

The Five-Number Summary and Boxplots

Objective – Compute the Five-Number Summary

- _____ – a summary of a set of data that includes the Minimum, Q_1 , Median (M), Q_3 , and Maximum values.

The Five-Number summary is presented as follows:

Minimum	Q_1	M	Q_3	Maximum
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Example: The following values are final exam scores of the 12 students in a Statistics Summer course.

71, 61, 94, 82, 75, 73, 46, 70, 70, 84, 68, 76

Determine the **five-number summary** of the data using your calculator.

First, to input the values into L1 (or any list) hit:

Stat, highlight Edit, **Enter**, then hit **enter** after inputting **each** number:

71, 61, 94, 82, 75, 73, 46, 70, 70, 84, 68, 76

L1	L2	L3	L4	L5
71	-----	-----	-----	-----
61				
94				
82				
75				
73				
46				
70				
70				
84				
68				

To find the Five-Number Summary:

Hit **Stat**, right arrow once to **Calc**, hit **Enter** to execute the 1-Var Stats program:

Then hit **2nd**, **L1** (the #1) to use the data from L1, and hit **Enter**

```
NORMAL FLOAT AUTO REAL DEGREE CL
EDIT CALC TESTS
1:1-Var Stats
2:2-Var Stats
3:Med-Med
4:LinReg(ax+b)
5:QuadReg
6:CubicReg
7:QuartReg
8:LinReg(a+bx)
9↓LnReg
```

```
NORMAL FLOAT AUTO REAL DEGREE CL
1-Var Stats L1
```

We are provided with the results from the 1-Var Stats Program:

arrow
down:

To see the Five-Number Summary, simply

```
1-Var Stats
x̄=72.5
Σx=870
Σx²=64648
Sx=11.95826074
σx=11.449163
n=12
minX=46
↓Q1=69
```

```
1-Var Stats
↑Sx=11.95826074
σx=11.449163
n=12
minX=46
Q1=69
Med=72
Q3=79
maxX=94
```

- “minX” represents the *minimum* value
- “Med” represents the Median
- “maxX” represents the *maximum* value

Thus, the Five-Number Summary is:

46	69	72	79	94
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Pause the video and try these problems:

Questions.

1) The ages of the eight patients participating in an experiment testing a new drug are given below.

54 48 65 64 57 54 69 62

Find the five-number summary.

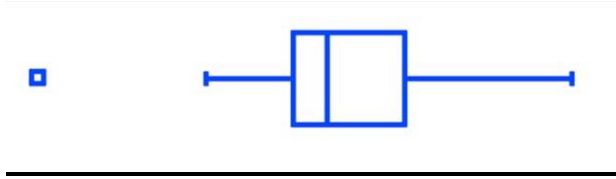
2) A sample of 11 students in an English was asked how many novels they had read the previous year. The following data represent their responses.

2 5 2 0 2 3 1 5 6 10 4

Find the five number summary.

Objective – Draw and Interpret Boxplots

The five-number summary and outliers (if any) can be illustrated using a graph called a **boxplot**.



Drawing a Boxplot

Step 1: Find the five-number summary.

Step 2: Determine the lower and upper fences.

$$\text{Lower Fence} = Q_1 - 1.5(\text{IQR})$$

$$\text{Upper Fence} = Q_3 + 1.5(\text{IQR})$$

Step 3: Draw a number line long enough to include the maximum and minimum values. Insert vertical lines at Q_1 , M , and Q_3 . Enclose these vertical lines in a box.

Step 4: Label the lower and upper fences.

Step 5: Draw a line from Q_1 to the smallest data value that is larger than the lower fence. Draw a line from Q_3 to the largest data value that is smaller than the upper fence. These lines are called *whiskers*.

Step 6: Any data values *less than the lower fence or greater than the upper fence* (that is, “outside” the fences) are *outliers* and are marked with an asterisk (*).

Example: Back to the final exam scores of the 12 students in a Statistics Summer. Below is the data (in ascending order). Construct a boxplot.

46, 61, 68, 70, 70, 71, 73, 75, 76, 82, 84, 94

We previously found the Five-Number Summary:

min = _____, Q_1 = _____, $M = Q_2$ = _____, Q_3 = _____, max = _____

Now we need to calculate the lower and upper fences:

Lower Fence: $Q_1 - 1.5(IQR)$ = _____

Upper Fence: $Q_3 + 1.5(IQR)$ = _____

Now sketch the boxplot:

Final Exam Scores

To construct a boxplot of the data using a calculator:

Enter the data into any list (we previously input our data into L1)

Hit: 2nd, Stat Plot (Y= button),

Enter (to enter plot 1),

Highlight “On” (by hitting Enter)

Arrow down to Type,

Arrow Right to boxplot *with outliers* and hit Enter

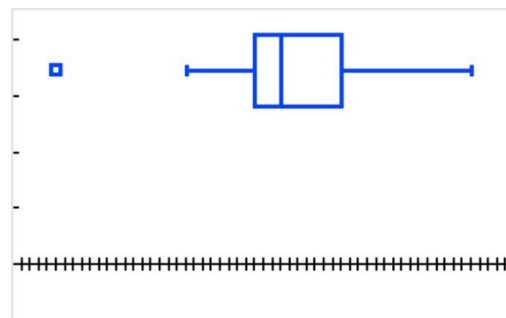
Xlist: L1

Freq: 1

Mark: hit enter on any icon



Now hit Zoom, arrow down to ZoomStat, and hit Enter



Note: Once we have the graph, we can hit Trace, then arrow right and left to see key values such as the Five-Number Summary on the boxplot.

Pause the video and try these problems:

Questions.

1) The ages of the eight patients participating in an experiment testing a new drug are given below.

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Construct a boxplot.

2) A sample of 11 students in an English was asked how many novels they had read the previous year. The following data represent their responses.

2 5 2 0 2 3 1 5 6 10 4

Construct a boxplot.