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MAT 375 Report on the *Mystery Stick*

When we first looked at this tool, it was very intimidating trying to figure out what the purpose of it was with so many numbers that seemed random. Luckily, we were able to examine the photos that were taken of the stick and looked at the measurements/writings on the stick. We noticed the company was from Berry, Canada and it seemed to be a tool of some sort by a company called Lufkin. Then we just looked up "Lufkin tool company wooden tools" and a stick-like tool popped up that looked very similar to the one shown in class, here is the picture:

We noticed that the name of this tool is called a "Log Rule" or a "Log Lumber Stick". We then looked up other log rules and log lumber sticks and found this picture...

This is what a modern day log rule/log lumber stick looks like. We then became confident that the tool shown in class was a log rule and was considered an antique log rule. But now comes the question, "What is the practicality of this tool and how is the tool used?"

The use of this tool according to Brian Bond, Associate Professor in Forestry, Wildlife and Fisheries claims that the log rule is used to "... determine the quantity of wood and is done primarily to determine the value of individual logs." With that being said, we learned that it can be difficult and time consuming to even read the log rule, but benefits include being easy to carry and not extremely expensive compared to other options. The stick is primarily used to measure the diameter of standing trees in inches, their height in 16-foot logs, and the volume they contain in board feet or cords. It can also be used to measure diameters of logs and estimate their volume. Additionally, the stick has an angle gauge that can be used to determine basal area—a measurement of tree density or crowding.

Based on further research, we learned that one of the specific rules used for this lumber stick is called the Doyle Log Rule. Edward Doyle developed this rule prior to 1850. This rule estimates the volume based on log length, diameter, slabs, edgings, shrinkage and production of sawdust. The allowance for slabs and edgings is too large for small logs and is too small for large logs. Also, the rule allows for only a 4.5 percent reduction of log volume for sawdust and shrinkage where most rules allow between 10-30 percent.

The formula used in estimating lumber volumes using the Doyle rule is

$$((D-4)^2*L)/16 = \text{Log Volume (bd. ft.)}$$

where D is the diameter inside the bark measured in inches at the small end of the log and L is the nominal log length measured in feet.

Another specific rule that can be used is called the Scribner Log Rule. J. M. Scribner developed the Scribner log rule in 1846. This rule is based on a series of diagrams outlining the cutting pattern for 1-inch lumber for each diameter and length class with a 1/4-inch al- lowance for saw kerf.

The formula used in estimating lumber volumes using the Scribner Log Rule is

$$(.79D^2 - 2D - 4)(L/16) = \text{Log Volume (bd. ft.)}$$

where D is the diameter inside the bark measured in inches at the small end of the log and L is the nominal log length measured in feet.

However, the formula we are interested in for our specific ruler would be the Ontario Rule, based on the fact that our ruler has the word Ontario on it. The formula used to determine the volume of a log takes into consideration the allowances for kerf and slab lost during the process of cutting the wood. The formula to be used in estimating lumber volumes using the Ontario Rule is

$$(0.55D^2 - 1.2D) * L/12 = \text{Lumber Volume (bd. ft.)}$$

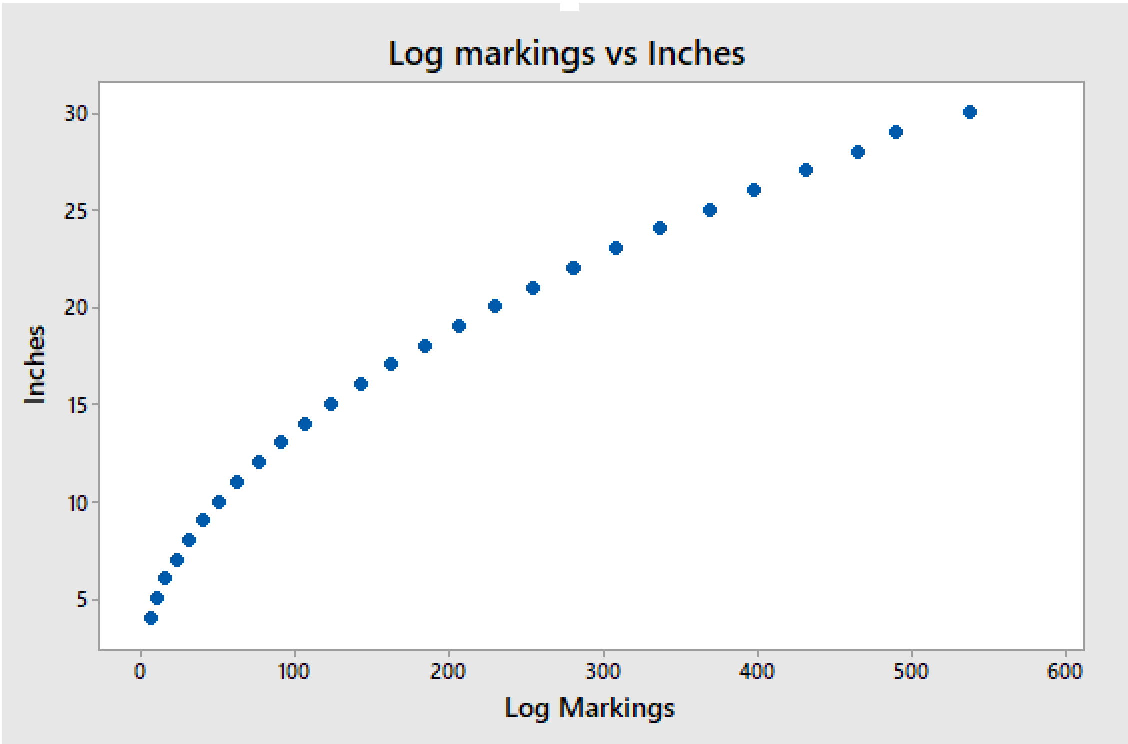
Based on the information above, time to answer "what do the numbers mean and how do you measure the tree with the actual tool?" Based on this wonderful youtube video, [How to Measure Logs for board feet and weight], he explains very well how to use a Lufkin Log Rule. The summary of the video is:

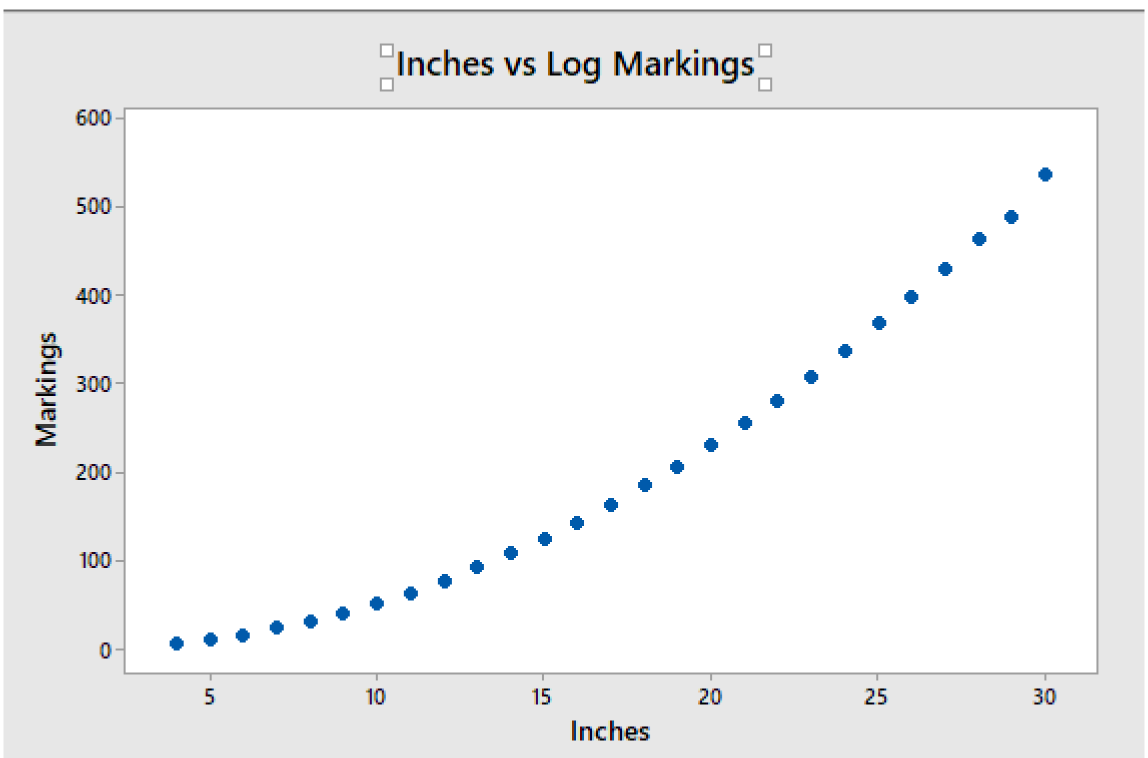
1.) Look at how long your cut lumber is in height. The reason this matters is because this is how many board feet you will obtain and if you look on the stick you will see different measurements for how much wood you will obtain from the length/diameter of your cut lumber/.
2.) With already cut lumber, measure the diameter of the tree by measuring from "Inside the bark". This means the part where the inside of the tree is shown.
3.) With this data you can see based on the diameter and the length of the log how many board feet this will give you. In the example video his cut wood length was 10ft and his diameter was 24in and this corresponded to 250 board feet (bd. ft). If your log length is larger, then this means you would have more board feet of wood.

We can verify the videos use of the Doyle log rule by using the exact same numbers he did and compare with the number of board feet he ended up retrieving based on his measurements. He claimed that he found that the trees diameter was 24 feet and the length was 10 ft. This should equal based on the equation above: ((24-4)^2 * L)/16 = (400 * 10)/16 = 4,000/16 = 250 board feet! Would you look at that, the data matches perfectly with the equation and what the Doyle log rule said he should get for his number of board feet which was 250 board feet.

Useful Websites for information/sources we used:

1.) https://www.idl.idaho.gov/forestry/contest/1.0-fc-manual-logscaling2016.pdf
2.) How to Read a Doyle Log Scale Rule
3.) Understanding Log Scales and Log Rules
4.) Description of Log Rules Doyle, Scribner and International
5.) How to Read a Doyle Log Scale Rule


Log markings vs Inches
Inches
Log Markings
30
25
20
15
10
5
0
100
200
300
400
500
600


Inches vs Log Markings
Markings
Inches
600
500
400
300
200
100
0
5
10
15
20
25
30

Polynomial Regression Analysis: y versus x

The regression equation is

$y = - 1.347 - 1.138 x + 0.6321 x^2$

Model Summary

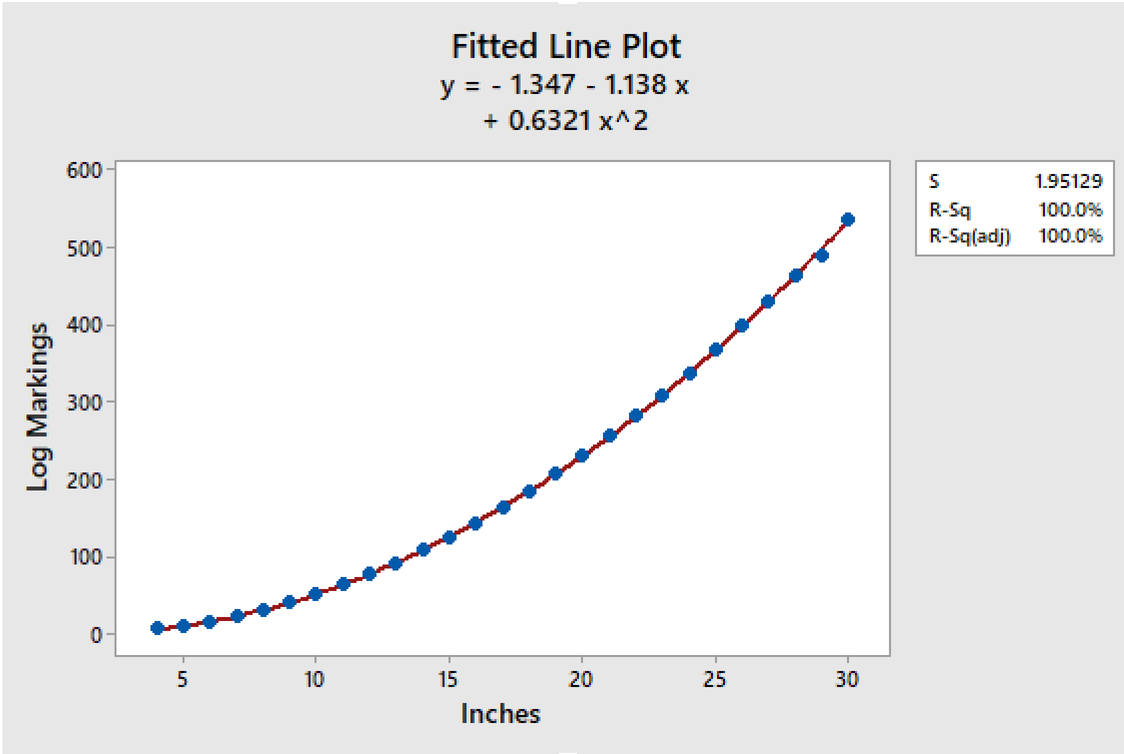
S	R-sq	R-sq(adj)
1.95129	99.99%	99.99%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	2	710197	355098	93262.32	0.000
Error	24	91	4		
Total	26	710288			

Sequential Analysis of Variance

Source	DF	SS	F	P
Linear	1	678565	534.75	0.000
Quadratic	1	31632	8307.75	0.000


Fitted Line Plot
y = - 1.347 - 1.138 x
+ 0.6321 x^2
S 1.95129
R-Sq 100.0%
R-Sq(adj) 100.0%
Log Markings
600
500
400
300
200
100
0
5
10
15
20
25
30
Inches