Solution   Section 1.6 – Additional Displays

Exercise

Identify the class width, class midpoints, and class boundaries for the given frequency distribution. Then construct the cumulative frequency distribution that corresponds to the frequency distribution.

a)

Tar (mg) in Nonfiltered Cigarettes	***Frequency***
10 – 13	1
14 – 17	0
18 – 21	15
22 – 25	7
26 – 29	2

b)

Tar (mg) in Filtered Cigarettes	***Frequency***
2 – 5	2
6 – 9	2
10 – 13	6
14 – 17	15

c)

Weights (lb) of Discarded Metal	***Frequency***
0.00 – 0.99	5
1.00 – 1.99	26
2.00 – 2.99	15
3.00 – 3.99	12
4.00 – 4.99	4

d)

Weights (lb) of Discarded Plastic	***Frequency***
0.00 – 0.99	14
1.00 – 1.99	20
2.00 – 2.99	1
3.00 – 3.99	4
4.00 – 4.99	2
5.00 – 5.99	1

Solution

a) *Class width*: $14-10 \ \underline{=4|}$ (***Subtracting the first two lower class limits***)

Class midpoints: $\frac{10+13}{2} \ \underline{=11.5|}$ adding **4** to obtain the rest: 11.5, 15.5, 19.5, 23.5, 27.5.

Class boundaries: $\frac{13+14}{2} \ \underline{=13.5|}$ (boundary between the first and second class). The other can be obtained by adding 4: 9.5, 13.5, 17.5, 21.5, 25.5, 29.5.

b) *Class width*: $6-2 \ \underline{=4|}$ (***Subtracting the first two lower class limits***)

Class midpoints: $\frac{2+5}{2} \ \underline{=3.5|}$ adding **4** to obtain the rest: 3.5, 7.5, 11.5, 15.5.

Class boundaries: $\frac{5+6}{2} \ \underline{=5.5|}$ (boundary between the first and second class). The other can be obtained by adding 4: 1.5, 5.5, 9.5, 13.5, 17.5.

c) *Class width*: $1.00-0.00 \ \underline{=1.00|}$ (***Subtracting the first two lower class limits***)

Class midpoints: $\frac{0.00+0.99}{2} \ \underline{=0.495|}$ adding **1.00** to obtain the rest: 0.495, 1.495, 2.495, 3.495, 4.495.

Class boundaries: $\frac{0.99+1.00}{2} \ \underline{=0.995|}$ (boundary between the first and second class). The other can be obtained by adding or subtracting **1.00**: -0.005, 0.995, 1.995, 2.995, 3.995, 4.995.

d) *Class width*: $1.00 - 0.00 = 1.00$ (***Subtracting the first two lower class limits***)

Class midpoints: $\dfrac{0.00 + 0.99}{2} = 0.495$ adding **1.00** to obtain the rest: 0.495, 1.495, 2.495, 3.495, 4.495, 5.495.

Class boundaries: $\dfrac{0.99 + 1.00}{2} = 0.995$ (boundary between the first and second class). The other can be obtained by adding or subtracting **1.00**: -0.005, 0.995, 1.995, 2.995, 3.995, 4.995, 5.995.

Exercise

Given listed amounts of Strontium-90 (in millibecquerels) in a simple random sample of baby teeth.

155	142	149	130	151	163	151	142	156	133	138	161	128	144	172
137	151	166	147	163	145	116	136	158	114	165	169	145	150	150
150	158	151	145	152	140	170	129	188	156					

a) Construct a dot plot of the amounts of Strontium-90. What does the dot plot suggest about the distribution of those amounts?

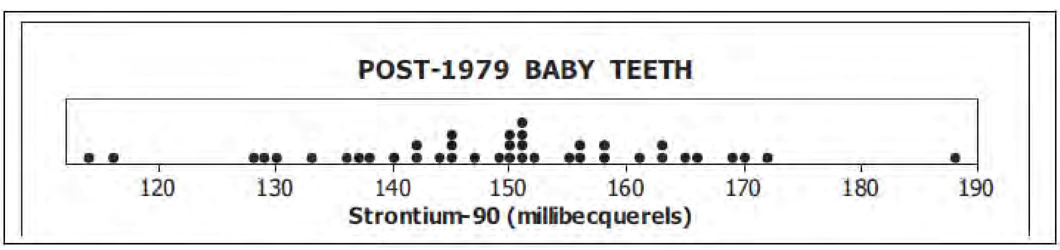
b) Construct a stemplot of the amounts of Strontium-90. What does the stemplot suggest about the distribution of those amounts?

c) Construct a frequency polygon of the amounts of Strontium-90. For the horizontal axis, use the midpoints of the class intervals in the frequency distribution: 110-119, 120-129, 130-139, …, 180-189.

d) Construct an ogive of the amounts of Strontium-90. For the horizontal axis, use the class boundaries corresponding to the class limits. How many of the amounts are below 150 millibecquerels?

Solution

a) The dotplot is given below.



The strontium-90 levels appear to have a normal distribution clusters around 150.

b) The stemplot is given:

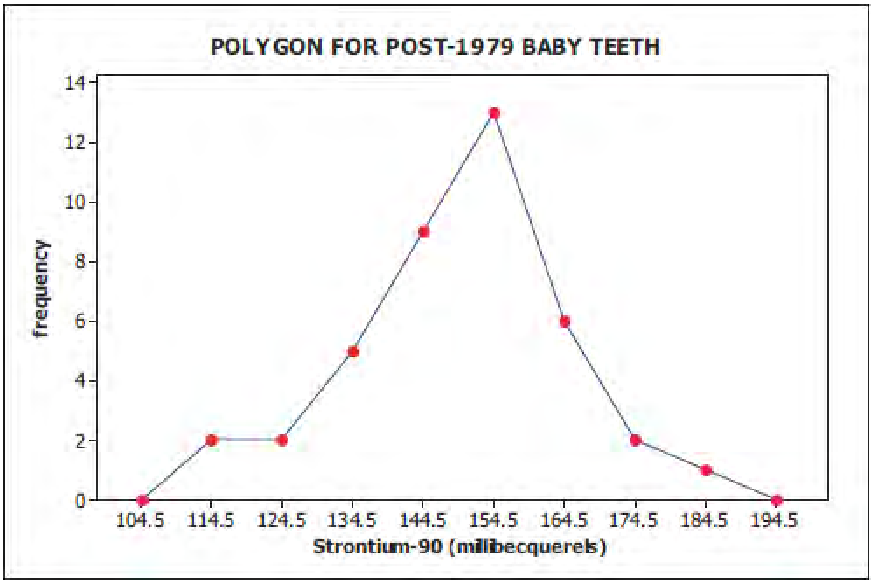
Strontium – 90

11	46
12	89
13	03678
14	022455579
15	0001111256688
16	133569
17	02

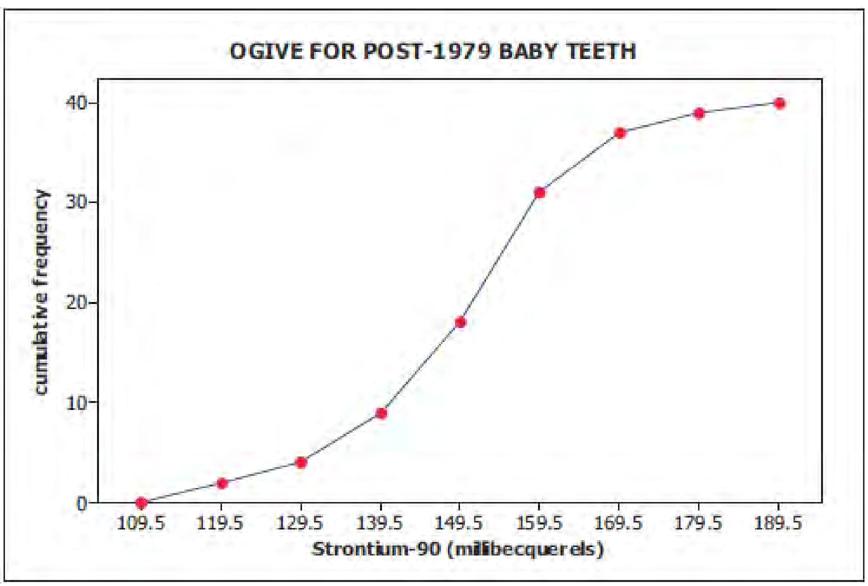
18	8

The strontium-90 levels appear to have a normal distribution clusters around 150.

c) The frequency polygon is given:



d) The ogive is given:



Using the figure: move up from 150 on the horizontal scale to intersect the graph, then move left to intersect the vertical scale at 18. This indicates there were approximately 18 data values which would have been recorded as being below 150, which agrees with the actual data values.

Exercise

Use the 62 weights if discarded plastic listed in Data set below

0.27 1.41 2.19 2.83 2.19 1.81 0.85 3.05 3.42 2.10 2.93 2.44 2.17 1.41 2.00

0.93	2.97	2.04	0.65	2.13	0.63	1.53	4.69	0.15	1.45	2.68	3.53	1.49	2.31	0.92
0.89	0.80	0.72	2.66	4.37	0.92	1.40	1.45	1.68	1.53	1.44	1.44	1.36	0.38	1.74
2.35	2.30	1.14	2.88	2.13	5.28	1.48	3.36	2.83	2.87	2.96	1.61	1.58	1.15	1.28
0.58	0.74													

a) Construct a dot plot of the weights of discarded plastic. What does the dot plot suggest about the distribution of the weights?

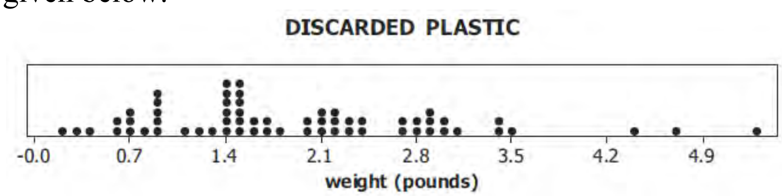
b) Construct a stemplot of the weights of discarded plastic. What does the stemplot suggest about the distribution of the weights?

c) Construct a frequency polygon of the weights of discarded plastic. For the horizontal axis, use the midpoints of the class intervals: 0.00-0.99, 1.00-1.99, 2.00-2.99, 3.00-3.99, 4.00-4.99, 5.00-5.99.

d) Construct an ogive of the weights of discarded plastic. For the horizontal axis, use these classes boundaries: –0.005, 0.995, 1.995, 2.995, 3.995, 4.995, 5.995. How many of the weights are below 4 lb.?

Solution

a) The dotplot is given below.



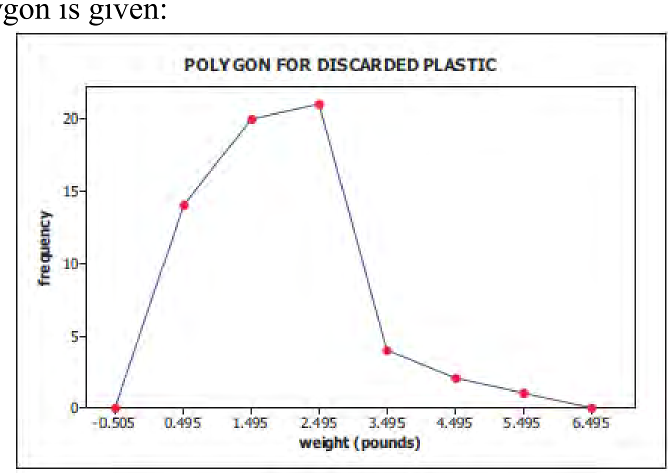
The weights appear to be approximately normally distributed, except for the presence of a few high values.

b) The stemplot is given:

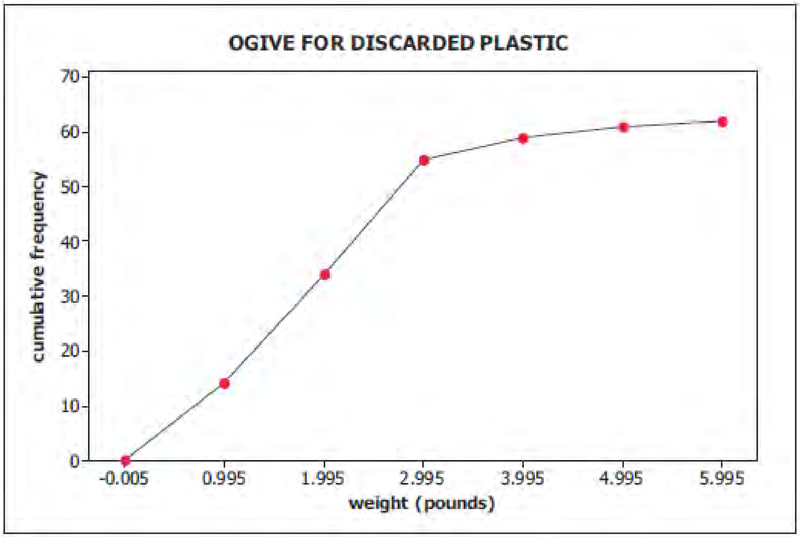
Weight (lb.)	
0.	1256677888999
1.	112344444445556678
2.	0011111333466888899
3.	9345
4.	36
5.	2

The weights appear to be approximately normally distributed, except for the necessary lower truncation at zero.

c) The frequency polygon is given:



d) The ogive is given



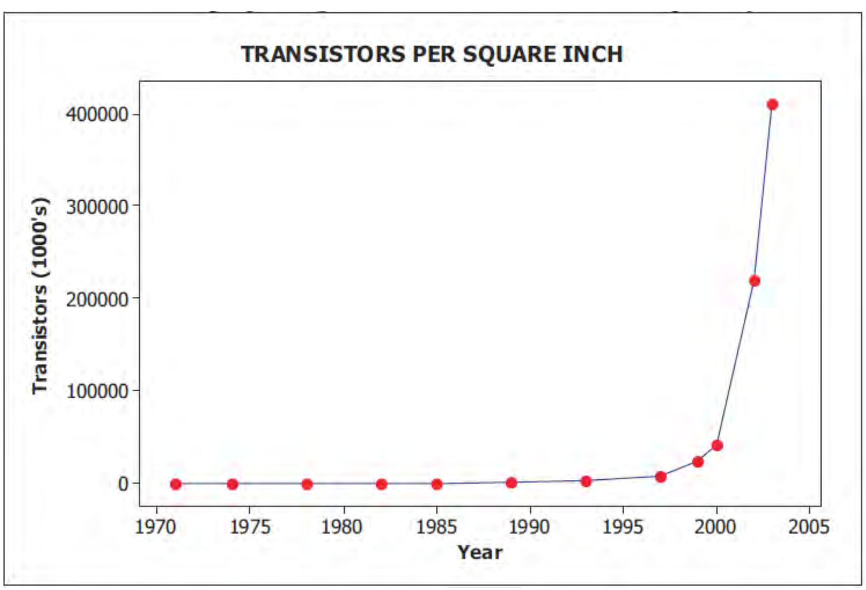
Using the figure: move up 3 on the horizontal scale to intersect the graph, then move left to intersect the vertical scale at 59. This indicates there were approximately 59 data values which would have been recorded as being below 4, which agrees with the actual data.

Exercise

In 1965, Intel cofounder Gordon Moore proposed what has since become known as Moore's law: the number of transistors per square inch on integrated circuits with double approximately every 18 months. The table below lists the number of transistors per square inch (in thousands) for several different years. Construct a time-series graph of the data.

Year	1971	1974	1978	1982	1985	1989	1993	1997	1999	2000	2002	2003
Transistors	2.3	5	29	120	275	1180	3100	7500	24,000	42,000	220,000	410,000

Solution



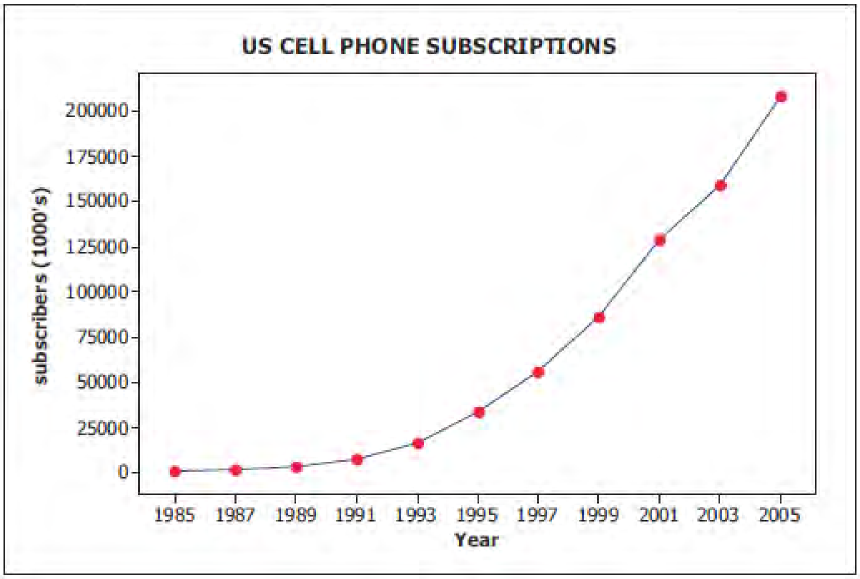
Exercise

The following table shows the numbers of cell phone subscriptions (in thousands) in the U.S. for various years. Construct a time-series graph of the data. "Linear" growth would result in a graph that is approximately a straight line. Does the time-series graph appear to show linear growth?

Year	1985	1987	1989	1991	1993	1995	1997	1999	2001	2003	2005
Number	340	1231	3509	7557	16,009	33,786	55,312	86,047	128,375	158,722	207,900

Solution

The time series graph is given:



The graph does not appear to show linear growth (constant slope) over the entire time period, but does appear that there was linear growth during certain periods (since 1999)

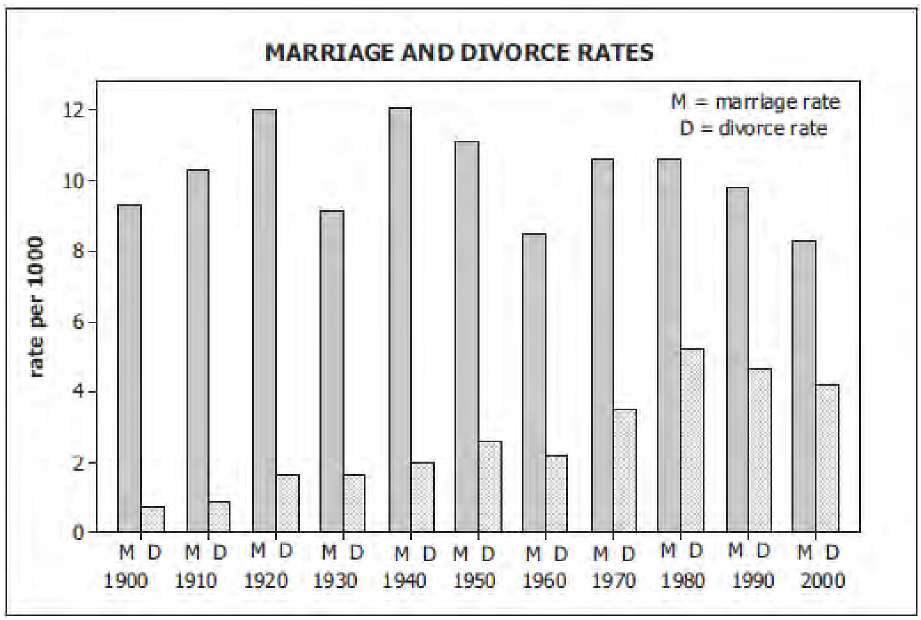
Exercise

The following table lists the marriage and divorce rates per 1000 people in the U.S. for selected years since 1900 (based on data from the Department of Health and Human Services). Construct a multiple bar graph of the data. Why do these data consist of marriage and divorce rates rather than total numbers of marriages and divorces? Comment on any trends that you observe in these rates, and give explanations for these trends.

Year	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Marriage	9.3	10.3	12.0	9.2	12.1	11.1	8.5	10.6	10.6	9.8	8.3
Divorce	0.7	0.9	1.6	1.6	2.0	2.6	2.2	3.5	5.2	4.7	4.2

Solution

As the population increases, the *numbers* of marriages and divorces will automatically increase. To identify any change in marriage and divorce patterns, one needs to examine the *rates*. This is analogous to using percents (or relative frequencies) instead of frequencies to compare categories for two samples of different sizes. The marriage rate appears to have remained fairly constant, with possible slight decrease in recent years. The divorce rate appears to have steadily grown, with a possible slight decrease in recent years.



Exercise

A car salesman records the number of cars he sold each week for the past year. The following frequency histogram shows the results

a) What are the most frequent number of cars sold in a week?
b) For how many weeks two cars sold?
c) Determine the percentage of time two cars were sold.
d) Describe the shape of the distribution

Solution

a) 4 cars
b) There were 9 weeks in which 2 cars sold
c) Total frequency = 4+2+9+8+12+8+5+2+1+1 = 52

Percentage of time two cars were sold $= \frac{9}{52} \times 100 = 17.3\%$

d) Slightly skewed to the right

Exercise

Use the data to create a stemplot

The midterm test scores for the seventh-period typing class are listed below

85 77 93 91 74 65 68 97 88 59 74 83 85 72 63 79

Solution

5	9
6	3 5 8
7	2 4 4 7 9
8	3 5 5 8
9	1 3 7

Exercise

Use the data to create a stemplot. Twenty-four workers were surveyed about how long it takes them to travel to work each day. The data below are given in minutes

20	35	42	52	65	20	60	49	24	37	23	24
22	20	41	25	28	27	50	47	58	30	32	48

Solution

2	0 0 0 2 3 4 4 5 7 8
3	0 2 5 7
4	1 2 7 8 9
5	0 2 8
6	0 5

Exercise

Find the original data from the stemplot

a)

Stem	*Leaves*
76	2 6 7
77	2 4 9
78	1 7

b)

1	0 1 4
2	1 4 4 7 9
3	3 5 5 5 7 7 8
4	0 0 1 2 6 6 8 9 9
5	3 3 5 8
6	2

c)

24	0 4 7
25	0 2 3 9 9
26	3 4 5 8 8 9
27	0 1 1 3 6 6
28	2 3 8

Solution

a) 762, 766, 767, 772, 774, 779, 781, 787

b) 10, 11, 14, 21, 24, 24, 27, 29, 33, 35, 35, 35, 37, 37, 38, 40, 40, 41, 42, 46, 46, 48, 49, 49,53, 53, 55, 58, 62

c) 240, 244, 247, 250, 252, 253, 259, 259, 263, 264, 265, 268, 268, 269, 270, 271, 271, 273, 276, 276, 270, 271, 271, 273, 276, 276, 282, 283, 288