OVERVIEW

Unit Title: Weather, Climate, Climate Change
Lesson Title: Heat Wave

Length of Lesson in # of Hours: 4.5   **# of Classes:** 3

How does this lesson connect to previous or future work as exemplified by the Standards in your scope and sequence?

This lesson is part of an earth science unit on weather, climate, and climate change. The unit begins by building a foundation of weather-related vocabulary and ideas and introducing basic data and probability concepts that will then be used to make sense of the long term, probabilistic concepts of climate and climate change. This lesson comes later in the unit, after students are comfortable with the distinction between weather and climate and have been introduced to visual displays of data using dot plots. The context for this lesson is climate and climate change, specifically the number of heat wave days in Massachusetts in the years between 1981 and 2010 as recorded by the Center for Disease Control.

Note: This lesson plan was adapted from the lesson plan "Heat Wave" by Sarah Lonberg-Lew, developed with funding from LaGuardia Community College and the SABES Mathematics and Adult Numeracy Curriculum and Instruction PD Center. It was adapted to address data concepts at a level A and transition to B of the Guidelines for Assessment and Instruction in Statistics Education (GAISE) framework.

LESSON OBJECTIVES

At the end of this lesson, students will be able to:

- find the median and range of a data set, and identify these as measures of center and spread

- informally describe the shape of a data set using a dot plot

- informally make comparisons between data sets based on median, range, and shape

- experience using long term weather data to look for climate trends

STANDARDS

Citation	
6.SP.2	Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
6.SP.3	Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number. [Only median as a measure of center and range as a measure of variation are explored in this lesson.]
6.SP.4	Display numerical data in plots on a number line, including dot plots, histograms, and box plots. [Only dot plots are addressed in this lesson.]

1 - 3 MATHEMATICAL PRACTICE(S) ADDRESSED IN THIS LESSON	ELEMENTS OF RIGOR
Construct viable arguments and critique the reasoning of others (MP.3)	*Which aspect(s) of Rigor do the targeted Standard(s) require?* ☒ Conceptual understanding of key concepts ☐ Procedural skill and fluency ☒ Rigorous application of mathematics in real-world contexts

ESSENTIAL QUESTIONS

How can we compare data sets using center, shape, and spread?

How do scientists look for evidence of climate change in long-term weather data?

EVIDENCE OF LEARNING

Ways I and my students will know the extent to which the objectives have been met.

Students will use the data analysis and graphs from their groups and from the class to create an argument about whether the heat wave data shows evidence of climate change.

LEARNING PLAN - Vocabulary		

Weather / Climate Vocabulary:
heat wave day

Math vocabulary: (Make sure to create and record a class definition of these words if they have not already been encountered in the unit.)
variation
median
outlier
range
distribution
trend

LEARNING PLAN - Introduction	MATERIALS	TIME

Opening Discussion:
1. Review the difference between weather and climate. **What does it mean for the weather to change? What does it mean for the climate to change?** Emphasize the long term aspect of climate.
 	
2. Ask students to each write down three words to describe:
   • The past summer in Boston
   • The past winter in Boston
 	
3. Collect students' ideas and read out loud. Make note of the variations in how we experience weather and climate: we may remember part of a season (a cold snap in a mild winter) more than another, or we may be influenced by our past experiences (where we have lived before) or our lifestyle (do we walk to school or drive in the winter) or our personal preferences (some people tolerate heat/cold better than others). In order for scientists to accurately determine if long term
	Slips of paper	5-10 mins

weather patterns are changing (climate change), they need to have objective ways to measure and compare weather data over time, using measurements and data. In this lesson we will be learning two new tools to analyze data (median and range) and will make use of dot plots to see if there is evidence that climate patterns are changing in MA.

LEARNING PLAN – Body of the Lesson	MATERIALS	TIME
Finding the Median and Range		60 mins

Line Up by Height 1. Review the idea that any time we collect data, we expect *variation*. If we wanted to know how tall people are in this classroom, we don't expect everyone to have the same height. Nevertheless, we want to be able to say something in general about the height of folks in the class. 2. Follow the instructions for Activity 1: Line Up, from EMPower *Many Points Make a Point*, Teacher Book, Lesson 9, pp. 112-113. Find the *median* both with and without yourself included to ensure that students experience finding the median with both an odd and even number of data points. Start with an odd number. 3. To demonstrate the effect of *outliers* on the median height of the class, add a small doll or stuffed animal to the short end of the line. **How does this effect the median?** 4. Write the heights of everyone on the board in order and show how the median divides them into two groups. **How does the median give us a measure of "center" for the heights in our class?** 5. Find and discuss the *range* of heights present in the classroom. **Does the median give us the middle between the highest and lowest values? Why or why not?** Repeat this both with and without the "outlier doll" to show that while the value halfway between the highest and lowest value will be sensitive to outliers, the median is not. **Why is the range useful?** Give examples of subsets of the class with a large range and a small range to demonstrate that the range gives us an	EMPower *Many Points Make a Point*, Teacher Book, pp. 112-114 Copies of Activity 1, EMPower *Many Points Make a Point*, Student Book, p. 112. Doll, stuffed animal, skeleton model, etc. to demonstrate the effect of an outlier on the lineup. Copies of Activity 2, EMPower *Many Points Make a Point*, Student Book, p. 113.	

idea of the spread of our data points.

6. If this is most students' first experience of finding the median, it may be helpful to complete Activity 2: At the Party, from EMPower's *Many Points Make a Point*, Teacher Book, pp. 113-114. This gives students experience with imagining a data set based on a given median, and can powerfully reinforce the idea of the median as a value that divides the data set into two equal sets, one higher and one lower than the median value.

Working with Climate Data		90 mins
1. Ask: Have you heard of the CDC? Do you know what it is? 2. Students use computers to access wonder.cdc.gov. What types of data are available? Some of them are very complicated. Some we can figure out how to get the information. Find something interesting and share it with the class. [Purpose is to expose students to a data and digital resource and to understand how to submit a form on a website.] (10 min) 3. Say: We talked about the difference between climate and weather and how climate shows trends over a much greater period of time. I tried to find some data about the climate in Massachusetts. Where do you think I might have looked? [I looked at Heat-Wave Days May-September.] 4. Briefly review this definition of a "heat wave day." The purpose of defining it rigorously is to show that we need to have terms clearly defined before talking about data. It is not actually important that students fully understand or remember this complicated definition: Relatively simply, the North America Land Data Assimilation System (NLDAS) looked at the maximum temperatures in an area in May through September in the 30 years from 1981 to 2010. Any time the temperature went above 95% of those temperatures for two or more days in a row, each of the days was considered a "heat wave day." [Note: What counts as a heat wave in one	Computer lab with access to internet	15 mins

place may not in another because it is based on how the temperature compares to temperatures in that particular place.] Ask:
- **Why do you think they looked at temperatures only for May to September?**
- **Would a heat wave day in Texas be the same temperature as a heat wave day in Massachusetts? Why or why not?**

5. Ask students to find the number of heat wave days in Essex County, MA and in St. Clair County, IL in 2006. [Essex: 5; St. Clair: 24]

|		

Finding the Median and Range of Climate Data
1. Hand out cards to students with one data point on each one showing the number of heat wave days in 1993 in the 14 Massachusetts counties – one set of cards for the whole class. Ask students to organize the data from fewest to most in one long line (don't stack up numbers that are the same).
 	
2. Have students identify the median and range of the set. [The median is 9, with 7 counties on either side of it. The median falls between two counties that both had 9 heat wave days.] Since the median falls between two data points, use a pencil, ruler, or another marker to mark where it is. Ask:
    • **How does the median give us a measure of "center" for this data?**
    • **What does the range tell us about the spread of this data?**
	<u>1993 Data Cards</u> (cut up)	15 mins

Creating a Dot Plot of Climate Data 1. Remind students of the dot plots they created of weather data in a previous lesson, emphasizing the importance of the horizontal scale. As a class, create a horizontal scale on the board for the heat wave data. 2. Have students add the heat wave days cards to the scale on the board to create a dot plot.	Tape	15 mins

3. As a class, discuss ways to describe the shape of the data. Ask students where they see both the median and range in the dot plot.
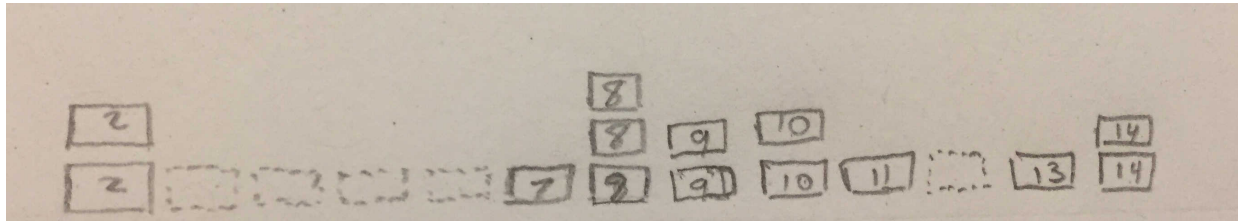
What a Year! 1. Hand out <u>What a Year!</u> In pairs, students choose a year and look up the data for Massachusetts for that year. They review the process and vocabulary involved in finding the median and range, and create a dot plot for their data. [Note: 1992 had *zero* heat wave days in MA! If students choose this year, allow them to discover this on their own, make note of this interesting data, and ask them to choose another year to make their plot.] **2.** After groups have finished, ask them to compare their data with the data from another group. They should make reference to center, shape, and spread when comparing. **Do you see evidence of climate change when comparing two years' worth of data? Why or why not? What would we need to be more convinced?**	Copies of <u>What a Year!</u> handout and access to internet	30-45 mins
Is There a Trend?		90 mins
1. Discuss what it means to have a *trend*, both informally and when as it applies to data. Make sure students understand that a trend shows a general, long-term direction, although there may be short-term fluctuations. Ask students to give examples of where they have seen trends (for example, increasing cost of rent over time, schools seem to be giving kids more homework, harder/easier to get certain types of jobs, etc.)		60 mins

2. Ask students to post their dot plots on the board by year. Line up the plots (vertically might be easier to compare) so that the scales align and so there is an appropriate distance between years (i.e. a greater distance between 1985 and 1995 than between 1985 and 1987). Depending on the years they chose, a trend may or may not be visible.

3. **Do we see evidence of climate change in this data? What arguments might be made that this data shows evidence of climate change?** [If a trend is visible, it appears to.] **What arguments might be made that this data does not show evidence of climate change?** [Even if a trend does appear, we aren't looking at very many years, so maybe it's a coincidence. It could be due to natural variability in weather.]

4. **What would we need to do to satisfy ourselves that there is or is not a trend in increasing numbers of heat wave days over the 30 years from 1981 to 2010?** [One possibility is that we could draw plots for each one of the years and see if we see a general trend over time. That would take a long time. To get a bigger picture without so much work, we can group the years and look at the combined data.]

5. Divide up the time into six 5-year spans: 1981-1985, 1986-1990, 1991-1995, 1996-2000, 2001-2005, 2006-2010. Assign a 5-year span to each group of students. Each group gets the data for their 5-year span and creates a dot plot, labeled with both the median and range. Ask students what they notice about both the numbers and the scale on the dot plot, compared to when we were graphing a single year. **Why did the scale from the dot plot have to change from before? How could you plot a number that falls between the labeled intervals (like 37?)** As students are plotting, check for understanding of the data in the context. Do they know that each dot represents one county in MA? Do they know that the number presents the total heat wave days in that county over a 5-year span?

6. Line up the charts (vertically works best, so the scales match up) to see that there is a trend of increasing numbers of heat wave days. [The numbers actually go down for 1996-2000, but there is still a general upward trend.]

Sidebar (right column):

Student dot plots from previous class (on <u>What a Year!</u> handout)

Handout <u>5 Years of Heat Wave Days</u> (Give each group one 5-year span. Print single sided so it is easier to plot dots on the graph.)

Answer Key for <u>5 Years of Heat Wave Days</u>

Note: You may want to make copies for each group, so students will be able to get a closer look at the 6 dot plots.	<u>Questions for Discussion</u> (cards)

7. **What do you notice? What do you wonder?** Give students some time to make observations and write questions about what they see in the 6 dot plots.

   Some other good questions for discussion, if they don't come up (available on cards to hand out to groups, if desired):

   Which 5-year period had the smallest range in the data? The largest?
   How does the range affect the look of the dot plot? What does that tell us about the heat wave days in those 5-year spans?

   Which 5-year periods had the data closely clustered together? Which had them spread apart? What does that tell us about the heat wave days in those 5-year spans?

   For which of the 5 year spans was the median near the middle of the range? For which was it not near the middle of the range? What does that tell us about the heat wave days in those 5-year spans?

   Do you notice any points in any of the plots that you would consider outliers? Why?

8. Ask: Do you think this data provides evidence of an increasing trend in the number of heat wave days in MA over time? Why or why not?

Wrap Up Discussion

1. Hand out <u>Climate Change: Making an Argument</u>. In groups, students come up with an argument in which they use data and dot plots to either support or disagree with the argument of a climate change skeptic.	Copies of <u>Climate Change: Making an Argument</u> handout	15-20 mins

2. Have groups share their arguments with the class. Of what was presented, what is the strongest evidence of climate change over time?		
LEARNING PLAN – Closure / Conclusion	**MATERIALS**	**TIME**
What other data might climate scientists collect to see if there are long term trends in climate change? What might be challenging about collecting evidence of climate change?		10 mins
Suggestions for Differentiation	**MATERIALS**	

<u>More accessible:</u> For a class with less background in data and statistics, stick with dot plots and informally describe center, shape and spread through comparisons. Push students to start to think about how we might measure or compare those things quantitatively. <u>More challenging:</u> Allow students to create their own scales for dot plots, reminding them that we want the scales to be the same so we can easily compare one plot to another. For students who have experience working with the mean, ask them to find the mean number of days for their data sets and to compare the mean and median as ways of measuring center. Note: A more advanced level version of this lesson plan is available at: https://www.sabes.org/content/heat-wave-math-lesson-plan-exploring-climate-change This version has students create five number summaries and box and whisker plots of data (GAISE level B) and would be appropriate for a class with more background and experience with A level concepts such as mean, median, mode, range, and dot plots.	

DUKES COUNTY

1993

HEAT WAVE DAYS:

2

HAMPDEN COUNTY

1993

HEAT WAVE DAYS:

7

NANTUCKET COUNTY

1993

HEAT WAVE DAYS:

2

BERKSHIRE COUNTY

1993

HEAT WAVE DAYS:

8

FRANKLIN COUNTY

1993

HEAT WAVE DAYS:

8

MIDDLESEX COUNTY

1993

HEAT WAVE DAYS:

9

HAMPSHIRE COUNTY

1993

HEAT WAVE DAYS:

8

WORCESTER COUNTY

1993

HEAT WAVE DAYS

9

BARNSTABLE COUNTY

1993

HEAT WAVE DAYS:

10

SUFFOLK COUNTY

1993

HEAT WAVE DAYS:

11

ESSEX COUNTY

1993

HEAT WAVE DAYS:

10

PLYMOUTH COUNTY

1993

HEAT WAVE DAYS:

13

BRISTOL COUNTY

1993

HEAT WAVE DAYS:

14

NORFOLK COUNTY

1993

HEAT WAVE DAYS:

14

What a Year!

Working with a partner, choose a year between 1981 and 2010 and look up the data for heat wave days in Massachusetts at wonder.cdc.gov. Fill in the data below.

Heat Wave Days in Massachusetts Counties in _____(year):

Barnstable County, MA	
Berkshire County, MA	
Bristol County, MA	
Dukes County, MA	
Essex County, MA	
Franklin County, MA	
Hampden County, MA	
Hampshire County, MA	
Middlesex County, MA	
Nantucket County, MA	
Norfolk County, MA	
Plymouth County, MA	
Suffolk County, MA	
Worcester County, MA	

What is the smallest (<u>minimum</u>) number of heat wave days? _____

What is the largest (<u>maximum</u>) number of heat wave days? _____

What is the range of this data? Show how you found the range.

What was the median number of heat wave days? Show how you found the median.

Draw a dot plot of your data using the number line below:

Year:_____

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
0  1  2  3  4  5  6  7  8  9  10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
```

Label the median and range on your dot plot.

Compare your plot to another group's plot. What do you notice? What do you wonder?

Five Years of Heat Wave Days

1981-1985

The data below shows the total number of heat wave days by county in MA for the years above.

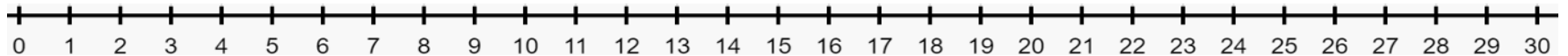|	
Barnstable County, MA	10
Berkshire County, MA	11
Bristol County, MA	8
Dukes County, MA	10
Essex County, MA	11
Franklin County, MA	11
Hampden County, MA	16
Hampshire County, MA	13
Middlesex County, MA	10
Nantucket County, MA	18
Norfolk County, MA	10
Plymouth County, MA	4
Suffolk County, MA	10
Worcester County, MA	12

What is the smallest (minimum) number of heat wave days?

What is the largest (maximum) number of heat wave days?

What is the range of this data? Show how you found the range.

What was the median number of heat wave days? Show how you found the median.

Draw a dot plot of your data using the number line below:

1981-1985

```
+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
```

Label the median and range on your dot plot.

Five Years of Heat Wave Days

1986-1990

The data below shows the total number of heat wave days by county in MA for the years above.

Barnstable County, MA	17
Berkshire County, MA	30
Bristol County, MA	14
Dukes County, MA	37
Essex County, MA	23
Franklin County, MA	25
Hampden County, MA	22
Hampshire County, MA	25
Middlesex County, MA	25
Nantucket County, MA	35
Norfolk County, MA	19
Plymouth County, MA	4
Suffolk County, MA	26
Worcester County, MA	26

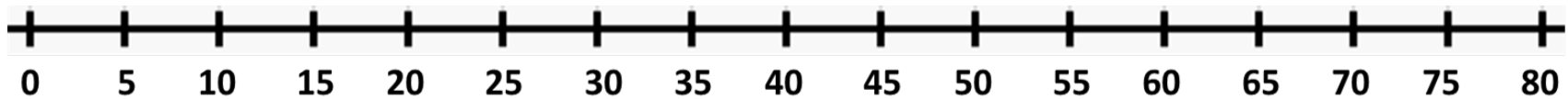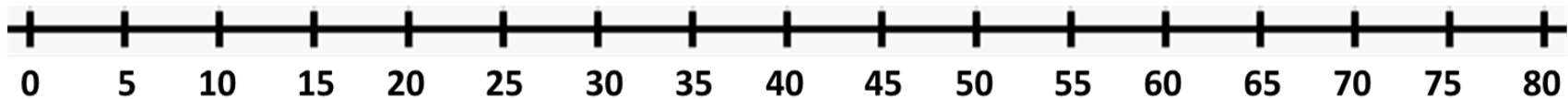What is the smallest (minimum) number of heat wave days?

What is the largest (maximum) number of heat wave days?

What is the range of this data? Show how you found the range.

What was the median number of heat wave days? Show how you found the median.

Draw a dot plot of your data using the number line below:

1986-1990

```
+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
```

Label the median and range on your dot plot.

Five Years of Heat Wave Days

1991-1995

The data below shows the total number of heat wave days by county in MA for the years above.

Barnstable County, MA	27
Berkshire County, MA	33
Bristol County, MA	38
Dukes County, MA	23
Essex County, MA	25
Franklin County, MA	28
Hampden County, MA	24
Hampshire County, MA	28
Middlesex County, MA	22
Nantucket County, MA	25
Norfolk County, MA	32
Plymouth County, MA	37
Suffolk County, MA	27
Worcester County, MA	25

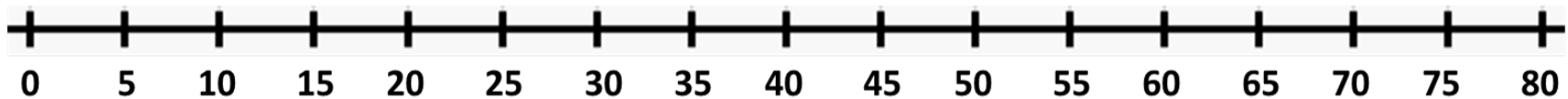What is the smallest (minimum) number of heat wave days?

What is the largest (maximum) number of heat wave days?

What is the range of this data? Show how you found the range.

What was the median number of heat wave days? Show how you found the median.

Draw a dot plot of your data using the number line below:

1991-1995

0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80

Label the median and range on your dot plot.

Five Years of Heat Wave Days

1996-2000

The data below shows the total number of heat wave days by county in MA for the years above.

Barnstable County, MA	19
Berkshire County, MA	14
Bristol County, MA	31
Dukes County, MA	15
Essex County, MA	15
Franklin County, MA	12
Hampden County, MA	18
Hampshire County, MA	15
Middlesex County, MA	20
Nantucket County, MA	21
Norfolk County, MA	26
Plymouth County, MA	28
Suffolk County, MA	16
Worcester County, MA	22

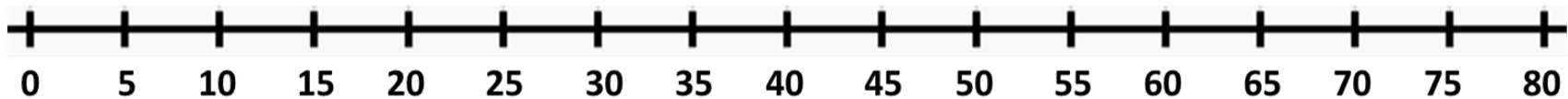What is the smallest (minimum) number of heat wave days?

What is the largest (maximum) number of heat wave days?

What is the range of this data? Show how you found the range.

What was the median number of heat wave days? Show how you found the median.

Draw a dot plot of your data using the number line below:

1996-2000

0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80

Label the median and range on your dot plot.

<u>Five Years of Heat Wave Days</u>

2001-2005

The data below shows the total number of heat wave days by county in MA for the years above.

Barnstable County, MA	32
Berkshire County, MA	47
Bristol County, MA	36
Dukes County, MA	23
Essex County, MA	31
Franklin County, MA	51
Hampden County, MA	43
Hampshire County, MA	51
Middlesex County, MA	39
Nantucket County, MA	20
Norfolk County, MA	36
Plymouth County, MA	37
Suffolk County, MA	37
Worcester County, MA	36

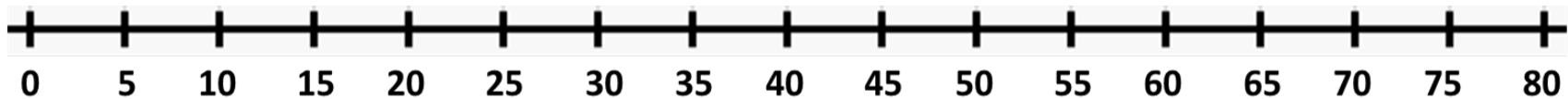What is the smallest (<u>minimum</u>) number of heat wave days?

What is the largest (<u>maximum</u>) number of heat wave days?

What is the range of this data? Show how you found the range.

What was the median number of heat wave days? Show how you found the median.

Draw a dot plot of your data using the number line below:

2001-2005

0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80

Label the median and range on your dot plot.

Five Years of Heat Wave Days

2006-2010

The data below shows the total number of heat wave days by county in MA for the years above.

County	Days
Barnstable County, MA	53
Berkshire County, MA	42
Bristol County, MA	47
Dukes County, MA	73
Essex County, MA	38
Franklin County, MA	39
Hampden County, MA	39
Hampshire County, MA	37
Middlesex County, MA	43
Nantucket County, MA	76
Norfolk County, MA	41
Plymouth County, MA	44
Suffolk County, MA	41
Worcester County, MA	40

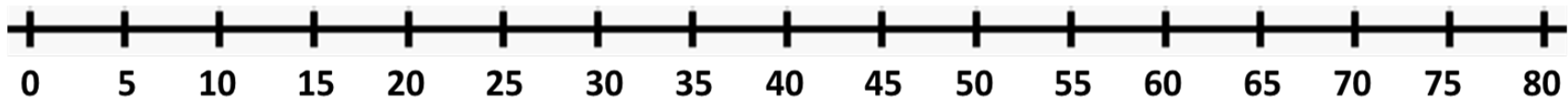What is the smallest (<u>minimum</u>) number of heat wave days?

What is the largest (<u>maximum</u>) number of heat wave days?

What is the range of this data? Show how you found the range.

What was the median number of heat wave days? Show how you found the median.

Draw a dot plot of your data using the number line below:

2006-2010

```
+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
0    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
```

Label the median and range on your dot plot.

Five Years of Heat Wave Days — ANSWER KEY

1981-1985

The data below shows the total number of heat wave days by county in MA for the years above.

Barnstable County, MA	10
Berkshire County, MA	11
Bristol County, MA	8
Dukes County, MA	10
Essex County, MA	11
Franklin County, MA	11
Hampden County, MA	16
Hampshire County, MA	13
Middlesex County, MA	10
Nantucket County, MA	18
Norfolk County, MA	10
Plymouth County, MA	4
Suffolk County, MA	10
Worcester County, MA	12

What is the smallest (<u>minimum</u>) number of heat wave days?

4

What is the largest (<u>maximum</u>) number of heat wave days?

18

What is the range of this data? Show how you found the range.

14. Students may use subtraction (18-4) or adding on (4 + 14 = 18) or some other method, such as a number line. Look for an understanding that the range is a single number that describes the difference between the largest and smallest value, and summarizes one aspect of the spread of the data. In common parlance, we use the word "range" to give the endpoints, such as 4 through 18, but in statistics, we want to reduce this to a single number (14 difference between 4 and 18.)
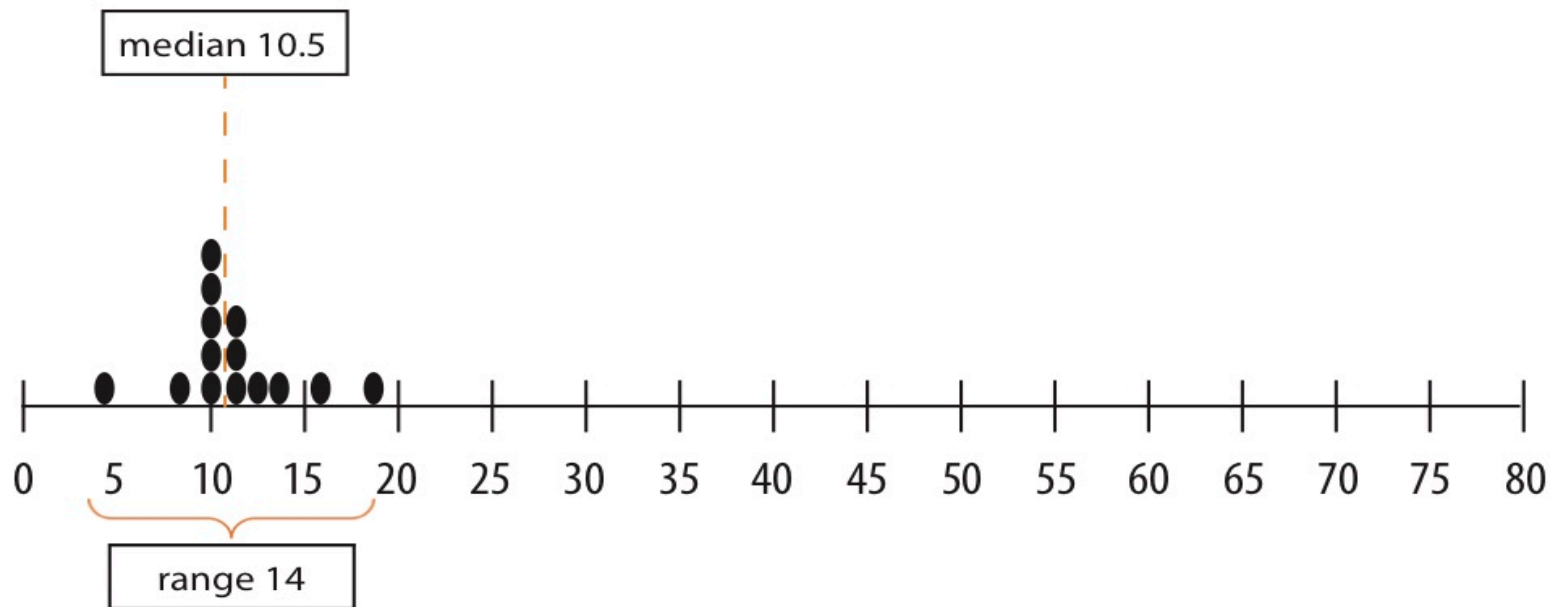
What was the median number of heat wave days? Show how you found the median.

10.5   Look for evidence that students lined up the numbers from largest to smallest.

4   8   10   10   10   10   10 ‖ 11   11   11   12   13   16   18

Draw a dot plot of your data using the number line below:

1981-1985

median 10.5

range 14

0   5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80

Label the median and range on your dot plot.

Five Years of Heat Wave Days — ANSWER KEY

1986-1990

The data below shows the total number of heat wave days by county in MA for the years above.

Barnstable County, MA	17
Berkshire County, MA	30
Bristol County, MA	14
Dukes County, MA	37
Essex County, MA	23
Franklin County, MA	25
Hampden County, MA	22
Hampshire County, MA	25
Middlesex County, MA	25
Nantucket County, MA	35
Norfolk County, MA	19
Plymouth County, MA	4
Suffolk County, MA	26
Worcester County, MA	26

What is the smallest (<u>minimum</u>) number of heat wave days?

14

What is the largest (<u>maximum</u>) number of heat wave days?

37

What is the range of this data? Show how you found the range.

23
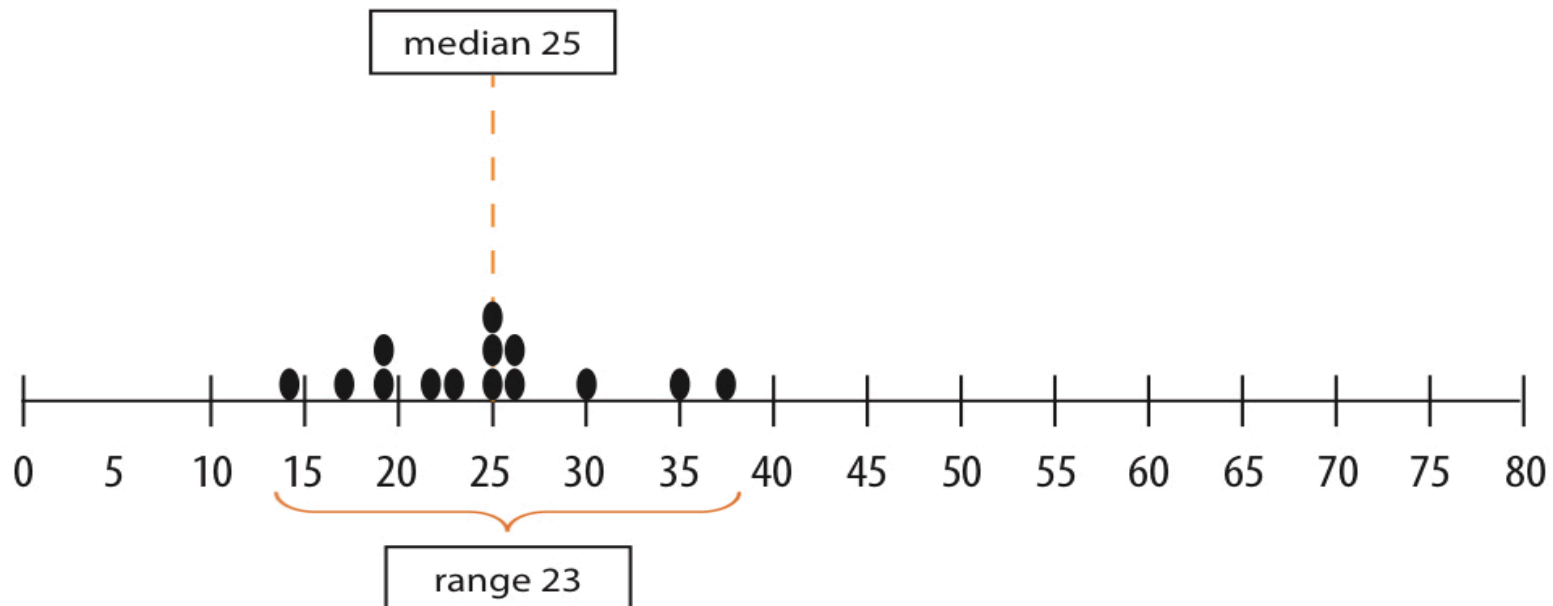
What was the median number of heat wave days? Show how you found the median.

25

14   17   19   19   22   23   25 ‖ 25   25   26   26   30   35   37

Draw a dot plot of your data using the number line below:

1986-1990

Label the median and range on your dot plot.

Five Years of Heat Wave Days — ANSWER KEY

1991-1995

The data below shows the total number of heat wave days by county in MA for the years above.

Barnstable County, MA	27
Berkshire County, MA	33
Bristol County, MA	38
Dukes County, MA	23
Essex County, MA	25
Franklin County, MA	28
Hampden County, MA	24
Hampshire County, MA	28
Middlesex County, MA	22
Nantucket County, MA	25
Norfolk County, MA	32
Plymouth County, MA	37
Suffolk County, MA	27
Worcester County, MA	25

What is the smallest (minimum) number of heat wave days?

22

What is the largest (maximum) number of heat wave days?

38

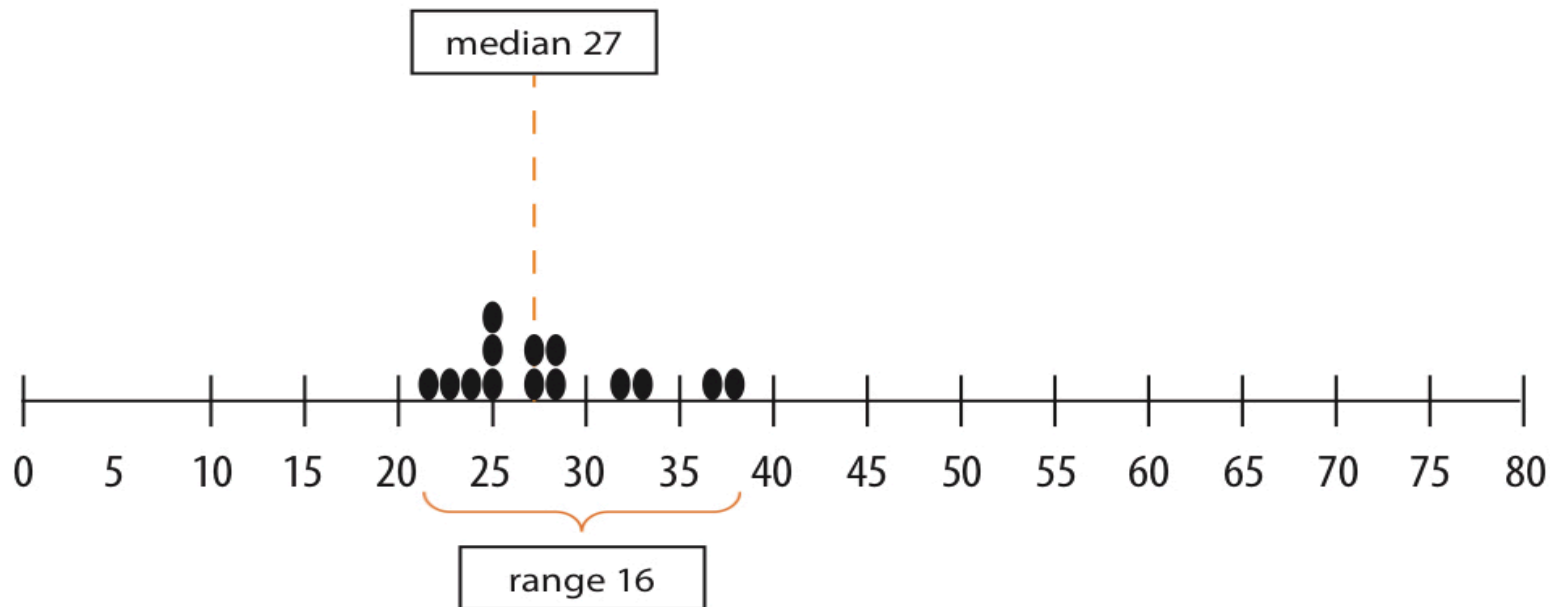What is the range of this data? Show how you found the range.

16

What was the median number of heat wave days? Show how you found the median.

27

22   23   24   25   25   25   27 ‖ 27   28   28   32   33   37   38

Draw a dot plot of your data using the number line below:

1991-1995

Label the median and range on your dot plot.

Five Years of Heat Wave Days — ANSWER KEY

1996-2000

The data below shows the total number of heat wave days by county in MA for the years above.

Barnstable County, MA	19
Berkshire County, MA	14
Bristol County, MA	31
Dukes County, MA	15
Essex County, MA	15
Franklin County, MA	12
Hampden County, MA	18
Hampshire County, MA	15
Middlesex County, MA	20
Nantucket County, MA	21
Norfolk County, MA	26
Plymouth County, MA	28
Suffolk County, MA	16
Worcester County, MA	22

What is the smallest (<u>minimum</u>) number of heat wave days?

12

What is the largest (<u>maximum</u>) number of heat wave days?

31

What is the range of this data? Show how you found the range.

19
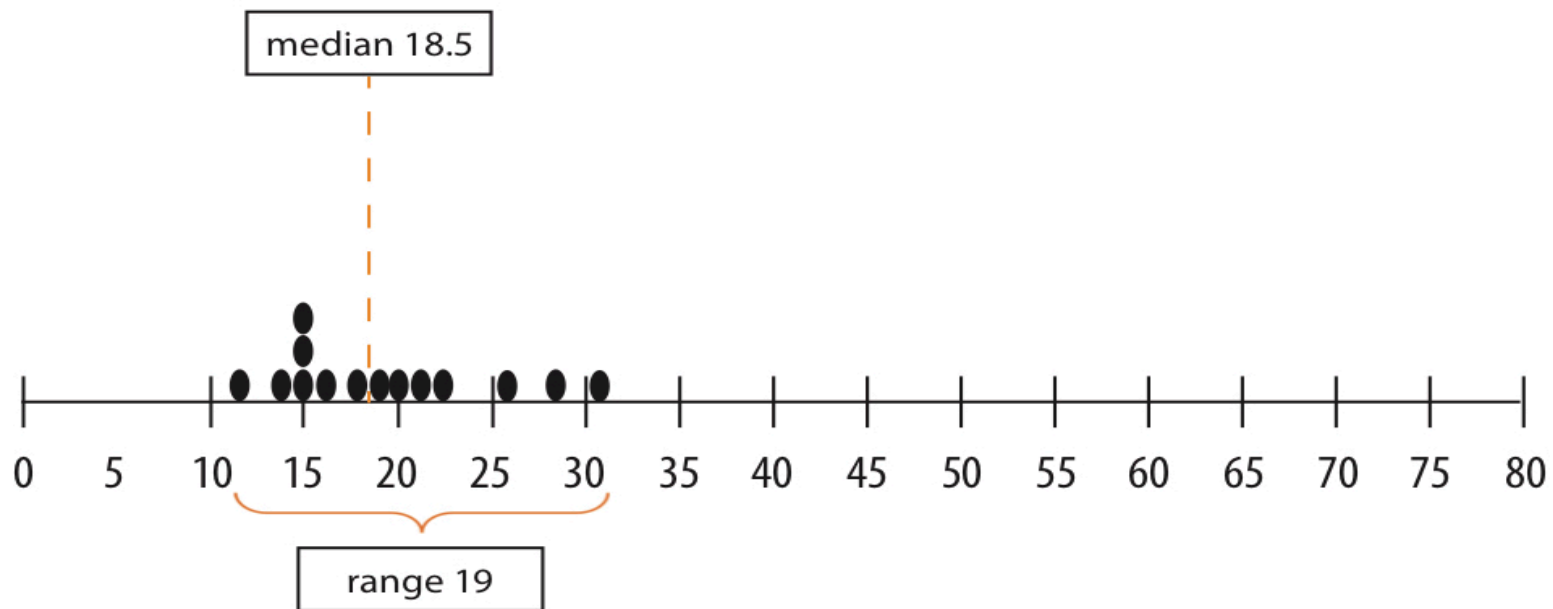
What was the median number of heat wave days? Show how you found the median.

18.5

12   14   15   15   15   16   18 ‖ 19   20   21   22   26   28   31

Draw a dot plot of your data using the number line below:

1996-2000

median 18.5

range 19

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80

Label the median and range on your dot plot.

Five Years of Heat Wave Days — ANSWER KEY

2001-2005

The data below shows the total number of heat wave days by county in MA for the years above.

Barnstable County, MA	32
Berkshire County, MA	47
Bristol County, MA	36
Dukes County, MA	23
Essex County, MA	31
Franklin County, MA	51
Hampden County, MA	43
Hampshire County, MA	51
Middlesex County, MA	39
Nantucket County, MA	20
Norfolk County, MA	36
Plymouth County, MA	37
Suffolk County, MA	37
Worcester County, MA	36

What is the smallest (<u>minimum</u>) number of heat wave days?

20

What is the largest (<u>maximum</u>) number of heat wave days?

51

What is the range of this data? Show how you found the range.
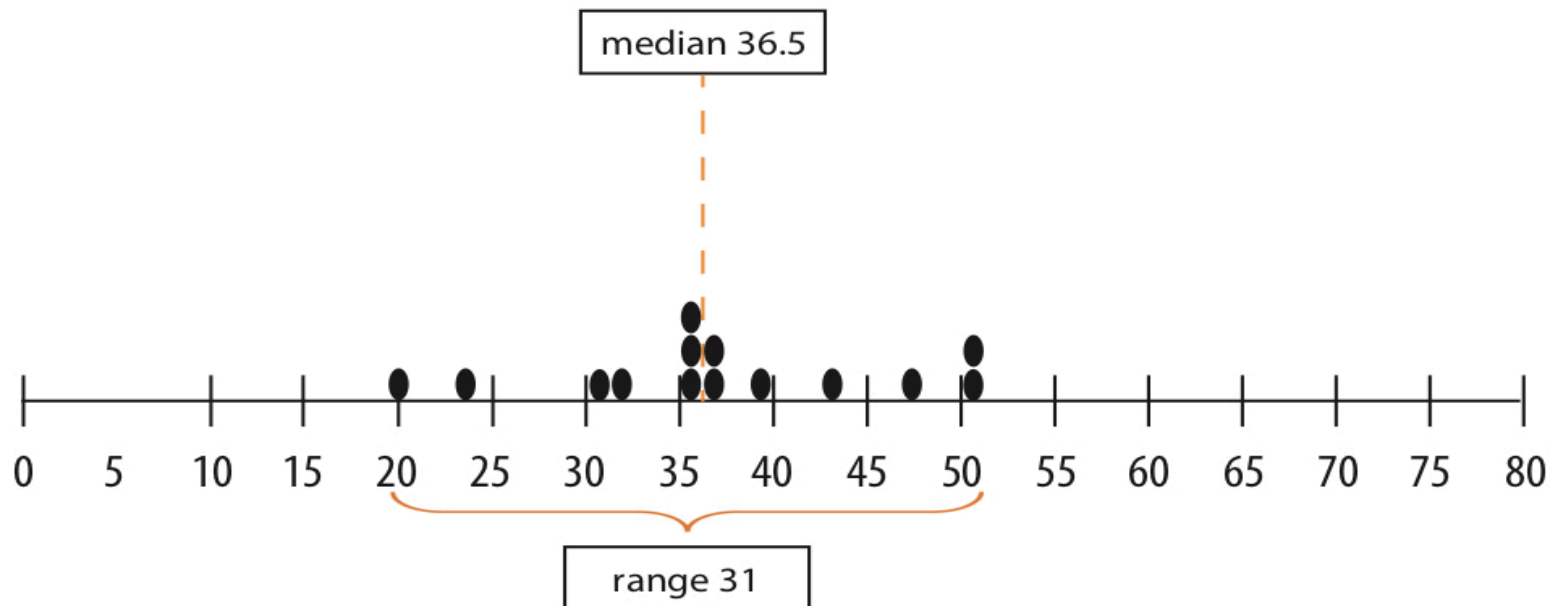
31

What was the median number of heat wave days? Show how you found the median.

36.5

20   23   31   32   36   36   36 ‖ 37   37   39   43   47   51   51

Draw a dot plot of your data using the number line below:

2001-2005

median 36.5

range 31

0   5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80

Label the median and range on your dot plot.

Five Years of Heat Wave Days — ANSWER KEY

2006-2010

The data below shows the total number of heat wave days by county in MA for the years above.

Barnstable County, MA	53
Berkshire County, MA	42
Bristol County, MA	47
Dukes County, MA	73
Essex County, MA	38
Franklin County, MA	39
Hampden County, MA	39
Hampshire County, MA	37
Middlesex County, MA	43
Nantucket County, MA	76
Norfolk County, MA	41
Plymouth County, MA	44
Suffolk County, MA	41
Worcester County, MA	40

What is the smallest (<u>minimum</u>) number of heat wave days?

37

What is the largest (<u>maximum</u>) number of heat wave days?

76

What is the range of this data? Show how you found the range.

39
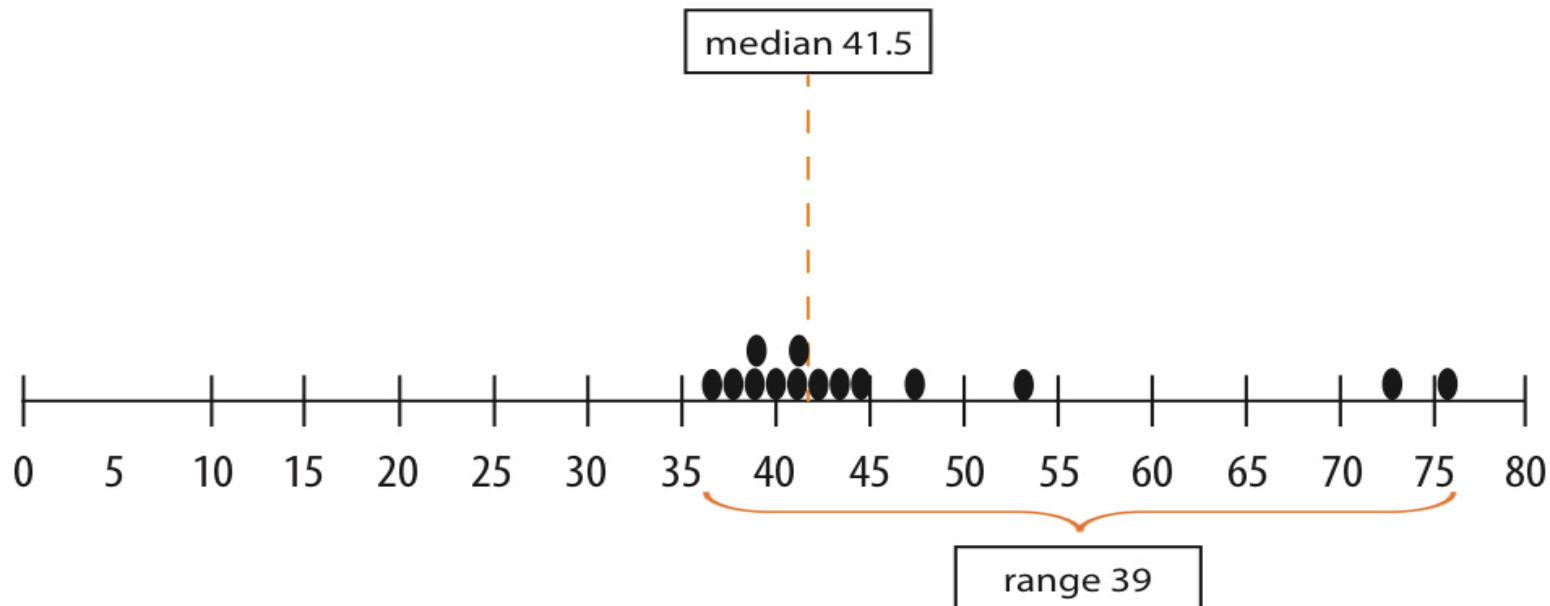
What was the median number of heat wave days? Show how you found the median.

41.5

37 38 39 39 40 41 41 ‖ 42 43 44 47 53 73 76

Draw a dot plot of your data using the number line below:

2006-2010

Label the median and range on your dot plot.

Questions for Discussion

A. Which 5 year period had the smallest range in the data? The largest? How does the range affect the look of the dot plot? What does that tell us about the heat wave days in those 5 year spans?	**B.** Which 5 year periods had the data closely clustered together? Which had them spread apart? What does that tell us about the heat wave days in those 5 year spans?
C. For which of the 5 year spans was the median near the middle of the range? For which was it not near the middle of the range? What does that tell us about the heat wave days in those 5 year spans?	**D.** Do you notice any points in any of the plots that you would consider outliers? Why?

Name: _____

Climate Change: Making an Argument

Your friend Livia has been looking at the data from wonder.cdc.gov and presents you with the following argument:

> People claim that the planet is warming up, but I've looked at the data and I don't agree. In 1992 there was not a single heat wave day in Massachusetts but in 1991 there were 9 heat wave days just in Bristol County. How can you say the planet is warming up when it was clearly hotter in 1991 than it was in 1992?

Discuss as a group Livia's points and share your conclusions based on the data. You may want to include:

- data
- a dot plot
- discussion of median and range.