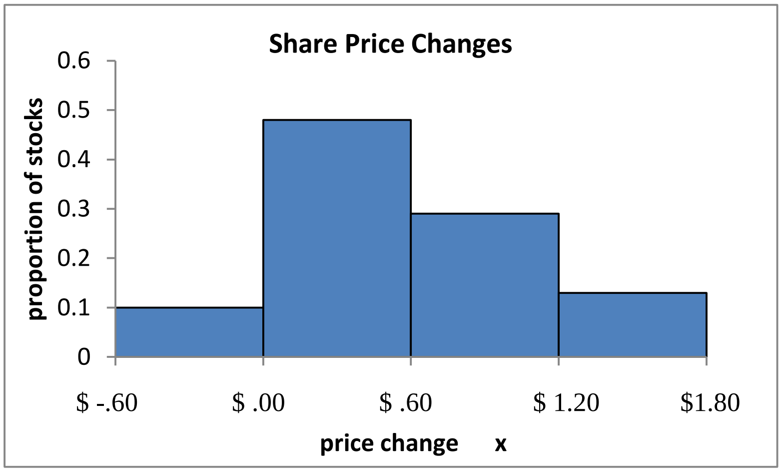
44. a)



b) Estimated Mean = 80.9
Estimated Variance = 2053.6
Estimated Standard Deviation = $\sqrt{\text{Variance}}$ = 45.3

m(midpoint)	f(x)	mf(x)	m−μ	$(m-\mu)^2$	$(m-\mu)^2 f(x)$
25	74	1850	−55.9	3124.81	231235.9
75	117	8775	−5.9	34.81	4072.77
125	58	7250	44.1	1944.81	112799
175	24	4200	94.1	8854.81	212515.4
totals	273	22075			560623.1
		μ = 80.9			σ^2 =2053.6

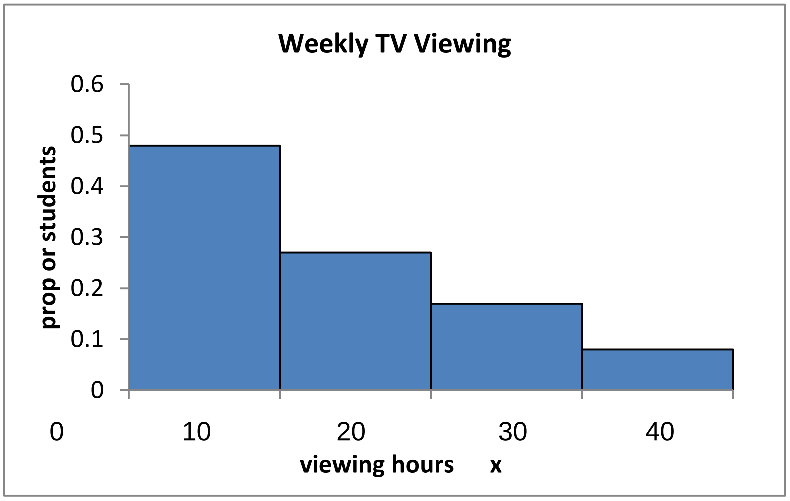
45. a)



b) Estimated Mean = $.57
Estimated Variance = .255
Estimated Standard Deviation = $\sqrt{\text{Variance}} \approx \$.505$

m (midpoint)	p(x)	mp(x)	m−μ	$(m-\mu)^2$	$(m-\mu)^2 p(x)$
−.30	.10	−.030	−.87	.757	.076
.30	.48	.144	−.27	.073	.035
.90	.29	.261	.33	.109	.032
1.50	.13	.195	.93	.865	.112
	mean =	.57		variance =	.255

46. a)



b) Estimated Mean = 13.5 hours
Estimated Variance = 94.75
Estimated Standard Deviation = $\sqrt{\text{Variance}} \approx 9.73$ hours

m(midpoint)	p(x)	mp(x)	m−μ	(m−μ)^2	(m−μ)^{2}p(x)
5	.48	2.4	−8.5	72.250	34.680
15	.27	4.05	1.5	2.250	.608
25	.17	4.25	11.5	132.250	22.483
35	.08	2.8	21.5	462.250	36.980
totals	1.00	13.5			94.75
		μ = 13.5			σ^2 = 94.75
					σ = 9.73

47. a) To produce relative frequencies, divide the frequency column by the total projected population of 357.4 (million).

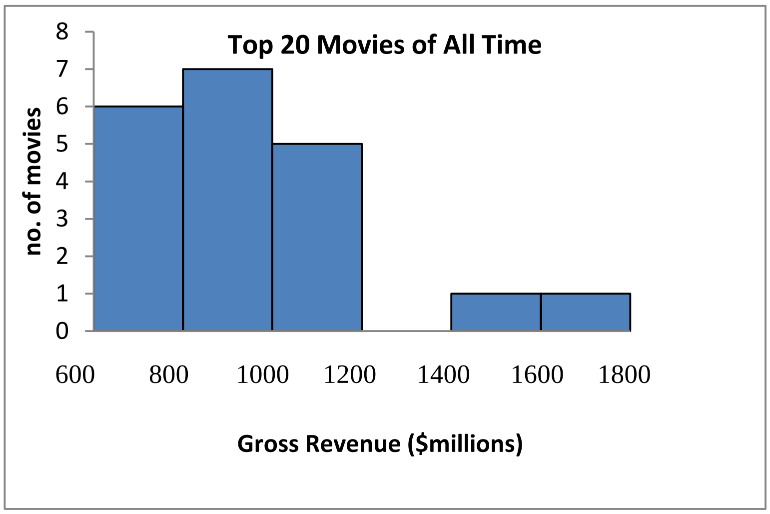
Age Group	mid	f(x)	p(x)	xp(x)
0 to under 20	10	94.3	0.264	2.64
20 to under 40	30	92.9	0.260	7.80
40 to under 60	50	85	0.238	11.89
60 to under 80	70	70.3	0.197	13.77
80 to under 100	90	14.8	0.041	3.73
100 to 120	110	0.1	0.000	0.03

Total = 357.4 mean = 39.85

b) Estimated Mean age = 39.85
Estimated Variance = 569.15
Estimated Standard Deviation = $\sqrt{\text{Variance}}$ = 23.86

m	f(x)	p(x)	mp(x)	(m−μ)	(m−μ)2	p(x)(m−μ)2
10	94.3	0.264	2.64	−29.85	891.02	235.10
30	92.9	0.260	7.80	−9.85	97.02	25.22
50	85	0.238	11.89	10.15	103.02	24.50
70	70.3	0.197	13.77	30.15	909.02	178.80
90	14.8	0.041	3.73	50.15	2515.02	104.15
110	0.1	0.000	0.03	70.15	4921.02	1.38
Total =	357.4	μ =	39.85		Var =	569.15

48. a)



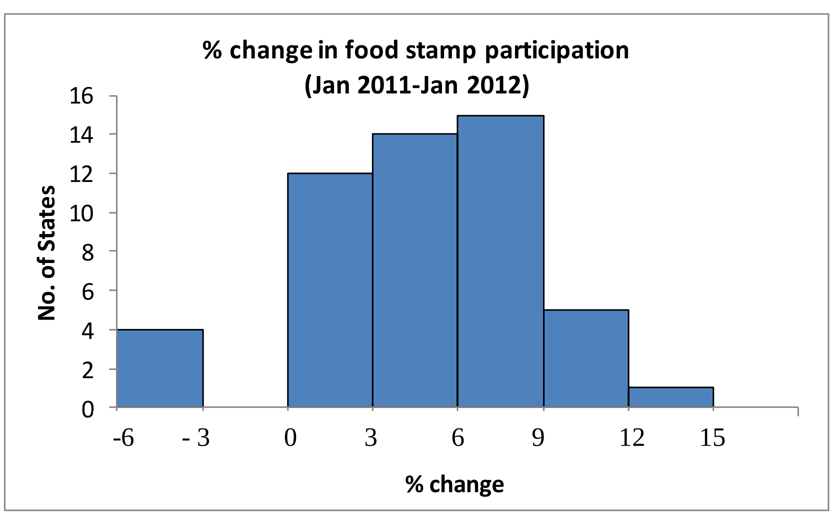
b)

Interval $millions	midpoint (m)	frequency f(x)	mf(x)	m − μ	(m – μ)²	(m – μ)²f(x)
600-800	700	6	4200	−260	67600	405600
800-1,000	900	7	6300	−60	3600	25200
1,000-1,200	1100	5	5500	140	19600	98000
1,200-1,400	1300	0	0	340	115600	0
1,400-1,600	1500	1	1500	540	291600	291600
1,600-1,800	1700	1	1700	740	547600	547600
			19200 μ = 19200/ 20 = 960			1368000 σ² = 1368000/20 = 68400 σ=261.5

Estimated Mean = $960 million
Estimated Variance = 68400
Estimated Standard Deviation = $\sqrt{68400}$ = $261.5 million

49.

Interval (% change)	Frequency (No. of States)
−6 to −3	4
−3+ to 0	0
0+ to 3	12
3+ to 6	14
6+ to 9	15
9+ to 12	5
12+ to 15	1



50. a) μ = 100 strokes.100 here represents the central tendency of your golf scores insofar as it serves as a "balance point" for the scores

b) The ordered list is 60, 80, 90, 100, 100, 110, 120, 140.

Median = 100 strokes, halfway between the 4th and 5th values (here, these values are both 100). It's the middle value insofar as at least half the scores are at or above this value and at least half the scores are at or below this value.

Mode=100 strokes. The most frequent score.

c) range = 140 − 60 = 80 strokes. The difference between the highest and lowest score.

MAD = 17.5 strokes. The average difference between the individual scores and the overall average score.

σ^2 = 525. The average squared difference between your individual scores and the overall average score.

$\sigma = \sqrt{525}$ = 22.9 strokes. Roughly the average difference between the individual scores and the overall average score.

x	x−μ	|x−μ|	(x−μ)²
100	0	0	0
90	−10	10	100
110	10	10	100
80	−20	20	400
120	20	20	400
140	40	40	1600
100	0	0	0
60	−40	40	1600
800	0	140	4200
μ= 800/8 =100		MAD=140/8 = 17.5	σ²=4200/8 =525

51. a) μ = \$17.51 billion (See detailed calculation below.)

b) The ordered list is 13.7, 15, 16.3, 18.6, 19, 19.2, 20.8

Median = \$18.6 billion, the 4th value

No Mode.

c) range = 20.8− 13.7 = \$7.1 billion; MAD = \$2.16 billion

σ^2 = 5.62; $\sigma = \sqrt{5.62}$ = \$2.37 billion

	x	lx−μl	(x−μ)2
	13.7	3.81	14.52
	15	2.51	6.30
	16.3	1.21	1.46
	18.6	1.09	1.19
	19.2	1.69	2.86
	19	1.49	2.22
	20.8	3.29	10.82
totals	122.60	15.09	39.37
	17.51	2.16	5.62
	mean	MAD	Variance

52. a) μ = 7 hours (See detailed calculation below.)
b) The ordered list is 3, 5, 5, 6, 7, 10, 13
Median = 6 hours, the 4th value ((7+1)/2 = 4)
Mode =5 hours.
c) range = 13 − 3 = 10 hours; MAD = 2.57 hours
$\sigma^2 = 10$; $\sigma = \sqrt{10} = 3.16$ hours

x	x−μ	lx−μl	(x−μ)^2
5	−2	2	4
6	−1	1	1
3	−4	4	16
5	−2	2	4
7	0	0	0
10	3	3	9
13	6	6	36
49	0	18	70
μ = 49/7 = 7		MAD = 18/7 = 2.57	σ^2 = 70/7 = 10

53. a) $\bar{x}$ = 106. (See the detailed calculations below.)
b) The ordered list is 89, 93, 95, 97, 99, 100, 100, 100, 106, 181
Median = 99.5, a value halfway between the 5th and 6th values in the ordered list.
Mode = 100.
c) Range = 181−89 = 92; MAD = 15
Variance= 715.8 ; Standard deviation = $\sqrt{715.8}$ = 26.75.

d) The median or mode would better represent the “typical” time since these are measures less influenced by the one extreme of 181.

x	$x-\bar{x}$	$\lvert x-\bar{x} \rvert$	$(x-\bar{x})^2$
106	0	0	0
100	−6	6	36
100	−6	6	36
97	−9	9	81
89	−17	17	289
95	−11	11	121
93	−13	13	169
181	75	75	5625
99	−7	7	49
100	−6	6	36
1060	0	150	6442
$\bar{x}$ =1060/10 = 106		MAD = 150/10 = 15	s^2 = 6442/9 = 715.8

54. a) μ = \$40,358. (See detailed calculations below.)
b) The ordered list is: 36427, 36919, 41661, 42578, 44205.
Median = \$41,661, the 3th value in the ordered list.
No mode.
c) range = 44205 – 36427 = \$7,778; MAD = \$2,948
σ^2 = 9,741,020; $\sigma = \sqrt{9741020}$ = \$3,121

	x	$\lvert x-\mu \rvert$	$(x-\mu)^2$
	44205	3847	14799409
	42578	2220	4928400
	41661	1303	1697809
	36919	3439	11826721
	36427	3931	15452761
Totals	201790	14740	48705100
	40358 mean	2948 MAD	9741020 Variance

55. In the chapter, the mean was described as a "balance point" for a set of data, equalizing distances (deviations) of values to the left of the mean with distances of values to the right. Show that this is the case for the data in

a) Exercise 50: The mean, μ, is 100, so summing the $x - \mu$ distances gives

$$\sum(x-\mu) = 0 + (-10) + 10 + (-20) + 20 + 40 + 0 + (-40) = 0$$

b) Exercise 53: The mean, $\bar{x}$, here is 106, so summing the $x - \bar{x}$ distances gives

$$\sum(x-\bar{x}) = 0+(-6)+(-6)+(-9)+(-17)+(-11)+(-13)+75+(-7)+(-6) = 0$$

56. The "central tendency" of team performance is the same for both teams: the mean and the median in each case are 75. The teams obviously differ in terms of "consistency:" The range for Team A is 10, vs. 50 for Team B. The standard deviation for Team A is 3.16, while the standard deviation for Team B is 18.4.

Most would choose the more consistent team, Team A. However, an argument could be made that even though assigning the job to Team B is more risky, Team B also offers the chance for superior performance, as indicated by the high score of 90. Team A appears the safer bet, but has a lower ceiling. Team B has a much higher "upside," but a more severe "downside."

57. a) The median must be halfway between 13 and 25: 19

b) If the MAD is 9, then the distance of each value from the mean must be 9 units. The sum of the squared distances, then, must be $9^2 + 9^2 = 162$. The variance, therefore, is 162/2 = 81, making the standard deviation $\sqrt{81} = 9$.

c) The standard deviation is 4. For a data set of two values, the standard deviation is precisely equal to the average distance of the two values from the mean. (See part b).)The values must be 20 – 4 = 16 and 20 + 4 = 24.

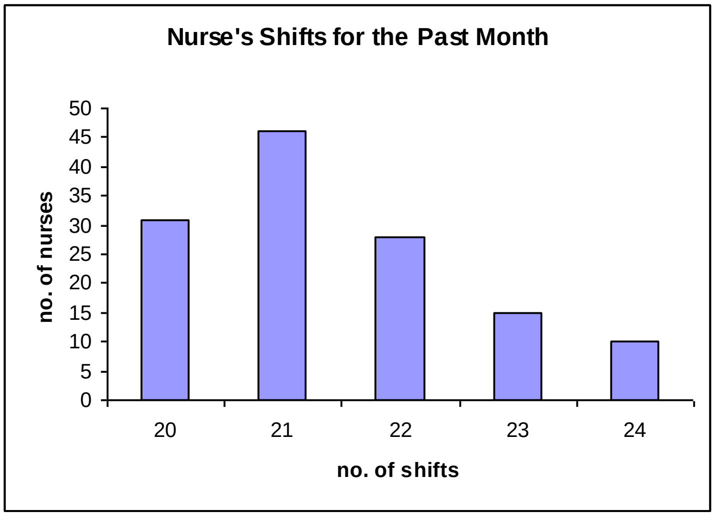
58. a) The MAD must be 4.

b) The range must be 10.

c) If the mode is 200, there must be two values of 200, making the third value 245 in order to have the mean of the three numbers be 215. The sum of the squared distances from the mean, therefore, must be $(-15)^2 + (-15)^2 + 30^2 = 1350$. The standard deviation, then, is $\sqrt{\frac{1350}{3}} = 21.2$.

59.

a)



b) Mean = 21.4 shifts; Variance = 1.42; standard deviation = $\sqrt{1.42}$ = 1.19 shifts. (See the details below.)

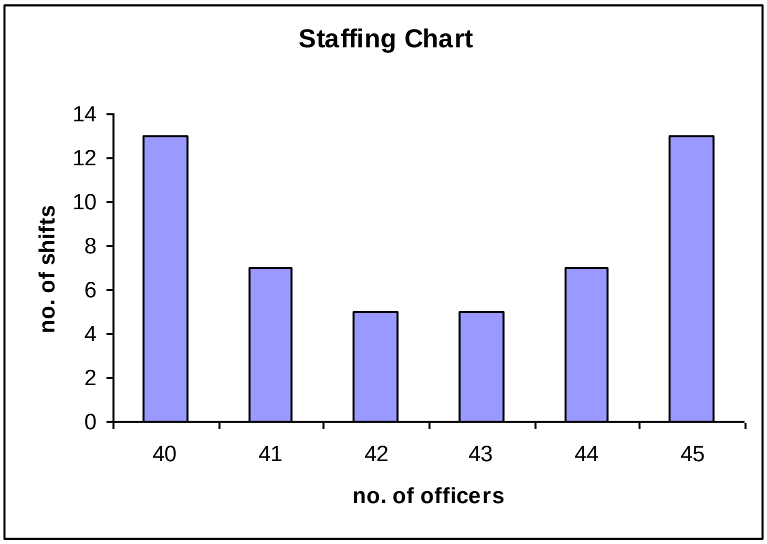
c) Median = 21 shifts, the value halfway between the 65th and 66th values ((130+1)/2 = 65.5) in the list.

Mode= 21.

d) This is a unimodal, positively skewed distribution

x	f(x)	xf(x)	$x-\mu$	$(x-\mu)2$	$(x-\mu)^2 f(x)$
20	31	620	−1.4	1.96	60.76
21	46	966	−0.4	0.16	7.36
22	28	616	0.6	0.36	10.08
23	15	345	1.6	2.56	38.4
24	10	240	2.6	6.76	67.6
totals	130	2787			184.2
		μ = 2787/130 = 21.4			σ^2 = 184/130 = 1.42

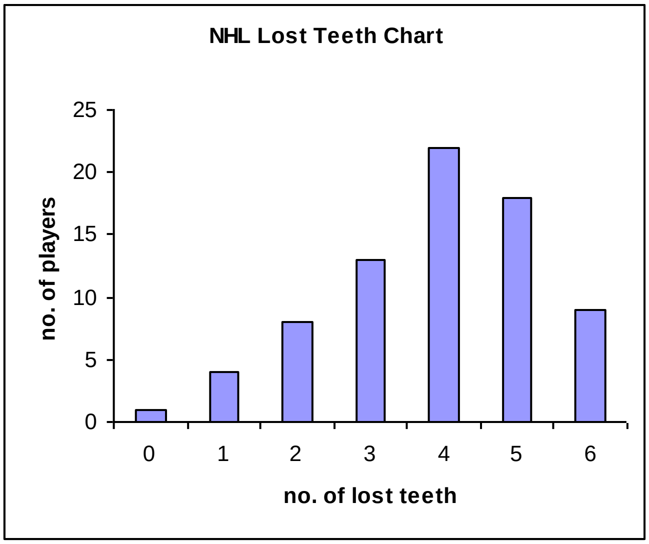
60. a)



b) Mean = 42.5 officers; Variance = 3.93; standard deviation = $\sqrt{3.93}$ = 1.98 officers. (See the details below.)
c) Median = 42.5, the value halfway between the 25th and 26th values ((50+1)/2 = 25.5) in the list. Modes are 40 and 45.
d) This is a symmetric, bi−modal distribution.

x	f(x)	xf(x)	x−μ	(x−μ)2	$(x-\mu)^2 f(x)$
40	13	520	−2.5	6.25	81.25
41	7	287	−1.5	2.25	15.75
42	5	210	−0.5	0.25	1.25
43	5	215	0.5	0.25	1.25
44	7	308	1.5	2.25	15.75
45	13	585	2.5	6.25	81.25
totals	50	2125			196.5
		μ = 2125/50 = 42.5			σ^2 = 196.5/50 = 3.93

61. a)



b) Mean = 3.88 teeth; Variance = 2.0; standard deviation = $\sqrt{2.0}$ = 1.41 teeth. (See the details below.).

c) Median = 4, the 38th value ((75+1)/2 = 38) in the list. Mode = 4.

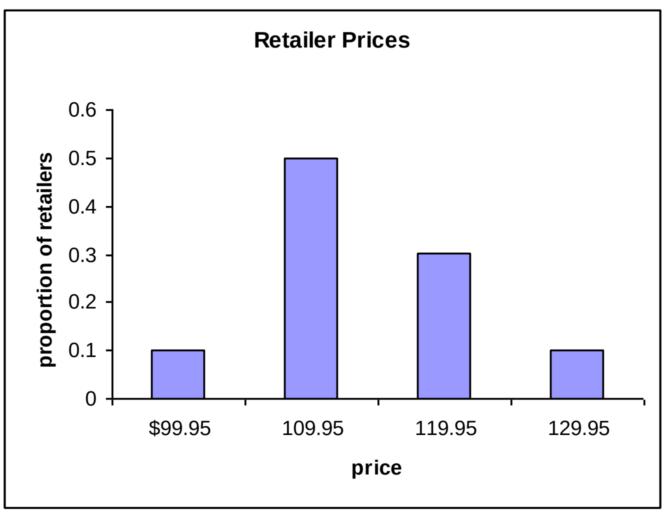
x	f(x)	xf(x)	x−μ	(x−μ)2	$(x-\mu)^2f(x)$
0	1	0	−3.88	15.05	15.05
1	4	4	−2.88	8.29	33.18
2	8	16	−1.88	3.53	28.28
3	13	39	−0.88	0.77	10.07
4	22	88	0.12	0.01	0.32
5	18	90	1.12	1.25	22.58
6	9	54	2.12	4.49	40.45
totals	75	291			150
		μ =291/75 = 3.88			σ^2 = 150/75 = 2.00

62. a) The chart shows two distinct groups of applicants, one that performed rather poorly on the test and another that performed fairly well. It might be useful for the company to try to identify what particular factors caused this sort of result: Was it a difference in education levels for the two groups? A difference in prior experience? A difference in the conditions under which the tests were administered? The particular administrators who conducted the tests? Etc.

b) The mean, as the balance point for the data, appears to be around 6.
The median—the 50-50 marker for the data—appears to be 8. At least half the values look to be at or below 8; at least half look to be at or above 8.
c) The MAD for the distribution appears to be approximately 3. It's the average distance of the values in the data set from the mean. Among the other possible answers here, 1 appears to be too small, and 7 and 10 appear too large to fit this definition.
d) The standard deviation for the distribution appears to be approximately 4. It should be *roughly* equal to the MAD, but will almost always be larger.

63. a) Clearly the company isn't meeting the 3-day standard for a significant number of its deliveries. In fact, in a number of instances, delivery time was at least double the 3-day standard.
b) The mean, as the balance point for the data, appears to be about halfway between 3 and 4 days.
The median—the 50-50 marker for the data—appears to be 3 days. At least half the times look to be at or below 3; at least half look to be at or above 3.
c) The MAD for the distribution looks to be approximately 1.5 days. It's the average distance of the values in the data set from the mean. The other possible answers here, 5.5, 8.5 and 15, all appear too large to fit this definition.
d) The standard deviation for the distribution looks to be approximately 2 days. It should be *roughly* equal to the MAD, but will almost always be larger.

64. a)

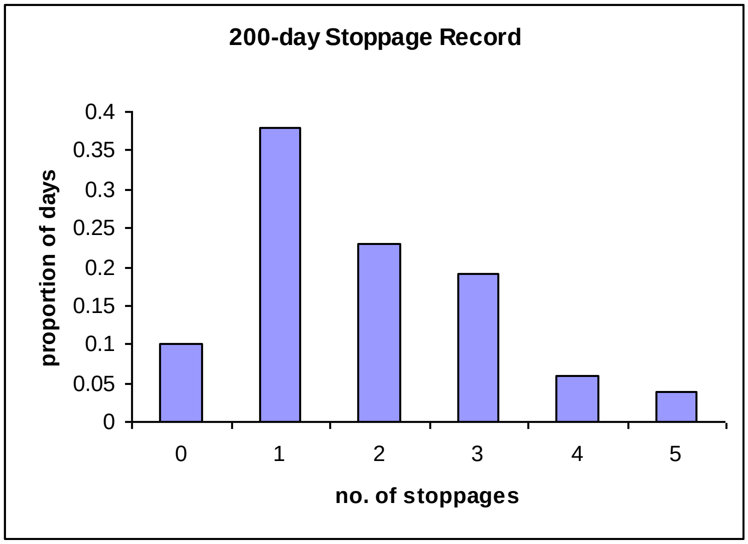


b) Mean = \$113.95; Variance = 64; standard deviation = $\sqrt{64}$ = \$8. (See the details below.).

x	p(x)	xp(x)	x−μ	(x−μ)²	(x−μ)²p(x)
99.95	0.1	9.995	−14	196	19.6
109.95	0.5	54.975	−4	16	8
119.95	0.3	35.985	6	36	10.8
129.95	0.1	12.995	16	256	25.6

$\mu = 113.95$ $\sigma^2 = 64$

65. a)



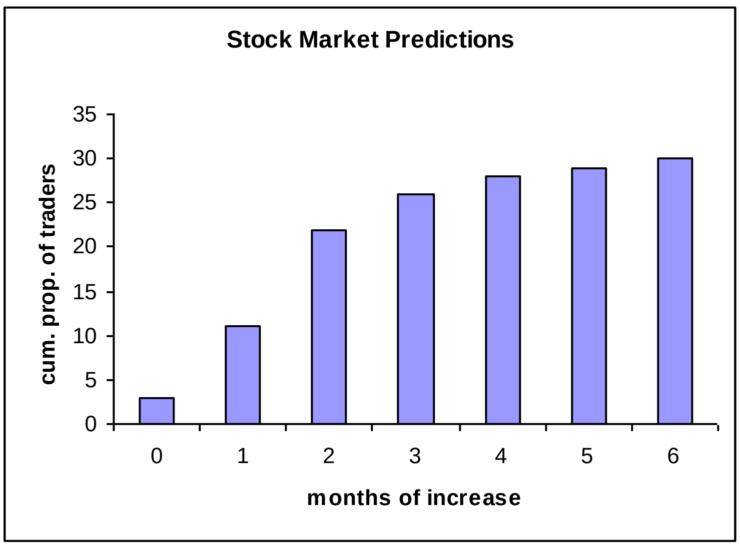
b) Mean = 1.85 stoppages per day; Variance = 1.548; standard deviation = 1.24 stoppages. (See the details below.)

x	p(x)	xp(x)	x−μ	(x−μ)²	(x−μ)²p(x)
0	0.1	0	−1.85	3.423	0.342
1	0.38	0.38	−0.85	0.723	0.275
2	0.23	0.46	0.15	0.023	0.005
3	0.19	0.57	1.15	1.323	0.251
4	0.06	0.24	2.15	4.623	0.277
5	0.04	0.2	3.15	9.923	0.397

$\mu = 1.85$ $\sigma^2 = 1.548$

66. a)

Prediction (No. of Months) *x*	No. of Traders whose predictions were less than or equal to *x* months *Cum. f(predict ≤ x)*
0	3
1	11
2	22
3	26
4	28
5	29
6	30

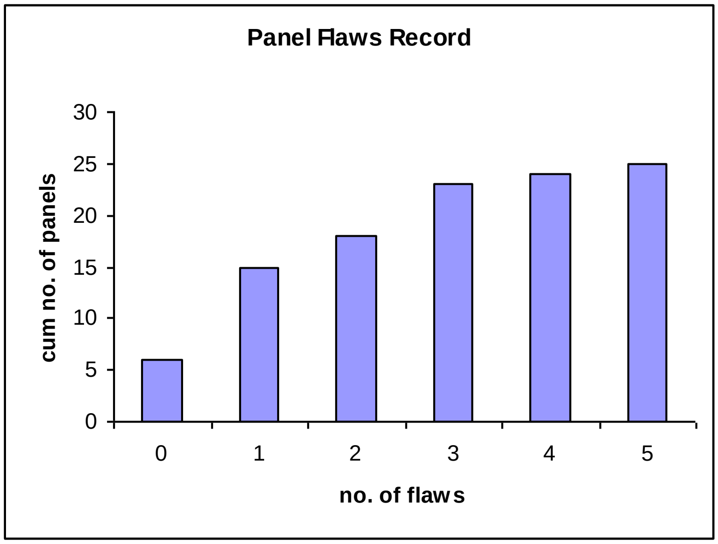


67.

a)

Flaws x	No. of panels with no more than x flaws *cum. f(flaws≤x)*
0	6
1	15
2	18
3	23
4	24
5	25

b)



68. Just divide the table values from Exercise 67 by the total number of panels, 25.

Flaws *x*	Proportion of panels with no more than *x* flaws *Cum. p(flaws≤x)*
0	.24
1	.60
2	.72
3	.92
4	.96
5	1.00

69. a)

No. of Commercials *x*	Proportion of Nights where no more than *x* commercials appeared *Cum. p(commercials≤x)*
0	4/30 = .133
1	16/30 = .533
2	23/30 = .767
3	28/30 = .933
4	30/30 = 1.00

b)

No. of Commercials *x*	Proportion of Nights where <u>at least</u> *x* commercials appeared cum *p(commercials≥x)*
0	30/30 = 1.00
1	26/30 = .867
2	14/30 = .467
3	7/30 = .233
4	2/30 = .067

70. a)

Number of Firearms *x*	Proportion of Households Owning the Indicated Number of Firearms *p(x)*
0	.57
1	.79 − .57 = .22
2	.93 − .79 = .14
4	.97 − .93 = .04
5	.99 − .97 = .02
6	1.00 − .99 = .01

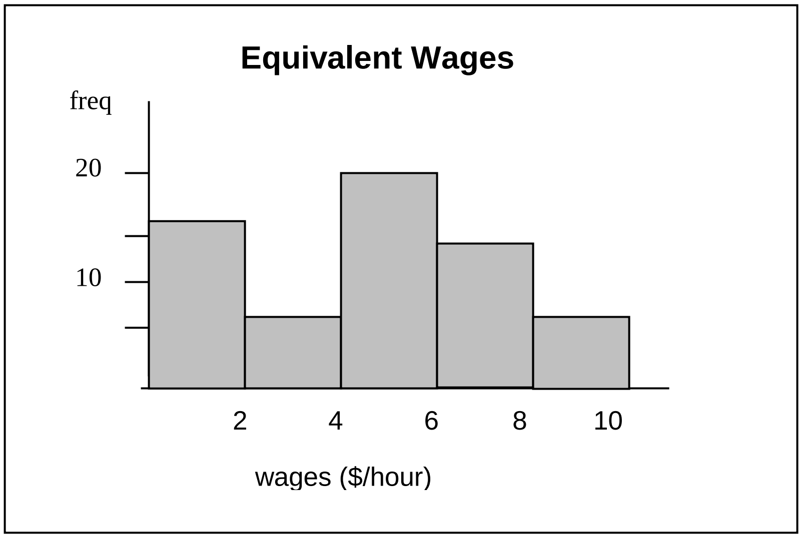
b)

x	p(x)	xp(x)	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2p(x)$
0	0.57	0	−0.82	0.672	0.383
1	0.22	0.22	0.18	0.032	0.007
2	0.14	0.28	1.18	1.392	0.195
4	0.04	0.16	3.18	10.112	0.404
5	0.02	0.1	4.18	17.472	0.349
6	0.01	0.06	5.18	26.832	0.268
	1.00	$\mu = 0.82$			$\sigma^2 = 1.608$

71. a)

Class	*midpoint*	*Frequency*
$0 to under $2	1.0	16
$2 to under $4	3.0	7
$4 to under $6	5.0	21
$6 to under $8	7.0	13
$8 to under $10	9.0	7

b)



c) Estimated mean = 4.63 (The actual mean of the raw data is 4.52)
Estimated variance = 6.86 (The actual variance of the raw data is 7.06)
Estimated standard deviation = $\sqrt{\text{Variance}}$ = 2.62 (Actual is 2.66)

m (midpoint)	f(x)	mf(x)	$m-\mu$	$(m-\mu)2$	$(m-\mu)^2 f(x)$	
1	16	16	−3.63	13.177	210.830	
3	7	21	−1.63	2.657	18.598	
5	21	105	0.37	0.137	2.875	
7	13	91	2.37	5.617	73.02	
9	7	63	4.37	19.097	133.678	
totals		296			439.001	
		μ = 296/64			σ^2 = 439/64	
		= 4.63			= 6.86	

72.

class	midpoint	frequency
0 to under 3	1.5	20
3 to under 6	4.5	24
6 to under 9	7.5	17
9 to under 12	10.5	3

a)

b) Estimated mean = 4.64
Estimated variance = 6.87
Estimated standard deviation = $\sqrt{\text{Variance}}$ = 2.62

m(midpoint)	*f(x)*	*mf(x)*	*m−μ*	*(m−μ)²*	*(m−μ)²f(x)*
1.5	20	30	−3.14	9.86	197.19
4.5	24	108	−0.14	0.02	0.47
7.5	17	127.5	2.86	8.18	139.05
10.5	3	31.5	5.86	34.34	103.02
totals	64	297			439.73
		μ = 297/64			σ^2 =439.73/64
		= 4.64			= 6.87

73. a)

class	midpoint	frequency
0 to under 5	2.5	34
5 to under 10	7.5	30

b) Estimated mean = 4.84
Estimated variance = 6.23
Estimated standard deviation = $\sqrt{\text{Variance}}$ = 2.50

m(midpoint)	*f(x)*	*mf(x)*	*m*−μ	(*m*−μ)^2	(*m*−μ)^2*f(x)*
2.5	34	85	−2.34	5.48	186.17
7.5	30	225	2.66	7.08	212.27
totals	64	310			398.44
		μ = 310/64			σ^2=398.44/64
		= 4.84			= 6.23

74. a)

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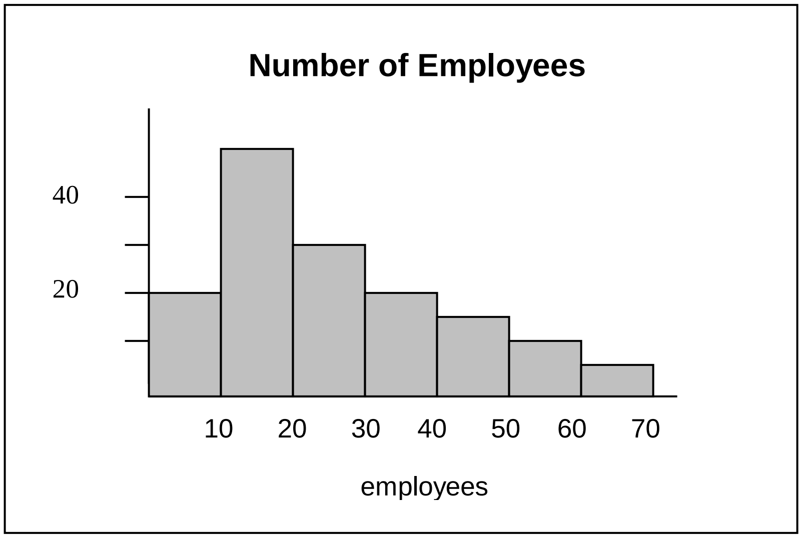
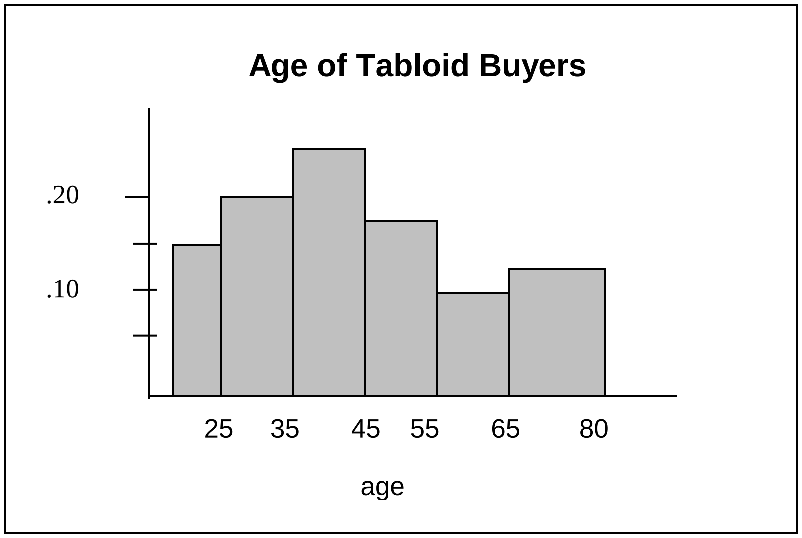


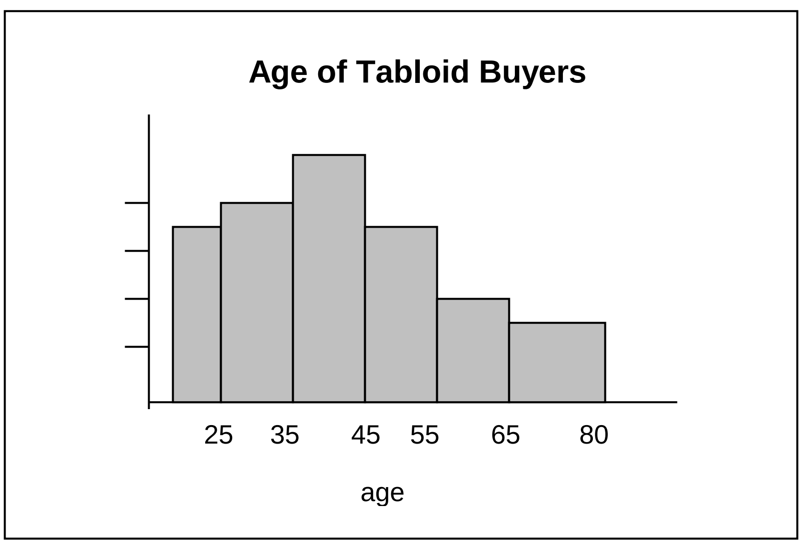
b) Estimated Mean = 25.7 employees.
Estimated Variance = 252.89
Estimated Standard Deviation = $\sqrt{\text{Variance}}$ = 15.9 employees.

m (midpoint)	*f(x)*	*mf(x)*	*m − μ*	*(m−μ)2*	*(m−μ)²fx)*
5	20	100.00	−20.7	428.49	8569.80
15	50	750.00	−10.7	114.49	5724.50
25	30	750.00	−0.7	0.49	14.70
35	20	700.00	9.3	86.49	1729.80
45	15	675.00	19.3	372.49	5587.35
55	10	550.00	29.3	858.49	8584.90
65	5	325.00	39.3	1544.49	7722.45
totals	150	3850.00			37933.50
		μ = 3850/150 = 25.7			σ^2 = 37933.5/150 = 252.89

75. a)



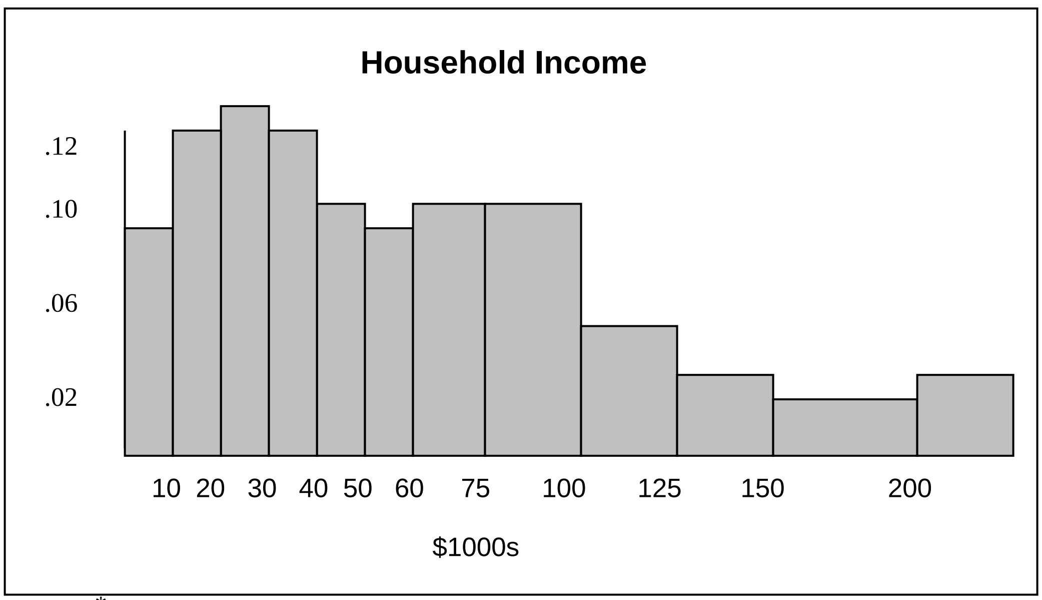
* Note: The *area* of each bar in a histogram should be proportional to the fraction of the observations that fall in the bar's class. Above we're showing a graph in which *heights* are used to represent relative frequency, even though we have classes of unequal width. Although technically incorrect, this is fairly common practice. The graph below shows the more technically correct picture, with areas representing frequency. To give the proper proportional area, the first bar height has been raised in response to the bar's relatively narrow width; the height of the last bar has been lowered because of its relatively greater width. These adjustments give a picture in which areas and not heights are proportional to the frequency of class membership. . Proper bar heights can be set by dividing class frequencies by class widths. (The vertical scale on the histogram would be a somewhat cumbersome "frequency per unit width.")



b) Estimated Mean = 43.42 years of age.
Estimated Variance = 256.16
Estimated Standard Deviation = $\sqrt{256.16}$ = 16.

m (midpoint)	p(x)	(m)p(x)	m − μ	(m−μ)2	$(m-\mu)^2 p(x)$
21.5	0.147	3.16	−21.9	479.61	70.50
30	0.194	5.82	−13.4	179.56	34.83
40	0.256	10.24	−3.4	11.56	2.96
50	0.17	8.50	6.6	43.56	7.41
60	0.101	6.06	16.6	275.56	27.83
72.5	0.133	9.64	29.1	846.81	112.63
		μ = 43.42			σ^2 = 256.16

76. a)



*
As noted in the solution to Exercise 57, the *area* of each bar in a histogram should be proportional to the fraction of the observations that fall in its class. Above we're showing a graph in which heights are used to represent relative frequency, even though we have classes of unequal width. Although technically incorrect, this is fairly common practice. The graph below shows the more technically correct picture, with areas representing frequency. Notice that the bar heights have been lowered as the classes get wider so that area is kept proportional to frequency. Proper bar heights can be set by dividing class frequencies by class widths. (The vertical scale on the histogram would be a somewhat cumbersome "relative frequency per unit width.")

b) Estimated Mean = 54.77 (times $1000).
Estimated Variance = 2311.4 (times $\$1000^2$).
Estimated Standard Deviation = $\sqrt{\text{Variance}}$ = 48.08 (times $1000).

m (*midpoint*)	*p(x)*	*(m)p(x)*	*m* − μ	*(m*−μ*)*^{2}	*(m*−μ*)*^{2}*p(x)*
5	0.095	0.48	−49.77	2477.05	235.32
15	0.126	1.89	−39.77	1581.65	199.29
25	0.13	3.25	−29.77	886.25	115.21
35	0.123	4.31	−19.77	390.85	48.07
45	0.107	4.82	−9.77	95.45	10.21
55	0.09	4.95	0.23	0.05	0.00
67.5	0.104	7.02	12.73	162.05	16.85
87.5	0.102	8.93	32.73	1071.25	109.27
112.5	0.052	5.85	57.73	3332.75	173.30
137.5	0.025	3.44	82.73	6844.25	171.11
175	0.022	3.85	120.23	14455.25	318.02
250	0.024	6.00	195.23	38114.75	914.75
		μ = 54.77			σ^2 = 2311.4

77. a) There is a significant cluster of customers in the 12 to 18 age group and another significant cluster of customers in their late 20s and early 30s. There is a substantial gap in the late teens/early 20s age group.
b) There is a clear indication here that the store attracts high income shoppers. The number of customers with family incomes of $60,000 or less is relatively small.
c) The store appears to attract customers who are relatively infrequent visitors to the mall. More than 50% of the shoppers made no more than 10 visits—a rate of less than once a month. (Of course it's possible that there just aren't that many people in general who visit the mall more than 10 time or so in a year.)

Based on what you see in these charts, what recommendations might you make to the owner of Kari H Junior Fashions?

Kari H might find a line that appeals to shoppers in their late teens and early 20s. Clearly this is an age group that is not well represented among Kari H shoppers. Furthermore, the store can either continue to cultivate its appeal to higher end shoppers or try to find ways to reach low to moderate income shoppers as well. Finally, the store doesn't appear to be attracting the more frequent mall visitors, which may mean more frequent changes in displays and/or merchandise may be appropriate.

78. a) 23 looks to be the approximate balance point for the data.
b) 27 appears to be the best answer among the possibilities. More so than any of the other choices, it looks like the approximate 50-50 marker. At least half the values are at or above; at least half are at or below.
c) The standard deviation—*roughly* the average distance of the values from the mean—looks to be around 6. Among the other answers, 3 looks much too small to be the average distance; 12 and 18 look too large.

79. a) 12 looks to be the approximate "balance point" for the data.
b) 7 appears to be the best answer among the possibilities. More so than any of the other choices, it looks like the approximate 50-50 marker: at least half the values appear to be at or above that point; at least half at or below.
c) The standard deviation—*roughly* the average distance of the values from the mean—looks to be closest to 13. The other answers all appear to be much too small to be measuring, even roughly, this sort of average distance.