Heart rate (beats per minute)	Heart rate (beats per minute)	Heart rate (beats per minute)	Heart rate (beats per minute)	Heart rate (beats per minute)	Heart ra (beats p minute)
72	68	80	75	65	78
70	67	79	74	66	77
71	69	81	76	64	73
69	71	82	77	65	74
70	68	80	75	66	79

1. **Calculate the range of the data set.** The range is the difference between the highest and lowest values in the data set.
2. **Determine the number of groups you want.** This will depend on the size of your data set and the level of detail you want to show in your frequency distribution.
3. **Calculate the class width.** The class width is the range of values in each group. To calculate it, divide the range of the data set by the number of groups you want.
4. **Create your groups.** Use the class width to create groups that span the range of the data set. Make sure that each group is mutually exclusive and exhaustive, meaning that each observation in the data set must belong to one and only one group.
5. **Tally the number of observations in each group.** This is the frequency of each group.
6. **Create a frequency table.** The frequency table should have two columns: one for the groups and one for the frequencies.

Range = $82 - 64 = 18$

Classes = 6

Class width = $\frac{18}{6} = 3$

Class	Tally
64 - 66	5
67 - 69	5
70 - 72	5
73 - 75	5
76 - 78	4
79 - 82	6

Heart Rates (per min.) of 50 Students

77	84	79	90	67	84	82	74	88	75
69	81	94	68	65	86	78	79	79	70
83	83	84	82	93	80	81	80	87	80
62	98	77	83	82	80	82	73	85	77
77	79	81	70	72	85	84	80	74	83

Table 3.3.1 - Frequency Distribution of Heart Rates

Heart Rate	Number of Students
57–66	2
67–76	10
77–86	32
87–96	5
97–106	1

Relative Frequency

The **relative frequency** of any class is the number of observations in the class divided by the total number of observations:

$$\text{Relative Frequency} = \frac{\text{Number in Class}}{\text{Total Number of Observations}}$$

DEFINITION

Heart Rate	Relative Frequency
57–66	2/50 = 0.04
67–76	10/50 = 0.20
77–86	32/50 = 0.64
87–96	5/50 = 0.10
97–106	1/50 = 0.02

Table 3.3.3 - Heart Rate Cumulative Frequency Distribution		
Heart Rate	**Frequency**	**Cumulative Frequency**
57–66	2	2
67–76	10	12
77–86	32	44
87–96	5	49
97–106	1	50

Table 3.3.4 - Heart Rate Cumulative Relative Frequency		
Heart Rate	**Relative Frequency**	**Cumulative Relative Frequency**
57–66	0.04 4%	0.04
67–76	0.20	0.24
77–86	0.64	0.88
87–96	0.10	0.98
97–106	0.02	1.00

Histogram

A **histogram** is a graphical representation of a frequency or relative frequency distribution. The horizontal scale corresponds to classes of quantitative data values and the vertical scale corresponds to the frequency or relative frequency of each class.

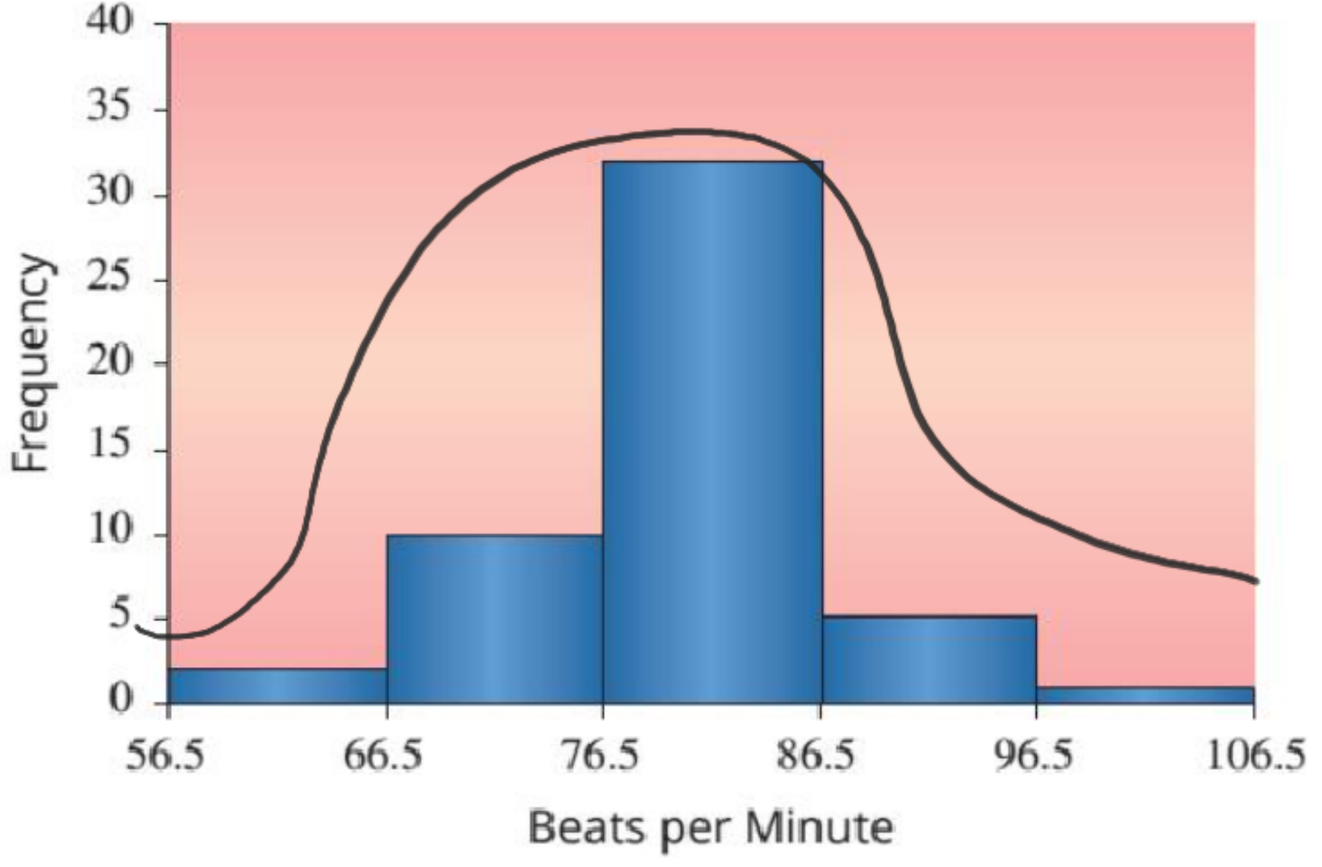


Table 3.3.1 - Frequency Distribution of Heart Rates

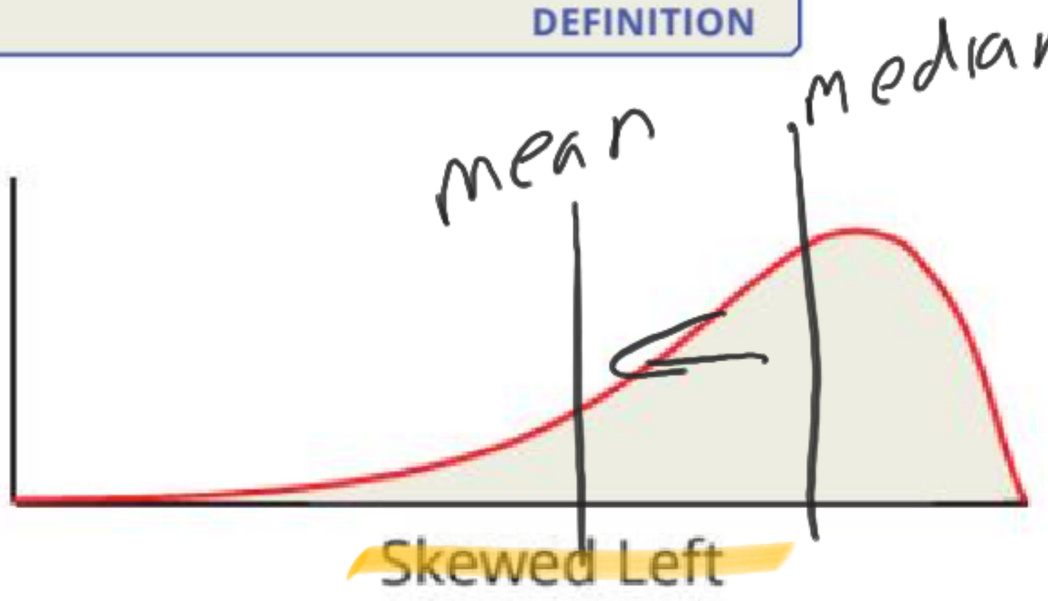
Heart Rate	Number of Students
57–66	2
67–76	10
77–86	32
87–96	5
97–106	1

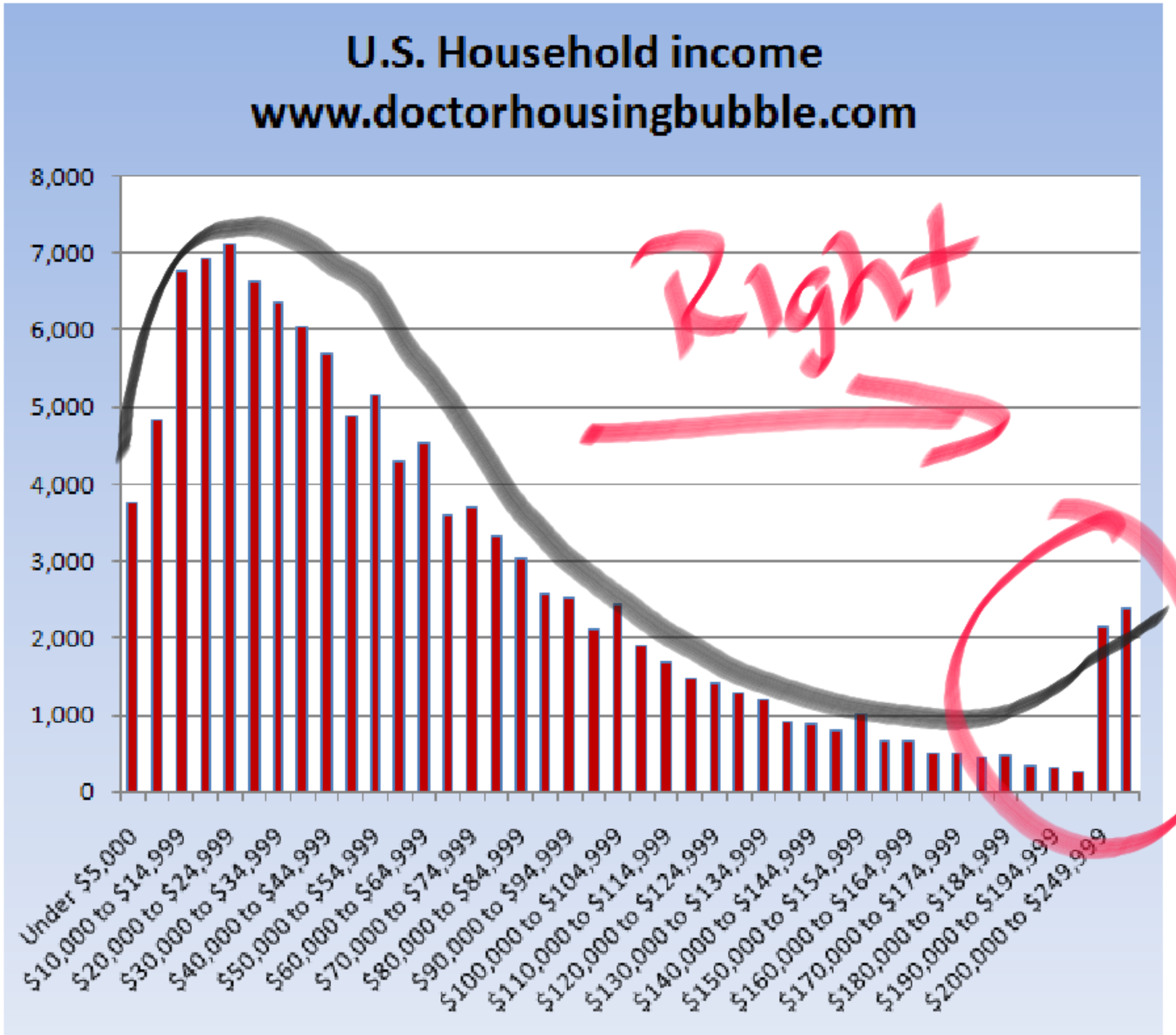
Symmetric vs. Skewed

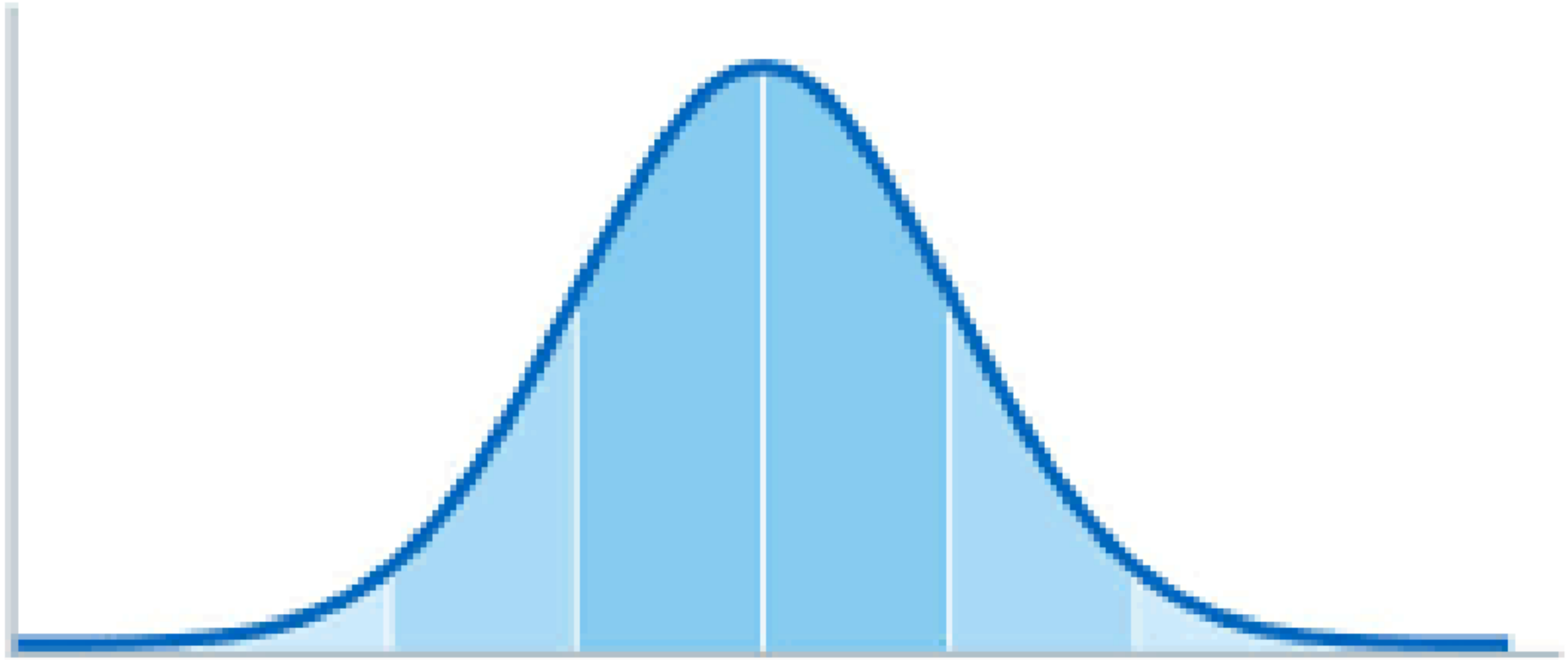
If you split the histogram of a distribution down the center, and the left and right sides of the histogram are approximately mirror images of one another, the distribution is said to be **symmetric**.

A **skewed distribution** is a nonsymmetric (or asymmetric) distribution that extends more to one side than the other. The distribution is said to be **skewed to the right** (or positively skewed) if the tail to the right of the peak of the distribution is longer than the tail to the left of the peak. The distribution is said to be **skewed to the left** (or negatively skewed) if the tail to the left of the peak of the distribution is longer than the tail to the right of the peak.

DEFINITION




U.S. Household income
www.doctorhousingbubble.com
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Right
Under $5,000
$10,000 to $14,999
$20,000 to $24,999
$30,000 to $34,999
$40,000 to $44,999
$50,000 to $54,999
$60,000 to $64,999
$70,000 to $74,999
$80,000 to $84,999
$90,000 to $94,999
$100,000 to $104,999
$110,000 to $114,999
$120,000 to $124,999
$130,000 to $134,999
$140,000 to $144,999
$150,000 to $154,999
$160,000 to $164,999
$170,000 to $174,999
$180,000 to $184,999
$190,000 to $194,999
$200,000 to $249,999



Stem-and-Leaf Plot

The **stem-and-leaf plot** is a graph representing quantitative data that separates each data value into two parts: the stem and the leaf.

DEFINITION

Table 3.4.1 - Data, Stems, and Leaves

Data	Stem	Leaf
97	09	7
99	09	9
108	10	8
110	11	0
111	11	1

Stem-and-Leaf Plot

Stem	Leaf
09	7 9
10	8
11	0 1
Key: 10	8 = 108

90-99 2

100-109 1

110-119 2

0, 4, 3, 2, 6

11

29 25 22

Ruth	Stem	Bonds
04326	0	5
1	1	69
952	2	54568
54	3	3473749
1676961	4	620965
494	5	
0	6	
	7	3

49 46 45

46 42 40

X

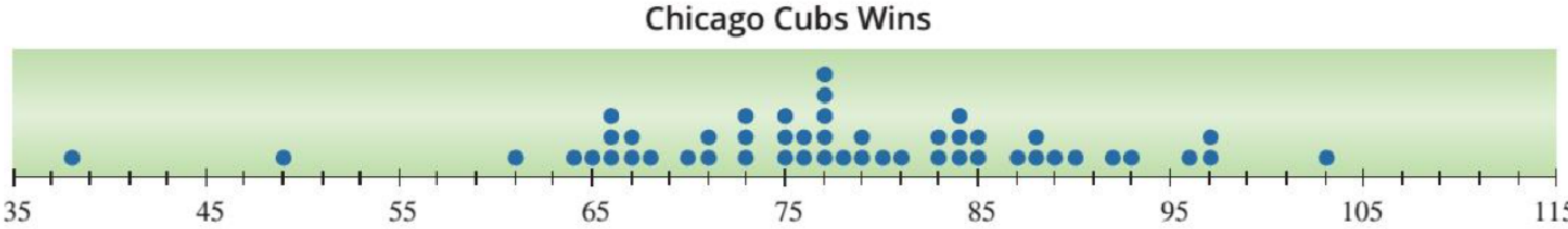
X

73

Dot Plots

A **dot plot** is a graph where each data value is plotted as a point (or a dot) above a horizontal axis. If there are multiple entries of the same data value, they are plotted one above the other. Dot plots are useful when you are interested in where the data is clustered and which values occur most often.

Wins by the Chicago Cubs (1967–2016)									
61	85	67	68	78	76	73	81	85	87
66	97	88	90	84	77	71	79	77	84
73	83	89	67	49	93	96	80	66	92
97	75	79	65	73	77	77	64	75	84
103	71	66	88	76	77	70	38	75	83



Geospatial Graphs

Choropleth maps