# MECE 4606 DIGITAL MANUFACTURING

### Laser Cut Box

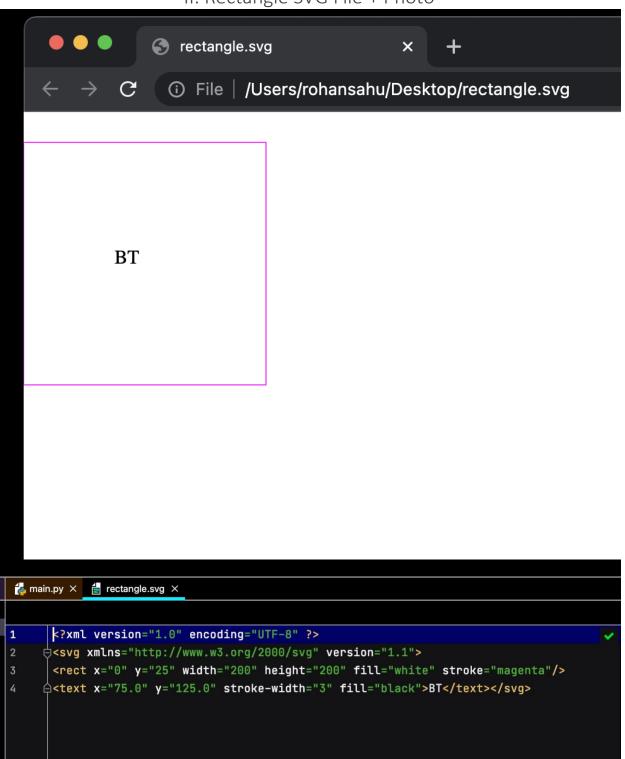
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February 12th: 11:59 PM

96 Grace Hours Before Submission, +24 Hours Gained, 120 Hours After Submission



# II. Rectangle SVG File + Photo





## III. Description of Software

The software starts by requesting input for all information about the box from the user (length, width, height, material thickness, top text, front text, and the number of dovetails). It then loops from 0 to 5 to create each side of the cube, saving the current position as x, y for each step and updating as necessary.

The squares themselves for the sides are made through a method called make\_square() which takes input parameters regarding which type of square it is. make\_square() differentiates between type 1 (front and sides) and type 2 (top and bottom) squares. The way our dovetails work, the front and sides have identical orientation of dovetails (3 in and 1 out). For the top and

bottom, all dovetails face out. Additionally, the top is a special case, as it functions as a lid by removing the holes for the fasteners. The program accounts for this by an additional parameter called top.

The program splits the process of making the dovetails of each square into x and y with directional inputs through a parameter called sign (valued 1 or -1). Additionally, by including make\_dovetails\_x and make\_dovetails\_y, it allows us to call make\_dovetail\_x or make\_dovetail\_y multiple times for smaller lengths depending on the number of dovetails requested by the user.

For making the dovetails themselves, it takes the current position as an input, and writes in xml to construct a dovetail which splits the input width into 3 sections. On the first step of making the dovetail, if the dovetail is on the bottom (sign = -1), then it makes rectangles for fasteners using the following parameters:

```
X = x - (1 / 2) * wid - screw_rad / 2 - 2
Y = y - screw_len, screw_rad + 4
Width = screw_rad + 4
Height = screw_len - material_thickness
```

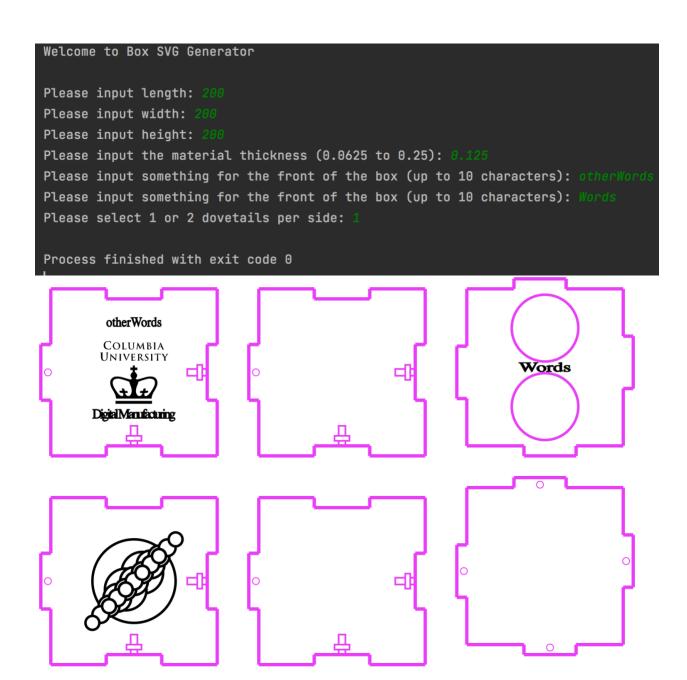
In which x, y are the current position saved by the program; screw\_rad and screw\_len are global constants for the dimensions of the screw; -2 and +4 are included as tolerances. The other fastener cuts have similar calculations.

The program includes the Columbia Logo by reading a .svg file of the logo from the same file directory, saving the file as a string, outputting that string into the .svg output file for the program, and adding a <g transform> script to move the logo and scale it. Some formatting changes needed to be made to the logo file in order for this to work.

Further description can be found in the in-line comments/documentation included in the code.

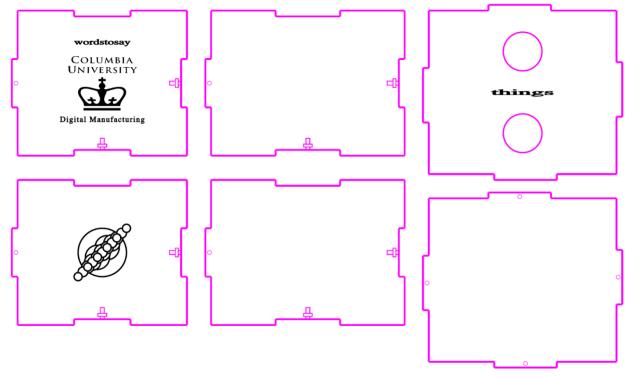
### IV. Examples of input and output

```
Welcome to Box SVG Generator
Please input length: 300
Please input width: 200
Please input height: 200
Please input the material thickness (0.0625 to 0.25): 0.0625
Please input something for the front of the box (up to 10 characters): stuff
Please input something for the front of the box (up to 10 characters): things
Please select 1 or 2 dovetails per side: 2
Process finished with exit code 0
      stuff
     COLUMBIA
UNIVERSITY
                                                               things
    Digital Manufacturing
```



```
Please input length: 4
You entered an invalid length. Please input between 200 and 400: 400
Please input width: 350
Please input height: 300
Please input the material thickness (0.0625 to 0.25): 0.125
Please input something for the front of the box (up to 10 characters): wordstosay
Please input something for the front of the box (up to 10 characters): things
Please select 1 or 2 dovetails per side: 1

Process finished with exit code 0
```



```
Welcome to Box SVG Generator

Please input length: 200

Please input width: 300

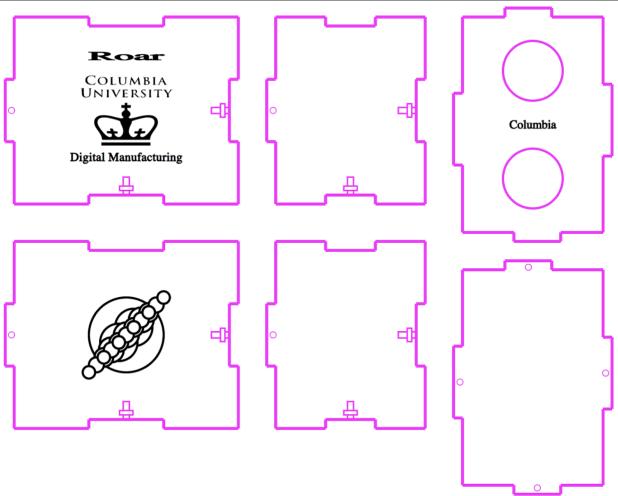
Please input height: 250

Please input the material thickness (0.0625 to 0.25): 0.125

Please input something for the front of the box (up to 10 characters): Roar

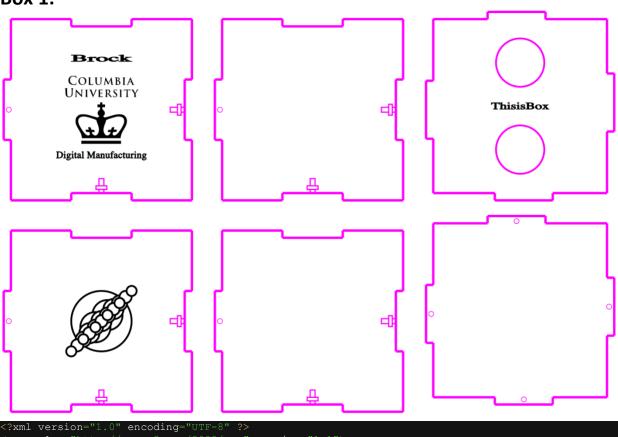
Please input something for the front of the box (up to 10 characters): Columbia

Please select 1 or 2 dovetails per side: 1
```



#### V. Print-out of SVGs and Boxes

#### **Box 1:**



```
<xml version="1.0" encoding="UTF-8" ?>
<svg xmlns="http://www.w3.org/2000/svg" version="1.1">
cline x1="25" y1="25" x2="125.0" y2="25" stroke="magenta" stroke-width="4" />
cline x1="125.0" y1="25" x2="125.0" y2="37.0" stroke="magenta" stroke-width="4" />
cline x1="125.0" y1="37.0" x2="225.0" y2="37.0" stroke="magenta" stroke-width="4" />
cline x1="125.0" y1="37.0" x2="225.0" y2="25.0" stroke="magenta" stroke-width="4" />
cline x1="225.0" y1="35.0" x2="325.0" y2="25.0" stroke="magenta" stroke-width="4" />
cline x1="325.0" y1="25.0" x2="325.0" y2="25.0" stroke="magenta" stroke-width="4" />
crect x="389" y="170.936" width="24.0" height="18" fill="White" stroke="magenta" stroke-width="2" />

crect x="301.0" y="166.0" width="6" height="18" fill="White" stroke="magenta" stroke-width="2" />

cline x1="325" y1="125.0" x2="313.0" y2="125.0" stroke="magenta" stroke-width="4" />

cline x1="313.0" y1="125.0" x2="313.0" y2="25.0" stroke="magenta" stroke-width="4" />

cline x1="313.0" y1="125.0" x2="313.0" y2="25.0" stroke="magenta" stroke-width="4" />

cline x1="313.0" y1="225.0" x2="325.0" y2="325.0" stroke="magenta" stroke-width="4" />

cline x1="325" y1="325" x2="225.0" y2="325.0" stroke="magenta" stroke-width="4" />

cline x1="325" y1="325" x2="225.0" y2="325.0" stroke="magenta" stroke-width="4" />

cline x1="325.0" y1="325" x2="225.0" y2="325.0" stroke="magenta" stroke-width="4" />

cline x1="25.0" y1="313.0" x2="125.0" y2="313.0" stroke="magenta" stroke-width="4" />

cline x1="25.0" y1="313.0" x2="125.0" y2="313.0" stroke="magenta" stroke-width="4" />

cline x1="25.0" y1="313.0" x2="125.0" y2="325.0" stroke="magenta" stroke-width="4" />

cline x1="25.0" y1="313.0" x2="25.0" y2="313.0" stroke="magenta" stroke-width="4" />

cline x1="25.0" y1="313.0" x2="25.0" y2="313.0" stroke="magenta" stroke-width="4" />

cline x1="25.0
```

```
<path d="M1350 4274 c-160 -69 -166 -304 -9 -384 50 -26 149 -27 205 -1 122
55 162 230 77 332 -15 18 -45 40 -68 50 -50 23 -156 24 -205 3z m150 -27 c61</pre>
<path d="M2715 4258 c-3 -18 -17 -107 -31 -198 -14 -90 -26 -165 -27 -166 -1</pre>
<p
```

```
<path d="M2430 2850 10 -60 -75 0 -75 0 0 -75 0 -74 73 -3 72 -3 3 -54 c3 -54</pre>
stroke-width="1" textLength="100.0">Brock</text><circle cx="175.0" cy="525.0" r="50.0"
fill="white" stroke="black" stroke-width="3"/>
<circle cx="185.0" cy="515.0" r="25.0" fill="white" stroke="black" stroke-width="3"/>
<circle cx="195.0" cy="505.0" r="16.6666666666668" fill="white" stroke="black" stroke-
width="3"/>
<circle cx="205.0" cy="495.0" r="12.5" fill="white" stroke="black" stroke-width="3"/>
<circle cx="215.0" cy="485.0" r="10.0" fill="white" stroke="black" stroke-width="3"/>
<circle cx="225.0" cy="475.0" r="8.33333333333334" fill="white" stroke="black" stroke-</pre>
width="3"/>
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<circle cx="205.0" cy="495.0" r="8.3333333333333334" fill="white" stroke="black" stroke-</pre>
width="3"/>
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circle cx="185.0" cy="515.0" r="8.3333333333334" fill="white" stroke="black" stroke-
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width="3"/>
circle cx="175.0" cy="525.0" r="16.66666666666668" fill="white" stroke="black" stroke-
width="3"/>
<circle cx="185.0" cy="515.0" r="12.5" fill="white" stroke="black" stroke-width="3"/>
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<circle cx="205.0" cy="495.0" r="8.333333333333334" fill="white" stroke="black" stroke-</pre>
width="3"/>
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```

```
525.0" r="10.0" fill="white" stroke="black" stroke-width="
<circle cx="185.0" cy="515.0" r="8.3333333333334" fill="white" stroke="black" stroke-</pre>
width="3"/>
<circle cx="165.0" cy="535.0" r="8.3333333333334" fill="white" stroke="black" stroke-</pre>
circle cx="165.0" cy="535.0" r="12.5" fill="white" stroke="black" stroke-width="3"/>
circle cx="175.0" cy="525.0" r="10.0" fill="white" stroke="black" stroke-width="3"/>
<circle cx="185.0" cy="515.0" r="8.33333333333334" fill="white" stroke="black" stroke-</pre>
width="3"/>
circle cx="165.0" cy="535.0" r="8.33333333333334" fill="white" stroke="black" stroke-
width="3"/>
 circle cx="165.0" cy="535.0" r="8.3333333333334" fill="white" stroke="black" stroke-
width="3"/>
<circle cx="145.0" cy="555.0" r="8.3333333333334" fill="white" stroke="black" stroke-</pre>
width="3"/>
circle cx="165.0" cy="535.0" r="25.0" fill="white" stroke="black" stroke-width="3"/>
circle cx="175.0" cy="525.0" r="16.66666666666668" fill="white" stroke="black" stroke-
circle cx="185.0" cy="515.0" r="12.5" fill="white" stroke="black" stroke-width="3"/>
circle cx="195.0" cy="505.0" r="10.0" fill="white" stroke="black" stroke-width="3"/>
circle cx="205.0" cy="495.0" r="8.333333333333333333334" fill="white" stroke="black" stroke-width="3"/>
width="3"/>
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width="3"/>
<circle cx="175.0" cy="525.0" r="10.0" fill="white" stroke="black" stroke-width="3"/>
 <circle cx="165.0" cy="535.0" r="8.3333333333334" fill="white" stroke="black" stroke-</pre>
width="3"/>
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circle cx="185.0" cy="515.0" r="8.333333333333334" fill="white" stroke="black" stroke-
width="3"/>
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width="3"/>
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circle cx="165.0" cy="535.0" r="8.333333333333334" fill="white" stroke="black" stroke-
width="3"/>
width="3"/>
circle cx="155.0" cy="545.0" r="16.66666666666668" fill="white" stroke="black" stroke-
width="3"/>
circle cx="165.0" cy="535.0" r="12.5" fill="white" stroke="black" stroke-width="3"/>
circle cx="175.0" cy="525.0" r="10.0" fill="white" stroke="black" stroke-width="3"/>
circle cx="185.0" cy="515.0" r="8.3333333333333334" fill="white" stroke="black" stroke-
<circle cx="165.0" cy="535.0" r="8.33333333333334" fill="white" stroke="black" stroke-</pre>
width="3"/>
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width="3"/>
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circle cx="155.0" cy="545.0" r="10.0" fill="white" stroke="black" stroke-width="3"/>
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width="3"/>
circle cx="145.0" cy="555.0" r="8.3333333333334" fill="white" stroke="black" stroke-
width="3"/>
circle cx="135.0" cy="565.0" r="10.0" fill="white" stroke="black" stroke-width="3"/>
circle cx="125.0" cy="575.0" r="8.3333333333334" fill="white" stroke="black" stroke-
width="3"/>
vidtn="3"/>
x1="25" y1="375" x2="125.0" y2="375" stroke="magenta" stroke-width="4" />
x1="125.0" y1="375" x2="125.0" y2="387.0" stroke="magenta" stroke-width="4" />
x1="125.0" y1="387.0" x2="225.0" y2="387.0" stroke="magenta" stroke-width="4" />
x1="225.0" y1="387.0" x2="225.0" y2="375.0" stroke="magenta" stroke-width="4" />
x1="225.0" y1="375.0" x2="325.0" y2="375.0" stroke="magenta" stroke-width="4" />
x1="325" y1="375" x2="325" y2="475.0" stroke="magenta" stroke-width="4" />
```

```
width="24.0" height="8.128" fill="White" stroke="magenta"
width="2" />
  	imesrect x="301.0" y="516.0" width="6" height="18" fill="White" stroke="magenta" stroke-width="2" />
<rect x="301.0" y="516.0" width="6" height="18" fill="White" stroke="magenta" stroke-width="
<li>x1="325" y1="475.0" x2="313.0" y2="475.0" stroke="magenta" stroke-width="4" />
x1="313.0" y1="475.0" x2="313.0" y2="575.0" stroke="magenta" stroke-width="4" />
x1="313.0" y1="575.0" x2="325.0" y2="575.0" stroke="magenta" stroke-width="4" />
x1="325.0" y1="575.0" x2="325.0" y2="675.0" stroke="magenta" stroke-width="4" />
x1="325" y1="675" x2="225.0" y2="675" stroke="magenta" stroke-width="4" />

width="2" />
<rect x="166.0" y="651.0" width="18" height="6" fill="White" stroke="magenta" stroke-width="2" />
x1="225.0" y1="675" x2="225.0" y2="663.0" stroke="magenta" stroke-width="4" />
x1="225.0" y1="663.0" x2="125.0" y2="663.0" stroke="magenta" stroke-width="4" />
x1="125.0" y1="663.0" x2="125.0" y2="675.0" stroke="magenta" stroke-width="4" />
x1="125.0" y1="675.0" x2="25.0" y2="675.0" stroke="magenta" stroke-width="4" />
x1="25" y1="675.0" x2="25" y2="575.0" stroke="magenta" stroke-width="4" />

<pr
<circle cx="21.5" cy="525.0" r="4.128" stroke="magenta" fill="white" stroke-width="I"
<li>x1="25" y1="575.0" x2="13.0" y2="575.0" stroke="magenta" stroke-width="4" />
x1="13.0" y1="575.0" x2="13.0" y2="475.0" stroke="magenta" stroke-width="4" />
x1="13.0" y1="475.0" x2="25.0" y2="475.0" stroke="magenta" stroke-width="4" />
x1="25.0" y1="475.0" x2="25.0" y2="375.0" stroke="magenta" stroke-width="4" />
x1="375" y1="25" x2="475.0" y2="25" stroke="magenta" stroke-width="4" />
x1="475.0" y1="25" x2="475.0" y2="37.0" stroke="magenta" stroke-width="4" />
x1="475.0" y1="37.0" x2="575.0" y2="37.0" stroke="magenta" stroke-width="4" />
x1="575.0" y1="37.0" x2="575.0" y2="25.0" stroke="magenta" stroke-width="4" />
x1="575.0" y1="37.0" x2="675.0" y2="25.0" stroke="magenta" stroke-width="4" />

<rect x="516.0" y="301.0" width="18" height="6" fill="White" stroke="magenta" stroke-width="2" />
 	ext{	iny ect } 	ext{	iny = "516.0"} width="6" height="18" fill="White" stroke="magenta" stroke-width="2" 	ext{	iny = stroke-width="2"}
< x1="675" y1="475.0" x2="663.0" y2="475.0" stroke="magenta" stroke-width="4" />< line x1="663.0" y1="475.0" x2="663.0" y2="575.0" stroke="magenta" stroke-width="4" />< line x1="663.0" y1="575.0" x2="675.0" y2="575.0" stroke="magenta" stroke-width="4" />< line x1="675.0" y1="575.0" x2="675.0" y2="675.0" stroke="magenta" stroke-width="4" />< line x1="675" y1="675" x2="575.0" y2="675" stroke="magenta" stroke-width="4" />< rect x="520.936" y="639" width="8.128" height="24.0" fill="White" stroke="magenta" stroke-</pre>
width="2" />
vidin 2 //-
<rect x="516.0" y="651.0" width="18" height="6" fill="White" stroke="magenta" stroke-width="2" />
x1="575.0" y1="675" x2="575.0" y2="663.0" stroke="magenta" stroke-width="4" />
x1="575.0" y1="663.0" x2="475.0" y2="663.0" stroke="magenta" stroke-width="4" />
x1="475.0" y1="663.0" x2="475.0" y2="675.0" stroke="magenta" stroke-width="4" />

 <1ine x1="475.0" y1="675.0" x2="375.0" y2="675.0" stroke="magenta" stroke-width="4" />
x1ine x1="375" y1="675" x2="375" y2="575.0" stroke="magenta" stroke-width="4" />
x2="375" y1="675" x2="375" y2="575.0" stroke="magenta" stroke-width="4" />

<circle cx="371.5" cy="525.0" r="4.128" stroke="magenta" fill="white" stroke-width="1"/>
```

```
stroke-width=
 %line x1="363.0" y1="575.0" x2="363.0" y2="475.0" stroke="magenta" stroke-width="4" />
%line x1="363.0" y1="475.0" x2="375.0" y2="475.0" stroke="magenta" stroke-width="4" />
x1="363.0" y1="475.0" x2="375.0" y2="475.0" stroke="magenta" stroke-width="4" ,
x1="375.0" y1="475.0" x2="375.0" y2="375.0" stroke="magenta" stroke-width="4" ,
x1="725" y1="25" x2="815.0" y2="25" stroke="magenta" stroke-width="4" />
x1="815.0" y1="25" x2="815.0" y2="13.0" stroke="magenta" stroke-width="4" />
x1="815.0" y1="13.0" x2="911.0" y2="13.0" stroke="magenta" stroke-width="4" />
x1="911.0" y1="13.0" x2="911.0" y2="25.0" stroke="magenta" stroke-width="4" />
x1="911.0" y1="13.0" x2="911.0" y2="25.0" stroke="magenta" stroke-width="4" />

cline x1="911.0" y1="25.0" x2="1013.0" y2="25.0" stroke="magenta" stroke-width="4"
cline x1="1013.0" y1="25" x2="1013.0" y2="15.0" stroke="magenta" stroke-width="4"
cline x1="1013.0" y1="25" x2="1013.0" y2="115.0" stroke="magenta" stroke=width="6"
%line x1="1013.0" y1="313.0" x2="923.0" y2="313.0" stroke="magenta" stroke-width="4" />
cline x1= 1013.0 y1= 313.0 x2= 923.0 y2= 313.0 stroke= magenta stroke=width= 4 //
cline x1="923.0" y1="313.0" x2="923.0" y2="325.0" stroke="magenta" stroke-width="4" />
cline x1="923.0" y1="325.0" x2="827.0" y2="325.0" stroke="magenta" stroke-width="4" />
cline x1="827.0" y1="325.0" x2="827.0" y2="313.0" stroke="magenta" stroke-width="4" />
<1ine x1="725.0" y1="313.0" x2="725.0" y2="223.0" stroke="magenta" stroke-width="4"</pre><1ine x1="725.0" y1="223.0" x2="713.0" y2="223.0" stroke="magenta" stroke-width="4"</pre><1ine x1="725.0" y1="223.0" x2="713.0" y2="127.0" stroke="magenta" stroke-width="4"</pre></pre
 x1="725.0" y1="127.0" x2="725.0" y2="25.0" stroke="magenta" stroke-width="4" />
text x="821.0" y="174.0" lengthAdjust="spacingAndGlyphs" stroke="Black" stroke-width="1"
textLength="96.0">ThisisBox</text><circle cx="869.0" cy="97.0" r="40" fill="white"
stroke="magenta" stroke-width="3"/>
stroke="magenta" stroke-width="3"/>
<circle cx="869.0" cy="241.0" r="40" fill="white" stroke="magenta" stroke-width="3"/>
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<circle cx="863.0" cy="359.5" r="4.128" stroke="magenta" rill="white" stroke-width="1"/>
x1="815.0" y1="363.0" x2="815.0" y2="351.0" stroke="magenta" stroke-width="4" />
x1="815.0" y1="351.0" x2="911.0" y2="351.0" stroke="magenta" stroke-width="4" />
x1="911.0" y1="351.0" x2="1013.0" y2="363.0" stroke="magenta" stroke-width="4" />
x1="911.0" y1="363.0" x2="1013.0" y2="363.0" stroke="magenta" stroke-width="4" />
x1="1013.0" y1="363.0" x2="1013.0" y2="453.0" stroke="magenta" stroke-width="4" />
<circle cx="1016.5" cy="501.0" r="4.128" stroke="magenta" fill="white" stroke-width="1"/>
x1="1013.0" y1="453.0" x2="1025.0" y2="453.0" stroke="magenta" stroke-width="4" />
x1="1013.0" y1="453.0" x2="1025.0" y2="453.0" stroke="magenta" stroke-width="4" />

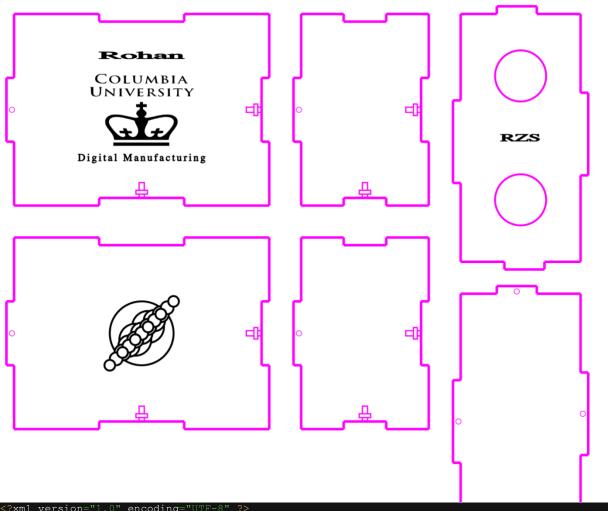
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x1="1025.0" y1="549.0" x2="1013.0" y2="549.0" stroke="magenta" stroke-width="4" />
x1="1013.0" y1="549.0" x2="1013.0" y2="651.0" stroke="magenta" stroke-width="4" />
cline x1="1013.0" y1="651.0" x2="923.0" y2="651.0" stroke="magenta" stroke-width="4" />
circle cx="875.0" cy="654.5" r="4.128" stroke="magenta" fill="white" stroke-width="1"/>
cline x1="923.0" y1="651.0" x2="923.0" y2="663.0" stroke="magenta" stroke-width="4" />
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<1ine x1="827.0" y1="651.0" x2="725.0" y2="651.0" stroke="magenta" stroke=width="4" />
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<1ine x1="713.0" y1="561.0" x2="713.0" y2="465.0" stroke="magenta" stroke-width="4" />
 x1="713.0" y1="465.0" x2="725.0" y2="465.0" stroke="magenta" stroke-width="4" />
```



**Box 2:** 



```
stroke="none">
<path d="M850 4361 c-112 -34 -174 -119 -175 -236 0 -91 30 -154 92 -199 65</pre>
Spath d="M2130 4279 c0 -4 9 -9 19 -12 18 -4 20 -17 23 -148 3 -161 12 -189
187 -226 48 -32 144 -32 192 0 59 39 69 73 69 230 0 130 1 139 20 144 39 10 19 18 -45 18 -63 0 -89 -10 -42 -17 21 -3 22 -7 25 -134 3 -164 -7 -201 -62 -228 -36 -17 -43 -18 -80 -5 -65 22 -76 55 -76 222 0 113 3 139 15 143 32 13 12 19
<path d="M476 3679 131 -9 5 -168 c4 -154 6 -173 29 -218 29 -58 68 -83 141</pre>
-91 106 -11 194 39 217 122 6 22 11 106 11 186 0 152 5 173 45 182 11 3 -20 5 -70 4 -49 0 -80 -2 -67 -4 39 -8 44 -35 40 -207 -4 -189 -13 -215 -86 -243 -39 -15 -49 -15 -85 -2 -76 27 -82 44 -82 257 10 186 25 7 c14 4 -22 7 -80 7
<path d="M1080 3441 c0 -186 -6 -226 -37 -234 -10 -3 16 -5 57 -4 41 0 65 2
53 4 -14 3 -25 13 -27 26 -9 42 -15 257 -8 257 4 0 72 -65 151 -145 78 -80</pre>
83 -95 53 -138 -12 -17 -25 -22 -58 -22 -46 0 -61 11 -83 59 -11 24 -11 23 -12 -22 -1 -43 2 -49 27 -58 36 -15 121 -4 152 19 14 11 30 35 37 55 20 59 2 98 -78 169 -77 69 -91 98 -64 128 35 39 123 18 126 -31 1 -8 5 2 9 21 5 19 5 38 1 42 -12 13 -94 18 -128 7z"/>
```

```
83 72 115 50 428 142 542 160 61 10 180 -1 236 -22z"/>
<path d="M1390 705 10 -85 1095 0 1095 0 0 85 0 85 -1095 0 -1095 0 0 -85z"/>
.
-/g><text x="125.0" y="255.0" stroke="Black" stroke-width="1" textLength="200.0">Digital
Manufacturing</text><text x="158.3333333333333333334" y="95.0" lengthAdjust="spacingAndGlyphs" stroke="Black" stroke-width="1" textLength="133.3333333333334">Rohan</text><circle cx="225.0"
cy="525.0" r="50.0" fill="white" stroke="black" stroke-width="3"/>
circle cx="235.0" cy="515.0" r="25.0" fill="white" stroke="black" stroke-width="3"/>
circle cx="245.0" cy="505.0" r="16.66666666666668" fill="white" stroke="black" stroke-
circle cx="255.0" cy="495.0" r="12.5" fill="white" stroke="black" stroke-width="3"/>
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width="3"/>
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width="3"/>
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circle cx="255.0" cy="495.0" r="8.33333333333334" fill="white" stroke="black" stroke-
width="3"/>
width="3"/>
width="3"/>
width="3"/>
<circle cx="225.0" cy="525.0" r="10.0" fill="white" stroke="black" stroke-width="3"/>
```

```
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width="3"/>
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width="3"/>
circle cx="235.0" cy="515.0" r="12.5" fill="white" stroke="black" stroke-width="3"/>
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width="3"/>
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width="3"/>
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circle cx="225.0" cy="525.0" r="10.0" fill="white" stroke="black" stroke-width="3"/>
circle cx="235.0" cy="515.0" r="8.3333333333334" fill="white" stroke="black" stroke-
circle cx="215.0" cy="535.0" r="8.3333333333334" fill="white" stroke="black" stroke-
width="3"/>
circle cx="205.0" cy="545.0" r="10.0" fill="white" stroke="black" stroke-width="3"/>
Ccircle cx="215.0" cy="535.0" r="8.33333333333334" fill="white" stroke="black" stroke-
width="3"/>
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width="3"/>
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width="3"/>
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stroke-width="4" />
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x1="413.0" y1="475.0" x2="413.0" y2="575.0" stroke="magenta" stroke-width="4" />
x1="413.0" y1="575.0" x2="425.0" y2="575.0" stroke="magenta" stroke-width="4" />

x1="413.0" y1="575.0" x2="425.0" y2="675.0" stroke="magenta" stroke-width="4" />
x1="425.0" y1="575.0" x2="291.66666666666666 y2="675" stroke="magenta" stroke-width="4" />
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stroke-width="2" />
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stroke-width="2" />
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stroke-width="4" />
 x1="291.666666666666663" y1="663.0" x2="158.3333333333333" y2="663.0" stroke="magenta"
stroke-width="4" />
stroke-width="4" />
cline x1="25" y1="675" x2="25" y2="575.0" stroke="magenta" stroke-width="4" />
circle cx="21.5" cy="525.0" r="4.128" stroke="magenta" fill="white" stroke-width="1"/>
<circle cx="21.5" cy="525.0" r="4.128" stroke="magenta" fill="white" stroke-width="1"/>
k1="25" y1="575.0" x2="13.0" y2="575.0" stroke="magenta" stroke-width="4" />
k1="13.0" y1="575.0" x2="13.0" y2="475.0" stroke="magenta" stroke-width="4" />
k1="13.0" y1="475.0" x2="25.0" y2="475.0" stroke="magenta" stroke-width="4" />
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<
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x1="663.0" y1="125.0" x2="663.0" y2="225.0" stroke="magenta" stroke-width="4" />
x1="663.0" y1="255.0" x2="663.0" y2="255.0" stroke="magenta" stroke-width="4" />

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<rect x="566.0" y="301.0" width="18" height="6" fill="White" stroke="magenta" stroke-width="2" />
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 x1="608.3333333333334" y1="313.0" x2="541.6666666666667" y2="313.0" stroke="magenta"
stroke-width="4" />
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stroke-width="4" />
stroke-width="4" />
```

```
<circle cx="471.5" cy="175.0" r="4.128" stroke="magenta" fill="white" stroke-width="1"/>
x1="475" y1="225.0" x2="463.0" y2="225.0" stroke="magenta" stroke-width="4" />
x1="463.0" y1="225.0" x2="463.0" y2="125.0" stroke="magenta" stroke-width="4" />
x1="463.0" y1="125.0" x2="475.0" y2="125.0" stroke="magenta" stroke-width="4" />
x1="463.0" y1="125.0" x2="475.0" y2="125.0" stroke="magenta" stroke-width="4" />
x1="475.0" y1="125.0" x2="475.0" y2="25.0" stroke="magenta" stroke-width="4" />
x1="475" y1="375" x2="541.6666666666666" y2="375" stroke="magenta" stroke-width="4" />

<
width="4" />
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stroke-width="4" />
<line x1="608.3333333333333" y1="387.0" x2="608.33333333333" y2="375.0" stroke="magenta"</pre>
stroke-width="4" />
x1="608.333333333333" y1="375.0" x2="674.999999999999" y2="375.0" stroke="magenta"
stroke-width="4" />
x1="675" y1="375" x2="675" y2="475.0" stroke="magenta" stroke-width="4" />
<rect x="639" y="520.936" width="24.0" height="8.128" fill="White" stroke="magenta" stroke-</pre>
 <rect x="651.0" y="516.0" width="6" height="18" fill="White" stroke="magenta" stroke-width="2" />
x1="675" y1="475.0" x2="663.0" y2="475.0" stroke="magenta" stroke-width="4" />
x1="663.0" y1="475.0" x2="663.0" y2="575.0" stroke="magenta" stroke-width="4" />
x1="663.0" y1="575.0" x2="675.0" y2="575.0" stroke="magenta" stroke-width="4" />

<
<1ine x1="675.0" y1="575.0" x2="675.0" y2="675.0" stroke="magenta" stroke-width="4" />
x1="675" y1="675" x2="608.3333333333334" y2="675" stroke="magenta" stroke-width="4" />
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width="4" />
stroke-width="4" />
stroke-width="4" />
<line x1="541.6666666666667" y1="675.0" x2="475.0000000000000 y2="675.0" stroke="magenta"
stroke-width="4" />
colong x1="475" y1="675" x2="475" y2="575.0" stroke="magenta" stroke-width="4" />
x1="475" y1="675" x2="475" y2="575.0" stroke="magenta" stroke-width="4" />
<circle cx="471.5" cy="525.0" r="4.128" stroke="magenta" fill="white" stroke-width="1"/>
x1="475" y1="575.0" x2="463.0" y2="575.0" stroke="magenta" stroke-width="4" />
x1="463.0" y1="575.0" x2="463.0" y2="475.0" stroke="magenta" stroke-width="4" />
x1="463.0" y1="475.0" x2="475.0" y2="475.0" stroke="magenta" stroke-width="4" />
x1="475.0" y1="475.0" x2="475.0" y2="375.0" stroke="magenta" stroke-width="4" />
x1="725" y1="25" x2="781.6666666666666" y2="25" stroke="magenta" stroke-width="4" />
x1="781.66666666666666" y1="25" x2="781.666666666666666" y2="13.0" stroke="magenta" stroke-width="4" />
width="4" /> < x1="781.66666666666666" y1="13.0" x2="844.333333333333" y2="13.0" stroke="magenta" stroke-</li>
width="4" />
<line x1="844.3333333333333" y1="13.0" x2="844.33333333333" y2="25.0" stroke="magenta" stroke-</pre>
width="4" />
stroke-width="4" /
x1="925.0" y1="148.33333333333333333" x2="925.0" y2="277.6666666666667" stroke="magenta"
stroke-width="4" />
x1="925.0" y1="277.66666666666667" x2="913.0" y2="277.666666666667" stroke="magenta"
stroke-width="4" />
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stroke-width="4" />
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stroke-width="4" />
 x1="793.6666666666667" y1="425.0" x2="793.666666666667" y2="413.0" stroke="magenta"
<line x1="793.6666666666667" y1="413.0" x2="725.00000000001" y2="413.0" stroke="magenta"</pre>
stroke-width="4" />
 1ine x1="725.0" y1="413.0" x2="725.0" y2="289.66666666666663" stroke="magenta" stroke-width="4"
```

```
y2="289.6666666666663"
stroke-width="4" />
stroke-width="4"
<line x1="713.0" y1="160.3333333333333333" x2="725.0" y2="160.33333333333" stroke="magenta"
stroke-width="4" />
<text x="787.666666666666" y="224.0" lengthAdjust="spacingAndGlyphs" stroke="Black" stroke-
width="1" textLength="62.6666666666666664">RZS</text><circle cx="819.0" cy="122.0" r="40"</pre>
fill="white" stroke="magenta" stroke-width="3"/>
circle cx="819.0" cy="316.0" r="40" fill="white" stroke="magenta" stroke-width="3"/>
cline x1="725" y1="463.0" x2="781.66666666666666" y2="463.0" stroke="magenta" stroke-width="4" />
circle cx="813.0" cy="459.5" r="4.128" stroke="magenta" fill="white" stroke-width="1"/>
x1="781.6666666666666" y1="463.0" x2="781.66666666666" y2="451.0" stroke="magenta"
stroke-width="4" />
 x1="781.66666666666666" y1="451.0" x2="844.33333333333" y2="451.0" stroke="magenta"
stroke-width="4" />
stroke-width="4" />
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stroke-width="4" />
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stroke-width="4" />
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stroke-width="4" />
cline x1="913.0" y1="715.6666666666667" x2="913.0" y2="851.000000000001" stroke="magenta"
stroke-width="4" />
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circle cx="825.0" cy="854.5" r="4.128" stroke="magenta" fill="white" stroke-width="1"/>
stroke-width="4" />
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stroke-width="4" /> x1="725.0" y1="851.0" x2="725.0" y2="727.66666666666666" stroke="magenta" stroke-width="4"
circle cx="721.5" cy="663.0" r="4.128" stroke="magenta" fill="white" stroke-width="1"/>
x1="725.0" y1="727.6666666666666" x2="713.0" y2="727.666666666666" stroke="magenta"
stroke-width="4" />
x1="713.0" y1="727.6666666666666" x2="713.0" y2="598.333333333333" stroke="magenta"
stroke-width="4" />
stroke-width="4" />
x1="725.0" y1="598.333333333333333" x2="725.0" y2="462.999999999999" stroke="magenta"
```



VI. References and Bibliography

"Convert SVG to DXF Online for Free." *AnyConv*, https://anyconv.com/svg-to-dxf-converter/.

Convertio, https://convertio.co/png-svg/.

"UCR-Education-Logo-Columbia-University.png." *Undergraduate Admissions*, https://admissions.ucr.edu/image/ucr-education-logo-columbia-university.png.

### VII. Code Appendix

#### Main Code:

```
screw len = 36
screw rad = 4.128
nut_wid = 18
nut_hei = 6
def make dovetail x(pos x, pos y, wid, sign, ):
    x = pos x
    y = pos_y
x_del = sign * wid
    y_del = 0
    for i in range(0, 5): f.write("<line x1=\"{}\" y1=\"{}\" x2=\"{}\" y2=\"{}\" stroke=\"magenta\" stroke-
width=\"4\" />\n".format(x, y, x + x del, y + y del))
         y += y_del
         if(i == 0):
              if(sign == -1):
                  f.write(
"<rect x=\"{}\" y=\"{}\" width=\"{}\" height=\"{}\" fill=\"White\" stroke=\"magenta\" stroke-width=\"2\" /\n"
                      .format(x - (1 / 2) * wid - screw_rad / 2 - 2, y - screw_len, screw_rad + 4,
             x del = 0
             y_del = sign * material_thickness
             x_{del} = sign * wid
         y_del = 0
if(i == 2):
             y_del = sign * (-material thickness)
             x del = sign * wid
y_del = 0

def make_dovetails_x(pos_x, pos_y, wid, num, sign, version, top):
    x = pos x
    y = pos_y
```

```
make_dovetail_x(x, y, wid / (3 * num), sign)
        def make dovetail y(pos x, pos y, hei, sign):
   x = pos x
   y = pos_y

x del = 0
   y_del = sign * hei
width=\"4\"\ />\n".format(x, y,
x + x_{del}
y + y del)
        y += y_del
        if (i == 0):
            if(sign == -1):
                f.write(
                         x + sign * (material thickness / 2 - 2.5), y + sign * (1 / 2) * hei,
                f.write(
"<rect x=\"{}\" y=\"{}\" width=\"{}\" height=\"{}\" fill=\"White\" stroke=\"magenta\" stroke-width=\"2\" />\n"
material_thickness, screw_rad + 4))
                f.write(
            y_del = 0
            x del = 0
            y_del = sign * hei
        x_del = material_thickness
y_del = 0
if(i == 3):
            y_del = sign * hei
def make_dovetails_y(pos_x, pos_y, hei, num, sign, version, top):
    x = pos x
   y = pos y
            make dovetail y(x, y, hei / (3 * num), sign)
        \label{eq:make_dovetail_y_2(x, y, hei / (3 * num), sign, top)} $y += sign * (hei / num)$
def make_dovetail_x_2(pos_x, pos_y, wid, sign, top):
   x = pos x
    y = pos y
```

```
x del = sign * (wid - material_thickness / 2)
   y_del = 0
        f.write("<line x1=\"{}\" y1=\"{}\" x2=\"{}\" y2=\"{}\" stroke=\"magenta\" stroke-
        x += x_del
        y += y_del
        if (i == 0):
            if(top != 1):
                         x + sign * (1 / 2) * wid, y - sign * (material thickness / 2 - 2.5),
            y_del = sign * (-material_thickness)
            x_del = sign * wid
        y_del = 0
if (i == 2):
            x_del = 0
        y_del = sign * (material_thickness)
if (i == 3):
            x del = sign * (wid + material thickness / 2)
def make_dovetail_y_2(pos_x, pos_y, hei, sign, top):
   x = pos x
   y = pos_y
f.write("<line x1=\"{}\" y1=\"{}\" x2=\"{}\" y2=\"{}\" stroke=\"magenta\" stroke-width=\"4\" />\n".format(x, y,
        x += x_del
        y += y_del
        if (i == 0):
                        x + sign * (material thickness / 2 - 2.5), y + sign * (1 / 2) * hei,
screw_rad))
            x del = sign * material thickness
        y_del = 0
if (i == 1):
            x del = 0
            y_del = sign * hei
            x_del = sign * (-material_thickness)
            y_{del} = 0
            y del = sign * (hei + material thickness / 2)
```

```
def make_square(pos_x, pos_y, wid, hei, num_dovetails, version, top):
   x = pos x
   y = pos y
   if(version == 1):
       make dovetails x(x, y, wid, num dovetails, 1, 1, top)
       make dovetails y(x, y, hei, num dovetails, 1, 1, top)
       make dovetails x(x, y, wid, num dovetails, -1, 1, top)
       x -= wid
       make dovetails y(x, y, hei, num dovetails, -1, 1, top)
       make dovetails x(x, y, wid, num dovetails, 1, 2, top)
       make dovetails y(x, y, hei, num dovetails, 1, 2, top)
       make dovetails x(x, y, wid, num dovetails, -1, 2, top)
       make dovetails y(x, y, hei, num dovetails, -1, 2, top)
        y -= hei
def make fractal(f, pos x, pos y, wid, hei, depth):
   x = pos_x + (wid / 2)
   y = pos y + (hei / 2)
   if(depth <= 6):</pre>
           .format(x, y, 50 / depth))
       make_fractal(f, x + 10, y - 10, 0, 0, depth + 1) make_fractal(f, x - 10, y + 10, 0, 0, depth + 1)
lf __name__ == '__main__':
   # taking user input for dimensions and text detail
   while (length < 200 or length > 400):
   width = int(input("Please input width: ")) while (width < 200 or width > 400):
   while (height < 200 or height > 400):
   while (material thickness < 0.0625 or material thickness > 0.25):
       material thickness = float(input("You entered an invalid thickness. Please input between
```

```
material thickness *= 96
        le (len(front_text) > 10 or len(front_text) == 0):
front text = input("Invalid length. Please input 1 to 10 characters: ")
        e (len(top_text) > 10 or len(top_text) == 0):
        top text = input("Invalid length. Please input 1 to 10 characters: ")
   # 3 or more dovetails is possible with a large enough box, but we are limiting to two for
   num dovetails = int(input("Please select 1 or 2 dovetails per side: "))
   while (num dovetails < 1 or num dovetails > 2):
      num dovetails = int(input(\overline{"}Invalid number. Please select 1 or 2 dovetails per side: "))
   f = open("Box.svg", "w")
f.write("<?xml version=\"1.0\" encoding=\"UTF-8\" ?>\n")
        if(i == 0):
            make_square(x, y, w, h, num_dovetails, 1, 0)
            logo_f = open("Columbia_Logo_Simple.svg", "r")
             # we
            logo = logo_f.read()
             logo f.close()
 h, (0.03 / 300) * w, -(0.03 / 300) * h))
             f.write(logo)
f.write("<text x=\"{}\" y=\"{}\" stroke=\"Black\" stroke-width=\"1\" textLength=\"{}\">Digital Manufacturing</text>"
                     .format(x + w / 4, y + (3/4) * h + 5, w / 2))
             f.write(
            make_fractal(f, x, y, w, h, 1)
make_square(x, y, w, h, num_dovetails, 1, 0)
            make_square(x, y, w, h, num_dovetails, 1, 0)
            w, h = length - material thickness, width - material thickness #top face
        # top and bottom plates need to be type 2 squares
```

# For the Square:

```
if __name__ == '__main__':
    print("Welcome to Rectangle SVG Generator\n")
    #maximum 2x2 square. 100 pixels per inch
    width = int(input("Please input width: "))
    height = int(input("Please input height: "))
    while(height < 75 or height > 200):
        height = int(input("You entered an invalid height. Please input between 75 and 200: "))
    while (width < 75 or width > 200):
        width = int(input("You entered an invalid width. Please input between 75 and 200: "))

    name = input("Please input your initials (up to 4 characters): ")
    while(len(name) > 4 or len(name) == 0):
        name = input("Invalid initials. Please input 1 to 4 characters: ")

    f = open("rectangle.svg", "w")
    f.write("<?xxml version=\"1.0\" encoding=\"UTF-8\" ?>\n")
    f.write("<svg xmlns=\"http://www.w3.org/2000/svg\" version=\"1.1\">\n")
    f.write("<rrect x=\"0\""y=\"25\"" width=\"{}\" height=\"{}\" fill=\"white\"
    stroke=\"magenta(">>\n".format(width, height))
    f.write("<text x=\"{}\" y=\"{}\" stroke-width=\"3\" fill=\"black\">{}</text>".format(width / 2 - 25, height / 2 + 25, name))
    #center. 25 pixel offset to adjust for up to 4 characters (initials)
    f.write("</svg>")
    f.close()
```

### VIII. Rubrics Completed

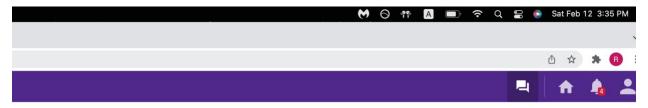
- 1. 10pt Cover page correct and complete
- 2. 10pt small rectangle cut correctly (SVG+Photo) submitted a week before deadline
- 3. 10pt Software inputs length, width and height of box and detects errors (show input dialog)

```
Welcome to Box SVG Generator
Please input length: 100
You entered an invalid length. Please input between 200 and 400: 500
You entered an invalid length. Please input between 200 and 400: 400
You entered an invalid width. Please input between 200 and 400: 400
Please input height:
Please input the material thickness (0.0625 to 0.25): 0
You entered an invalid thickness. Please input between 0.0625 and 0.25 0.3
You entered an invalid thickness. Please input between 0.0625 and 0.25 0.25
Please input something for the front of the box (up to 10 characters):
Invalid length. Please input 1 to 10 characters:
Please input something for the front of the box (up to 10 characters): asdfjkljasdfjkl;
Invalid length. Please input 1 to 10 characters: asdf
Please select 1 or 2 dovetails per side:
Invalid number. Please select 1 or 2 dovetails per side: 0
Invalid number. Please select 1 or 2 dovetails per side: 1
Process finished with exit code 0
```

- 4. 10pt A description of the software you wrote calculation steps, formulas, conditions.
- 5. 20pt Four examples showing input parameters and output flat pattern.
- 6. 20pt Printout of the two SVG files and photo of boxes they produced
- 7. 10pt User-specified text engraved on the top of the box
- 8. 10pt User-specified text engraved on the front of the box
- 9. 10pt Columbia logo and "Digital Manufacturing" engraved on the front of the box
- 10. 10pt A fractal engraving generated by the program embedded on one side of the box
- 11. 10pt a lid to cover the box
- 12. 10pt Any additional parameter accommodated by software:

Software allows for specification of number of dovetails desired

13. 10pt box image posted on Ed at least 24h day before the deadline (show screenshot)



# Box images Rohan Sahu & Brock Taylor #99



Mi everyone,

We've attached some pictures of our boxes below:

