

## Biased Rectangles?

- 1.) Drag a new Case Table off the shelf. (See Figure 1) Double click on the title **Collection 1** and rename **Biased Rectangles**.

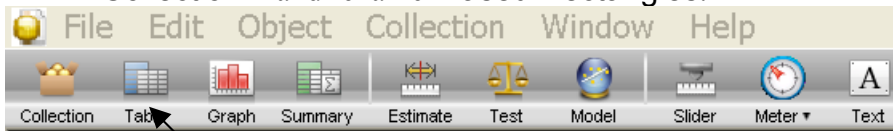


Figure 1

Enter data from rectangle sheet using **Number**, **Length** and **Width** as attributes. (See Figure 2a)

- 2.) Create a new attribute, **Area** by typing its name where you the <new> column heading. Then press enter or tab.
- 3.) To create the formula for **Area**, highlight the column and choose **Edit > Edit Formula**. The formula editor appears; enter **Length \* Width** and then press **OK** to close the editor. (See Figure 2b)

Biased Rectangles			
	Number	length	width
1	1	1	1
2	2	1	1
3	3	1	1
4	4	1	1
5	5	1	1
6	6	1	5

Figure 2a

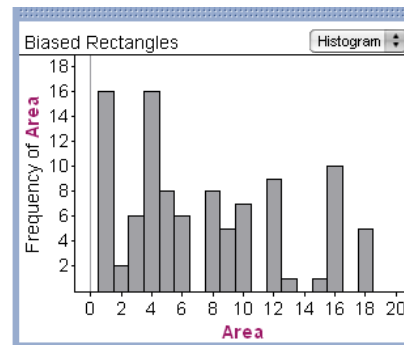


Figure 2b

- 4.) Drag a new graph off the shelf; drag the name of the attribute **area** to the horizontal axis. Change from Dot Plot to Histogram. (See Figure 3)

Biased Rectangles				
	Number	length	width	Area
=				length * width
1	1	1	1	1
2	2	1	1	1
3	3	1	1	1
4	4	1	1	1
5	5	1	1	1

Figure 3

- 5.) Choose Graph > Plot Value. The formula editor appears; enter  $\text{mean}()$  and then press OK to close the editor. Repeat for  $\text{median}()$ . (See Figure 4)

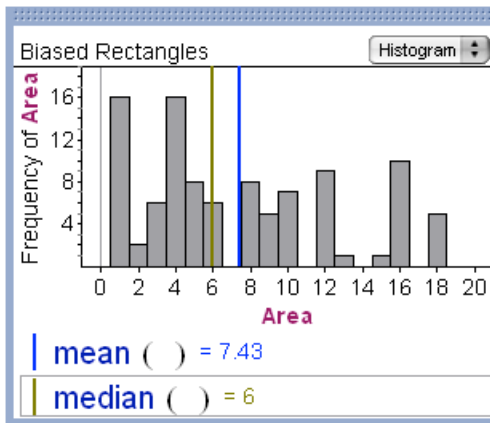


Figure 4

- 6.) Drag a summary table off the shelf. (See Figure 5a)

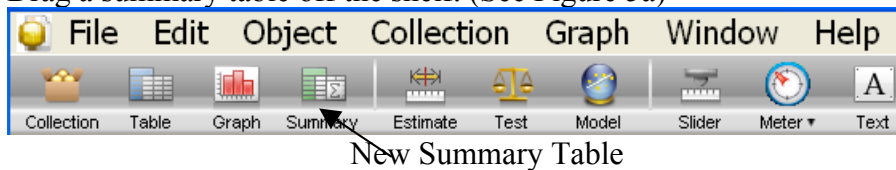


Figure 5a

Then drag **Area** to the cell below the down arrow. A value for mean will appear automatically. Note the summary table must be selected for the summary table to appear. (See Figure 5b)

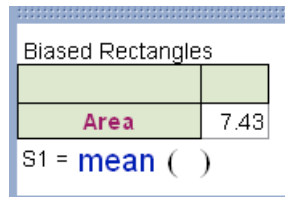


Figure 5b

- 7.) Choose Summary > Add Formula; enter in  $\text{median}()$ . (See Figure 6)

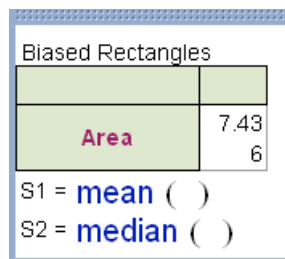


Figure 6

- 8.) Select the collection **Biased Rectangles** (gold balls). Choose **Collection > Sample Cases**. You will see the collection **Sample of Rectangles** appear.
- 9.) Double click on **Sample of Rectangles**; the Inspector will appear. Deselect 'Animation' and 'With Replacement'; type in **5** for Cases. Click 'Sample More Cases'. (See Figure 7)

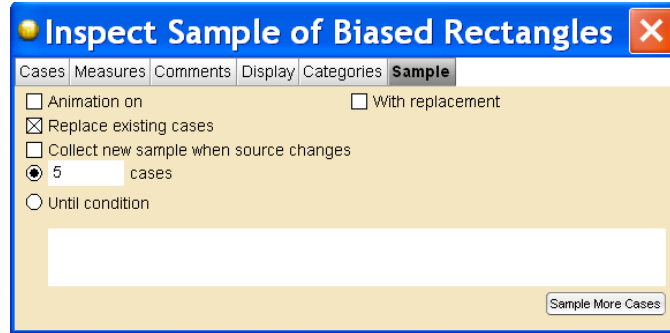


Figure 7

- 10.) Drag a new Case Table off the shelf for **Sample of Rectangles**. This will show a random sample of 5 cases from the **Rectangles** collection. Note that if the sample collection is not selected, this will not work. (See Figure 8)

Sample of Biased Rectangles				
	Number	length	width	Area
1	85	4	2	8
2	89	2	6	12
3	88	2	2	4
4	100	2	6	12
5	57	3	6	18

Figure 8

- 11.) Drag a new graph off the shelf; create a histogram of area. (See Figure 9)

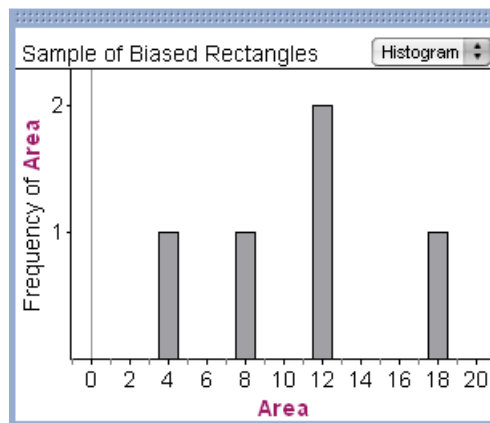


Figure 9

- 12.) Choose Graph > Plot Value; Enter `mean ( )` and press OK to close the formula editor. The mean appears as a vertical line in the graph. Repeat for `median ( )`. (See Figure 10)

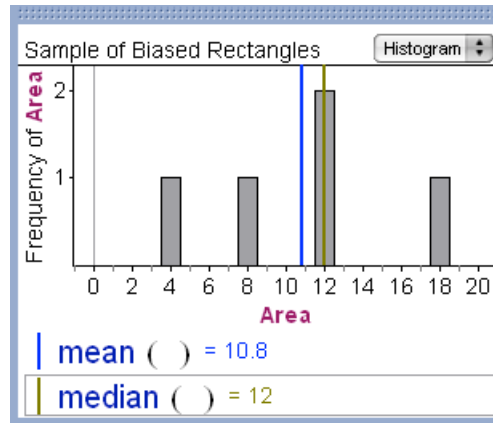


Figure 10

- 13.) Double click on the Collection **Sample of Rectangles** to get the Inspector. Click on **Measures**; type in **MeanArea**. Click on the 'Formula' cell for the **MeanArea** and enter `mean (area)`. (See Figure 11)

Measure	Value	Formula
MeanArea	8.8	<code>mean (area)</code>
<new>		

Figure 11

- 14.) Select the collection **Sample of Rectangles**; choose Collection > Collect Measures. A new collection, **Measures from Sample of Rectangles** will appear.
- 15.) Drag a Case Table from the shelf for the collection **Measures from a Sample of Rectangles**. It will show 5 means, each of which is the result of selecting 5 random rectangles, which was done 5 different times. (See Figure 12a)

- 16.) Double click on the collection Measures from Sample of Rectangles to get the Inspector. Deselect 'Animation' and enter '100' for measures; click 'Collect More Measures'. Your Case Table should now have 100 entries. (See Figure 12b)

Measures from Sample of Biased Rectangles		
	MeanArea	<new>
1	7.2	
2	6.4	
3	6.2	
4	8.2	
5	7.6	

Figure 12a

Measures from Sample of Biased Rectangles		
	MeanArea	<new>
93	5	
94	6.2	
95	4.6	
96	8	
97	3.6	
98	4.4	
99	9	
100	8.8	

Figure 12b

- 17.) Drag a new graph from the shelf; create a histogram of Mean Area. Use the Graph > Plot Value; enter mean ( ). Repeat for median ( ). (See Figure 13)

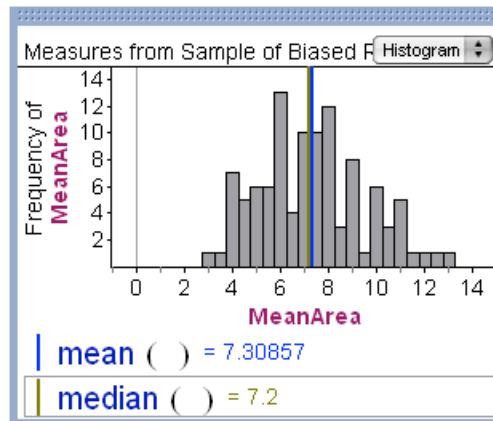


Figure 13

- 18.) Compare the graphs and their properties to the original data. Students should note any differences in spread, shape, mean, median, and mode. There is a tendency for people to select a sample of rectangles with large area, thus causing bias. Was there evidence of this bias in your original sample? How do you know?

- Extension:** Collect more measures (1000) and plot the Normal Curve on the Histogram. To accomplish this:
- With the graph selected, choose Graph > Scale > Density
  - Choose Graph > Plot Function
  - Enter `normalDensity(x,mean(),s())`. (Figure 14)

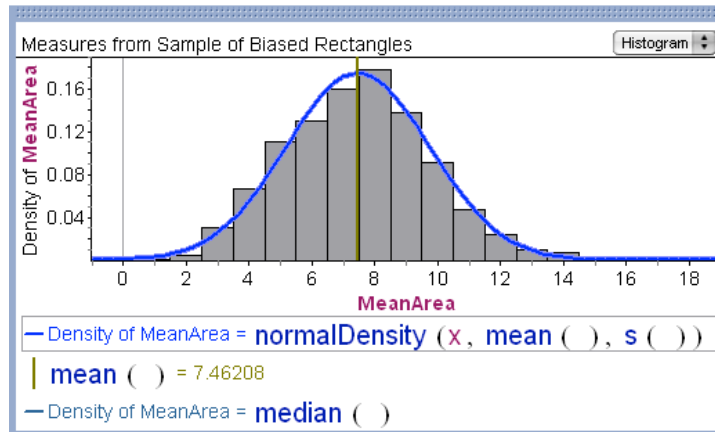


Figure 14