

## CS 4321 Project – Problem Statement

The system you develop has three major features:

- Specify how to optimally cut logs into lumber taking into account economic variables.
- Maintain an inventory of lumber that has been cut.
- Allow customers to purchase lumber.

Logs have previously been cut into rectangular solids. Thus, a log can be described by its height, width and length which are all measured in feet. The system provides for the input of geometric data for a batch of logs. The input is a text file in this exact format:

```
height width length
height width length
...
```

A piece of lumber that you are probably familiar with is a “two-by-four”, which means a 2” height, 4”width, and length that can be 8’, 10’, 12’, or others. Thus, you want to determine how to cut a log into lumber. For example, a log may be cut into 12 2x6’s and 6 2x4’s, all 10 feet long. That same log may also be able to be cut into 24 2x4’s. Logs can be cut into lumber which has any rectangular solid shape with one inch precision. Different sizes/dimensions of lumber have different values. For example, a 2x4 10 feet long might be worth \$3, while a 2x6 10 feet long might be worth \$5. The system provides for the input of economic variables that describe the allowable dimensions and their value. The input is a text file in this exact format:

```
height width length value
height width length value
...
value_of_scrap
```

where height, width, and length are provided in inches and value is in dollars. After a log is cut, in general, there will be lumber left over which is called scrap. However, scrap has a value (dollars) per volume (cubic feet) as it can be chipped to produce wood fiber for making paper products, among other uses.

The system will accept these two input files mentioned above and decide how to cut the logs into lumber to maximize the total value and produce a report that shows the breakdown of number of each size cut, the total value of each size, and the total value of the all the lumber cut. This report is displayed to the user and can be saved. This report is in this format:

```
quantity height width length total_value
quantity height width length total_value
...
volume_of_scrap value_of_scrap
total_value
```

As lumber is cut it is accumulated in inventory and can be purchased at the current value (in the absence of a current value, the most recent value is used). For example, a batch of logs is processed under these economic variables:

2.0 4.0 96.0 2.0	i.e. 2x4's 8' long are valued at \$2
2.0 4.0 120.0 3.5	i.e. 2x4's 10' long are valued at \$3.50
1.0	i.e. Scrap is valued at \$1 per cubic foot

And suppose the output is 100 boards that are 2x4x96 and 150 boards that are 2x4x120 (for simplicity we assume no scrap in this example), which is the current inventory. If a customer purchases 60 boards that are 2x4x96 then she pays:  $60 * \$2 = \$120$  and there are 40 of these boards left in inventory. Now, suppose another batch of logs is processed under these economic variables:

2.0 4.0 96.0 1.0	i.e 2x4's 8' long are now valued at \$1.00
1.0 8.0 120.0 5.0	
0.9	

Suppose the output is 20 boards that are 2x4x96 and 100 that are 1x8x120. Thus, inventory is now:

Size	Quantity	Price
2x4x96	80	\$1.00
2x4x120	150	\$3.50
1x8x120	100	\$5.00
Scrap	n/a	0.9

Notice that 2x4's 8' long are now priced at \$1, 2x4's 10' long remain priced at \$3.50, and scrap is now priced at \$0.90 per cubic foot.

All orders for lumber are shipped via trucks each of which have a capacity of 10,000 lbs. of lumber to a fixed number of cities. The weight of lumber is calculated at 38 lbs./ft<sup>3</sup>. All deliveries originate in Valdosta and are delivered to a particular city (not an address, to make it a bit simpler). Delivery is free to any of these locations: Quitman, Hahira, Adel, Lakeland, Statenville, Lake Park, Jasper, and Madison. Delivery to any of these locations incurs a cost that is a (changeable) dollar amount per mile per truck: Tifton, Nashville, Homerville, Pearson, Douglass, Waycross, Fargo, Lake City Monticello, Tallahassee, Thomasville, and Jacksonville. A bill of sale is produced which shows a breakdown of the lumber purchased, by size, unit and total cost per size, total lumber cost, delivery charge, and total cost. This report can be saved.

An order can also be inputted via a text file in the following format:

```

height width length quantity
height width length quantity
...
volume_of_scrap
delivery_destination

```

The order should be filled as completely as possible, depending on inventory. If there is inadequate inventory then appropriate notes should be made on the bill of sale.

The system can produce a master inventory report that shows all sizes of lumber currently available, quantity on hand, unit value, total value by size, and total value of all inventory. This report can be saved and has the following format:

Size	Quantity	Unit Price	Total Value
2x4x96	80	\$1.00	\$80.00
2x4x120	100	\$4.00	\$400.00
...	...	...	...
Scrap	26 ft <sup>3</sup>	\$0.50 ft <sup>3</sup>	\$13.00
Total Value: \$xxxx.xx			