What is the Weird Mystery Stick?

MAT 375

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Abstract

A debate for standard measurement in ancient times gave rise for the science to come up with a way to agree on measurements. An example of this is the ruler, which is also known as a rule. This attempt of standardized measurement is based on the human anatomy, such as the foot and the hand. By the 17th century, rulers were marked in inches, with smaller, fractional lengths coming later. This report will be analysing the numbers on this lumbermen stick, how it can be used, and different elements it can measure.

1 Data

1.1 Numbers on the Stick

There were originally eight sets of numbers: three sets on the front of the stick, three sets on the back of the stick, and one set on each of the sides of the stick. A "set" of numbers (in relation to this stick) is defined as a series of numbers on one side and in one orientation (i.e. - front side bottom) of the stick. Each set has a different set of numbers.

Example:

We were able to deduce that the middle set of larger numbers on each side aligned perfectly with a standard yardstick (in inches), so we were able to model other numbers based on these inch

markings. The numbers were placed in an Excel spreadsheet that would later be imported into an R script to finalize models.

	inches	Side 1	Side 1 Bott	Side 2 Top	Side 2 Bott	Half Inches	Side 1 Mid	Side 1 Mid	Side 2 Mid	Side 2 Middle Bottom	
1	inches	Side 1	Side 1 Bott	Side 2 Top	Side 2 Bott	Half Inches	Side 1 Mid	Side 1 Mid	Side 2 Mid	Side 2 Middle Bottom	
2	1					1.5					
3	2					2.5					
4	3					3.5					
5	4	5			4	4.5	7	8	5	6	
6	5	9			8	5.5	12		8	10	
7	6	15			13	6.5	18	21	13	15	
8	7	22			19	7.5	26	29		22	
9	8	30			26	8.5	34	38	25	30	
10	9	39			34	9.5	45	51	32	38	
11	10	50			43	10.5	56	64	40	48	
12	11	62			53	11.5	69	79	49		
13	12	76			65	12.5	83	95	59	71	
14	13	90			77	13.5	98	112	70	84	
15	14	106			91	14.5	115	131	82	98	
16	15	123			106	15.5	132	151	95	114	
17	16	142				16.5	152	173	108	130	
18	17	162			139	17.5	172	197		147	
19	18	183				18.5	194	221	138	168	
20	19	205			176	19.5	217	248	155	186	
21	20	229			196	20.5					
22	21	254			217	21.5					
23	22	280			240	22.5					
24	23	307			263	23.5					
25	24	336			288	24.5					

The Excel spreadsheet.

1.2   Missing/Unreadable Numbers

There were some limitations, however, to the dataset we created. For example, certain numbers were unreadable. There were a few instances in which certain numbers needed to be omitted due to a lack of knowing what the true number was ("guessing" at the number may affect models).

Example of omission:

| |
|---|
| 91 |
| 106 |
| |
| 139 |
| |
| 176 |
| 196 |

One set of numbers from the front side of the stick was omitted due to lack of clarity with most of the numbers. In addition, the numbers on the side were difficult to model without actually

having the stick because there was no true way of knowing which markings lined up with inches or half-inches. These numbers were omitted from modeling as well.

2 Methods

2.1 Models

After generating some basic graphs of inches versus other markings in R (see below), it was clear that some exponential relationship was present.
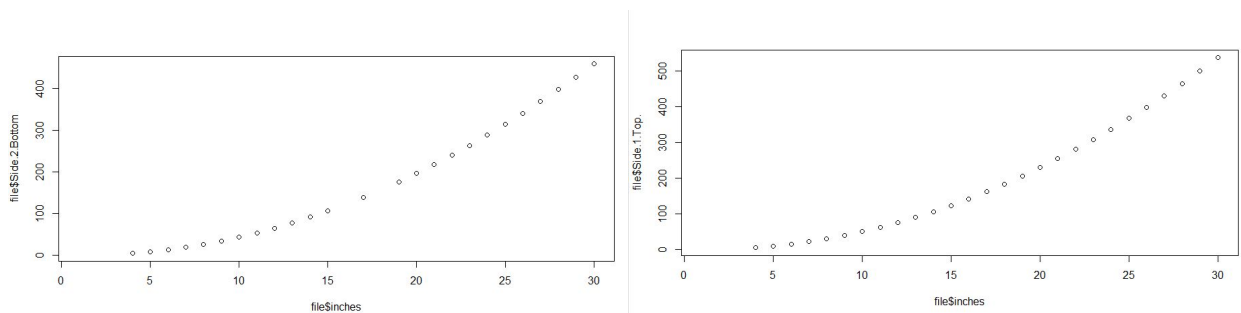
After some experimentation, it was discovered that a logarithmic transformation of both variables resulted in a linear model. From here, linear models were formed in R.

Side 1 Top Numbers

```
Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)       -1.35793    0.05232  -25.96   <2e-16 ***
log(file$inches)   2.26439    0.01898  119.29   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.05512 on 25 degrees of freedom
  (3 observations deleted due to missingness)
Multiple R-squared:  0.9982,    Adjusted R-squared:  0.9982
F-statistic: 1.423e+04 on 1 and 25 DF,  p-value: < 2.2e-16
```

Side 2 Bottom Numbers

```
Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)       -1.51741    0.06317  -24.02   <2e-16 ***
log(file$inches)   2.26572    0.02297   98.64   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.06653 on 23 degrees of freedom
  (5 observations deleted due to missingness)
Multiple R-squared:  0.9976,    Adjusted R-squared:  0.9975
F-statistic:  9729 on 1 and 23 DF,  p-value: < 2.2e-16
```

Both models have quite large R-squared values, which allows the possibility that these models do fit the data well. When transformed to exponential functions, these equations arise:

$$\text{Side 1 Top} = 0.257193 * e^{2.26439 inches}$$

$$\text{Side 2 Bottom} = 0.219279 * e^{2.26572 inches}$$

These equations seem quite similar, but this may also be because the numerical values in each set are quite similar.

2.2 Online Findings

Our main objective when we received the stick was to find out what it was used for. The easiest way to find where the stick came from and what it was used for was to use the power of the internet. We found a company printed on the stick which, despite being difficult to read, we found to be "The Lufkin Rule Co.," which is a company in Ontario, Canada. After looking up "lufkin rule co stick," we found images of sticks similar to ours, and descriptions told us that it was a log ruler.

Our next issue: we had no idea what a log ruler actually was. After some more internet exploring, we were able to find out that log rulers are used to "measure both the diameter and the height of the log being cut" [1]. Using the diameter and height found by the stick, you are able to use various logging rules (for example, the International, Doyle, or Scribner Log Rule) to estimate how many board feet (a piece of wood that is one inch thick by one inch long by one inch wide) can be cut out of the tree.

3 Conclusion

3.1 What does the Stick do/How is it Used?

We found out that the stick is used to measure the diameter and height of trees. Given the diameter and height, a person can use various logging rules to estimate the number of board feet that could be cut from the tree.

To use the stick to measure diameter, hold the stick horizontally at an arm's length away from you at chest level. Then, line up the side where the measurements start to the left side of the tree. Then, look at the right side of the tree and where the end of the tree meets the ruler. The number in the center of the stick is your diameter in inches. To use the stick to measure the height of the tree, first stand 66 feet away from the tree. Then, hold the stick at arm's length, vertically, with the edge facing you. The stick's markings on the edges indicate the height of the tree in feet.

3.2 How can we Recreate any of the Markings?

Recreating markings on the stick is quite simple with the models given. Take the models and input the diameter in inches, and recreating a marking is complete - easy when you have the models to do so!

4 Citations

[1] R. Preston. How to Read a Doyle Log Scale Rule,

https://www.ehow.com/how_6038625_read-doyle-log-scale-rule.html

[2] The Greenwood Project. Tips and Techniques log scale stick,

https://www.youtube.com/watch?v=RowgHxfsC9s