

CNC SKILLS COMPETITION

SKILL/TASK LIST

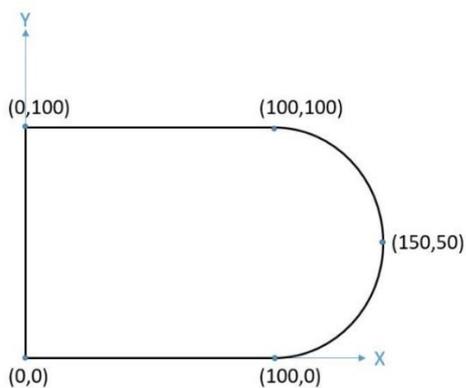
SKILL 1

Task: Write G-code for a given image (drawing) and make it appear in the CNC software screen.

Skill: Manual g-code writing skills.

Background: Even though advanced CAM softwares are available, it is a common scenario, where gcodes need to be manually edited, to customise the gcode for the job at hand. Hence basic understanding of Gcodes and ability to edit Gcodes is a useful skill to acquire.

e.g: 2D G-code writing



```
G00 Z5  
G00 X0 Y0  
G01 Z-5 F100  
G01 X100 Y0 F250  
G03 X100 Y100 I0 J50  
G01 X0 Y100  
G01 X0 Y0  
G00 Z5  
G00 X0 Y0  
M02
```

SKILL 2

Task: Make DXF for a given G-code

Skill: CAD skills

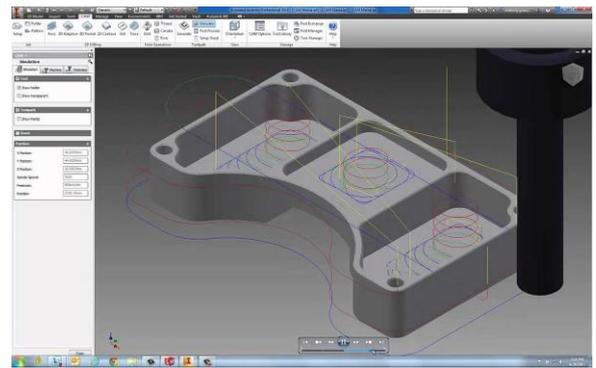
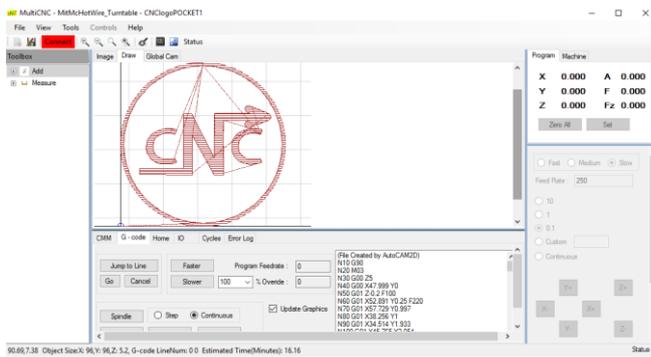
Tools: AutoCAD, Draftsight, etc.

SKILL 3

Task: Generate G-code for given DXF using a CAM software.

Skill: To understand the process involved in G-code generation by CAM software like tool-up, tool offset, multiple pass, feed rates for different material etc.

Tools: MultiCNC (<http://multicnc.in/downloads/>), CAM BAM, HSMExpress, etc.



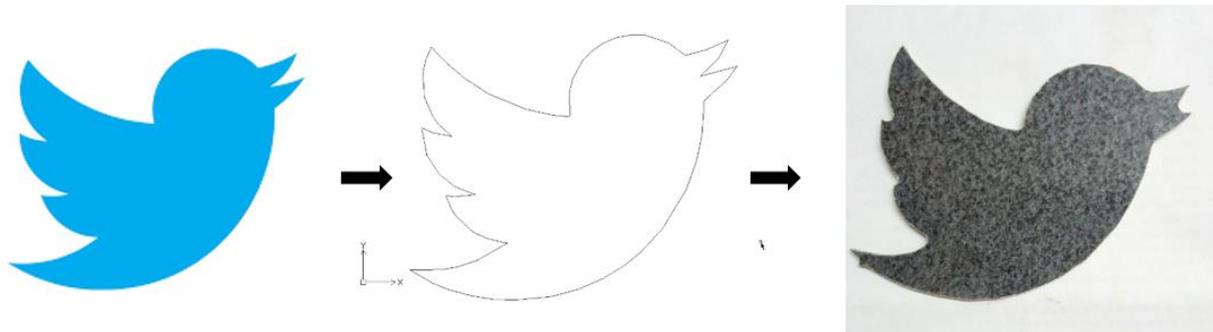
Skill 4

Task: Vectorise the given clean (silhouette) image for using in CNC.

Skill: using softwares for automatic conversion of images to vectors , by setting appropriate parameters.

Background: Images need to be converted to vectors before it can be machined in a CNC machine. Clean (silhouette) images can easily be converted to vectors automatically using image processing techniques (like edge detection, boundary tracing etc.). Graphics softwares like Vextractor, InkScape, PhotoShop etc. can do this automatically. You may have to adjust some parameters like threshold value for image binarizing, spline fitting params etc. Several personalised products like Logo, pendent, wall show-piece, etc. can be made with this skill.

Tools: “Vextractor” s/w (<http://www.vextrasoftware.com/download.htm>), Photoshop etc.



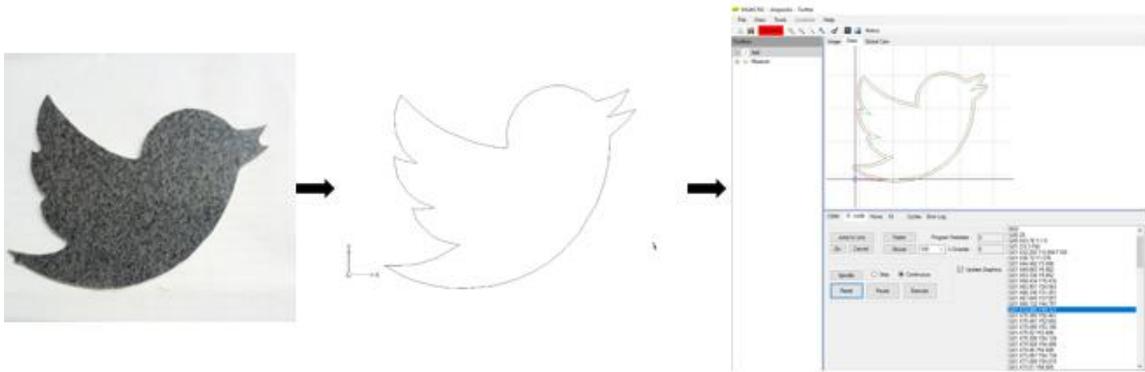
SKILL 5

Task: Vectorise the given real life photo / image of any object or feature for cutting in CNC.

Skill: Using softwares for manual tracing of image boundaries and vectorising.

Background: Images need to be converted to vectors before it can be machined in a CNC machine. Clean (silhouette) images can easily be converted to vectors automatically using image processing techniques. But real life images will have artefacts like shadow effects, background images etc. making automatic vectorising impossible. In such scenarios, some amount of manual editing, tracing will be required.

Tools: AutoCAD, Draftsight, Photoshop, Coral draw

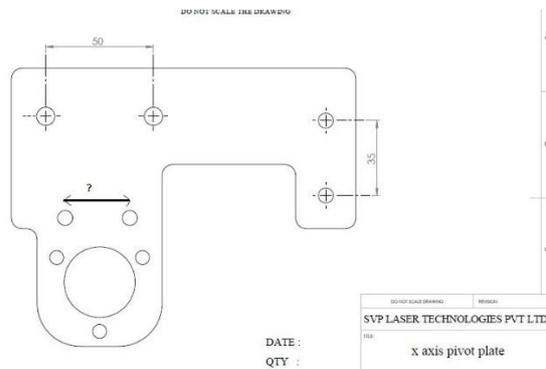


SKILL 6

Task: Finding missing dimension from the given image.

Skill: Image pixel size calibration

Tools: Irfan view, MultiCNC, etc.

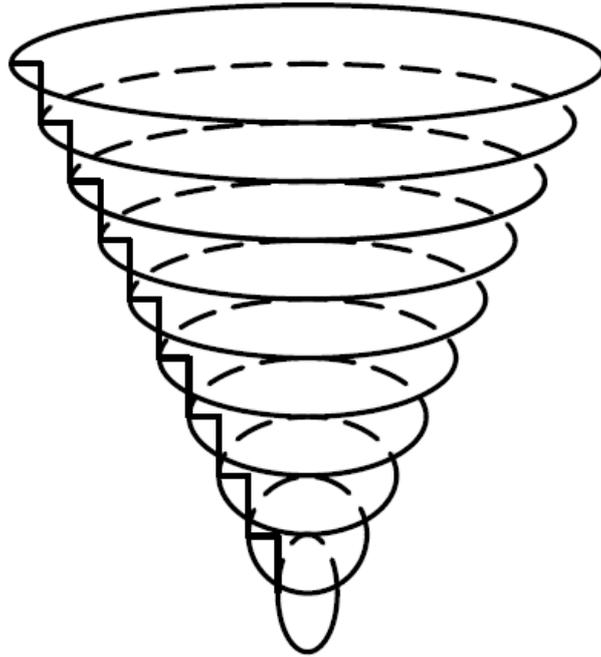


SKILL 7

Task: Generate G-code for toolpath for cutting simple 3D geometries like cone, sphere, circular pocketing without using CAM softwares etc.

Skill: Manual Gcode writing plus mathematics calculation skills.

Tools: Excel, MATLAB, MultiCNC etc.



Following tasks need to be performed on a CNC mc.

SKILL 8

Task: Plot a given DXF in CNC.

Skill: Jogging a CNC machine and understanding program zero of a G-code. Practical implementation of setting the g-code parameters.

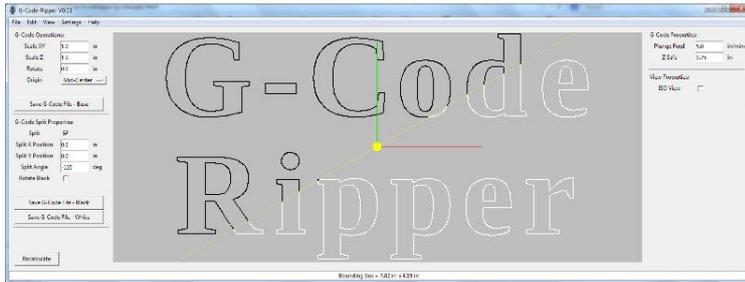
Background: Your basic CNC mc programming and operation skills will be tested. Pen plotter or HotKnife tool will be used instead of an end mill.

SKILL 9

Task: You will be given a drawing with one outer geometry (rectangle) and several inner geometries. You are also given raw material already cut to the outer rectangle size. Now you need to cut/plot the given inner geometries at exact locations as given in drawing with respect to the outer.

Skill: Understanding program zero, part alignment and rotating G-code.

Background: Sometimes the raw material are already cut in standard sizes, or the outermost geometry is already cut but some of the inner features get missed (so need to do rework). In that case we have to clamp the outer part and assign the program zero and check the part alignment to regenerate the G-code for cutting the inner features.



Tools: G-code ripper. G-code ripper is an online available software which enables operations involve Reading, scaling, rotating, splitting, and wrapping the G-code generated by a CAM software. (<http://www.scorchworks.com/Gcoderipper/gcoderipper.html>)

SKILL 10

Task 1: The given job is bigger than machine size. The Job should be cut in two pieces by breaking the DXF.

Task 2: The given job is bigger than machine size. The Job should be cut as a single piece, by indexing and realigning the Job.

Skill: Understanding how to split and rotate G-code according to part alignment.

Background: Very often we need to cut part size which are bigger than the available machine size. In those cases we can use these skills to cut the full part in a single piece.

Tools: G-code ripper.

SKILL 11

Task: To pen-plot or cut a long channel on a workpiece kept on an inclined surface.

Skill: Cutting/pocketing when part is uneven or not flat. The following figures describe the case when the machining surface is not parallel w.r.t CNC gantry and a straight slot is supposed to be cut for a given depth on the same surface.

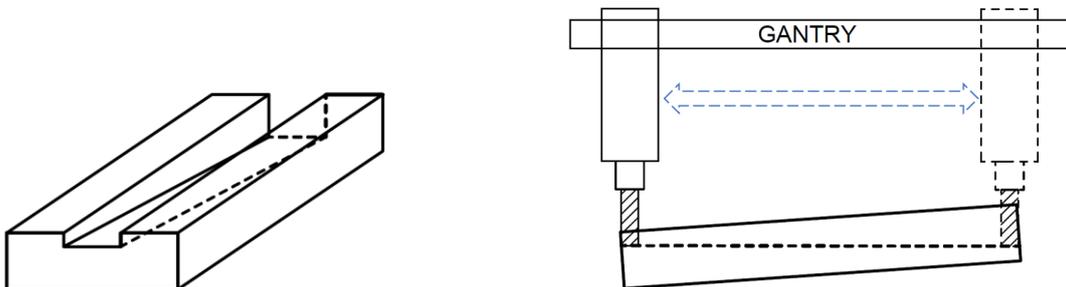


Fig 1: When the surface not parallel to the gantry and the inclination is not incorporated in the G-code.

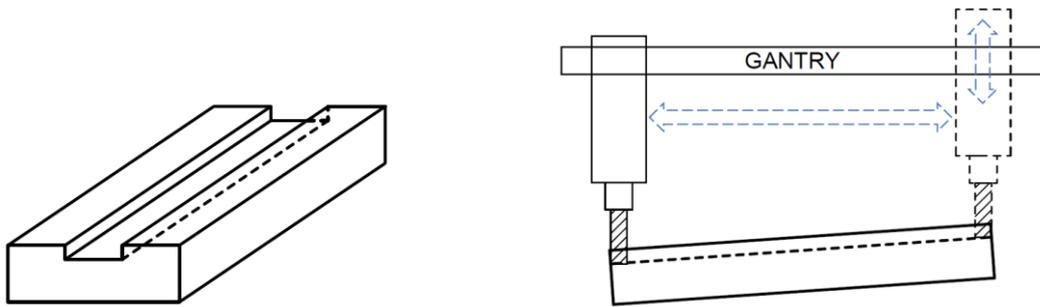


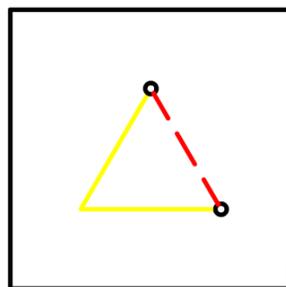
Fig 2: When the inclination of the machining surface is incorporated in the G-code.

Background: Many times when a engraving or pocketing operation has to be done on an uneven surface, the probing on the machining surface has to be done to compensate for the height variations in software. For example in case of PCB engraving, if the varying heights of the clamped copper clad sheet are not incorporated in the g-code then the path isolation may get damaged.

SKILL 12

Task: A component drawing having top side and bottom side features is given. Need to make sure the relative position between top and bottom features are maintained. Need to plot the top and bottom feature on a chart paper and prove the relative positions are in alignment.

Example1: Make a double sided PCB as shown in Figure1. The bold lines are on the top side of the PCB while the dashed line in the triangle is on the bottom side of the PCB. The two small circles are through holes and the outer square is the boundary of the PCB.



Skill: To get perfect alignment between top and bottom lines so that the position of holes match on either side.

Background: Very useful in case of double-sided PCB making, fabricating components with features on top & bottom sides etc.

Tools: Gcode ripper, MultiCNC etc.