

Box-and-Whisker Plots

Reporting Category Statistics

Topic Comparing and contrasting data sets, using box-and-whisker plots

Primary SOL A.10 The student will compare and contrast multiple univariate data sets, using box-and-whisker plots.

Materials

- Graphing calculators
- Box-and-Whisker Plots Problems 1, 2, and 3 (attached)

Vocabulary

median, range, mean, minimum, maximum (earlier grades)

lower quartile, upper quartile, interquartile range (A.10)

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Distribute copies of the Box-and-Whisker Plots Problems 1, 2, and 3. Have students complete the first problem as you demonstrate creating a box-and-whisker plot on the graphing calculator to the whole class or to small groups, depending on familiarity with using the calculator. Students should already have had experiences in creating box-and-whisker plots manually. As a class, discuss the answers and reasoning behind the answers to the first problem.
2. Have students complete the second problem in pairs or small groups. As a class, discuss the answers and reasoning behind the answers to the second problem. As students are discussing how they compared the two box-and-whisker plots, listen for and encourage talk about percentages (e.g., 75% of the students scored above a 77), the spread of the data (e.g., interquartile range, range), Class 2 not having a right whisker, and the box-and-whisker plot not showing the mean.
3. Have students complete the third problem in groups of four. To reduce the time spent on constructing the plots, direct two students in each group to create plots of the men's data and check accuracy, while the other two create plots of the women's data. Make sure all students are using the same number line in order to make it possible to compare plots later. As groups make conclusions about the experiment, encourage them to use of the plots to justify their conclusions. Have each group write their conclusions on chart paper for whole-class discussion. During class discussion of the third problem, allow each group to present and justify a conclusion they made. Encourage discourse by asking students to restate their conclusions and the reasoning behind them and asking other students whether they agree or disagree with the conclusions and/or reasoning.

Assessment

- **Questions**
 - What kind of information can you obtain from a box-and-whisker plot?
 - What kind of information can you *not* obtain from a box-and-whisker plot?

- In what kind of situation might you want to use a box-and-whisker plot?
- **Journal/Writing Prompts**
 - Explain the advantages and disadvantages of using box-and-whisker plots.
 - Describe how you might compare two box-and-whisker plots.
- **Other**
 - Have students gather data related to two groups and present the data in box-and-whisker plots. Then, have them analyze and compare the plots, noting their observations. Finally, have them exchange plots and analyze each other's plots and compare observations. Data collection could involve students gathering information from their classmates and then splitting the data into two groups based on gender. Other possibilities include gathering data about two sports teams, salary data of men and women, life expectancies in two different areas of the world, etc.

Extensions and Connections (for all students)

- After gathering and displaying data in box-and-whisker plots, have students eliminate an outlier to see what effect that has on the plot.
- Have students explore what happens to the mean when an outlier is removed.
- Have students represent the same data with a different graphical representation. Have them explore the difference between the representations and list any advantages or disadvantages of one over the other.
- Have students create box-and-whisker plots of their quiz grades. Then, have them compare these plots to plots of their grades in other subjects or to plots of their grades during a previous marking period.

Strategies for Differentiation

- Have students create a graphic organizer illustrating the process of constructing a box-and-whisker plot.
- Allow students to use graph paper when constructing box-and-whisker plots.
- Provide calculator keystrokes for students to use during the lesson.
- Provide predrawn number lines (x -axis) and straight edges to those students who need them.
- Clarify and simplify the description of data and directions for problem 3.

Box-and-Whisker Plots Problem 1

Name _____ Date _____

Six students made the following scores on a Statistics exam: 85, 96, 87, 54, 90, and 92.

1. Manually make a box-and-whiskers plot of these scores.

2. Now enter the scores into L₁, as shown at right.

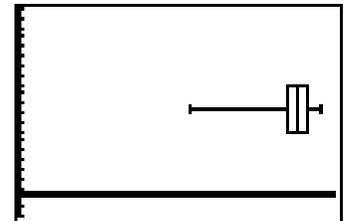
L1	L2	L3
85		
96		
87		
54		
90		
92		
L1(?)=		

3. Choose an appropriate Window, as shown at right.

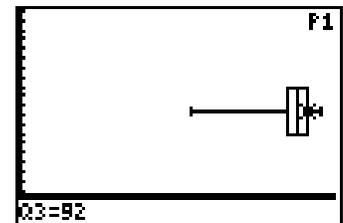
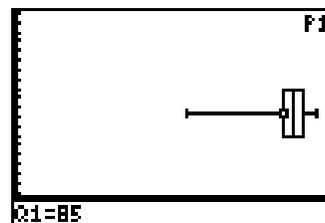
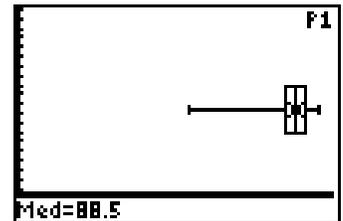
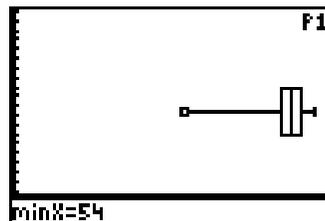
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WINDOW FORMAT
Xmin=0
Xmax=100
Xscl=1
Ymin=-2
Ymax=20
Yscl=1
    
```

4. Ensure that the STAT PLOT is on and that you have chosen the box-and-whisker plot to display; results as shown at right.

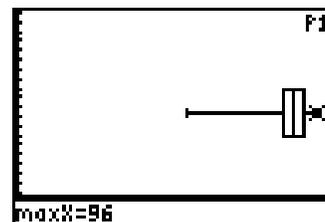


6. Trace to see the minimum, lower quartile (Q1), median, upper quartile (Q3), and maximum values, as shown in the five drawings at right.



7. Try different windows. Answer the following questions:

- What happens to the plot when the Xmin is increased?
- What happens when it is decreased?
- What happens to the plot when the Xmax is increased?
- What happens when it is decreased?
- Which window gave you the best view of the plot?



Box-and-Whisker Plots Problem 2

Name _____ Date _____

Scores on the first Physics test are as follows:

Class 1

Student	A	B	C	D	E	F	G	H	I	J
Score	55	64	83	92	100	77	86	95	80	98

Class 2

Student	A	B	C	D	E	F	G	H	I
Score	52	79	71	100	100	76	100	78	76

1. Make a box-and-whisker plot of each set of data on the same graphics screen. Note: You will have to use two different LISTS and two different STAT PLOTS.
2. Sketch each box-and-whisker plot, identifying the Min, Q1, Med, Q3, and Max of each.
3. Which class did better? _____ Why?
4. What is the average (mean) score for each class? _____
 Note: When you prompt the calculator to do one-variable statistics, you *must* follow the prompt with the “place” you stored the statistics—L₁ or L₂.
5. Does this change your opinion about which class did better? _____ Why, or why not?
6. When statistics are “quoted,” what words can be deceiving? _____
 That is, how can statistics be misrepresented to support any given argument?
7. Can the wording affect how one perceives the overall picture of “which class did better?” _____ If so, in what way?

