Create a Trophy

Tutorial Objectives

Learn how to prepare an image for laser cutting by:
- Converting a non-SVG image to an SVG
- Converting text to paths
- Creating a contoured cutting border
- Introduction to Kerf
- Splitting and joining lines
- Preparing line colours and thickness
- Cutting

Inkscape

Inkscape (https://inkscape.org/) is a professional vector graphics editor for Linux, Windows and macOS. It's free and open source. There is also a portable version which means you are able to run it directly off of a USB drive without having to install it on the machine that you are using.

Tutorial

Obviously before beginning one needs an idea. So let's assume that you are googling for some trophy ideas when you come across image A and decide to do something like image B using 3mm acrylic.
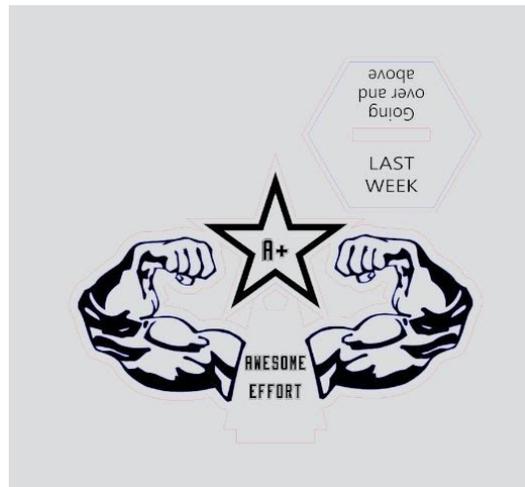

Image A

Image B

Notes

Notes to tutor

- discuss the use of layers for logically grouping parts of the drawing, hiding constructions lines, or locking parts of the drawing to prevent changes etc.
- This tutorial can be sped up by providing students with a partially done drawing and letting them complete it.

Notes to all

- When objects across different layers are grouped using the group command (ctrl-G) they will all be pulled into the same layer.
- Right-click on an object to move it to a different layer or to move it up or down within its current layer.
- Zooming: Ctrl + mouse scroll button (screen will zoom into where the mouse is on the page).
- Panning: Mouse scroll button to move up and down, Shift + mouse scroll button to move left and right

Notes about laser cutting

- Before cutting all lines need to be set to 0.001mm. In Inkscape this will render your drawing invisible. This step can therefore only be done just before cutting is commenced.
- RBG Red - cuts, RGB Black - etches, RBG Blue - engraves
- Kerf: the width of cut made by a saw or cutting torch i.e. the amount of material lost as a result of the cutting/vapourising process.
- If your image will just not cut, check to see that none of the lines have any transparency i.e. that all lines have an alpha value of 255.
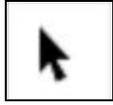
Creating the base image

Create a new layer called "Base". If you can't see the layers on the left, press Shift-Ctrl-L to bring them up. Click on the +, or rename the existing one to "Base". The eye and the padlock let you hide and lock the layer respectively. Check that the "Base" layer is selected.

From the tool menu, click on to draw the hexagon. This is done by selecting the regular polygon shape and entering 6 for the number of corners and dragging the shape onto the page. If you do this while holding the control key you will be able to position the top and bottom lines so that they are parallel to the top and bottom page edges (making things much easier to align later).
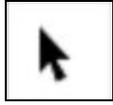
Using the select and transform icon , select the hexagon and click the padlock next to the width (w) box. This will ensure that any size changes are kept in proportion. Decide on how large you want the base to be and set the width to this in millimeters. In this case we want it to be 6cm (60mm).

No go to the "Fill and Stroke" properties box on the right (or press Shift+Ctrl+F to open it up). In the "Fill" tab select the **X** to remove the fill, In the "Stroke paint" tab click the solid square and set **R=255**, G=0, G=0. This will set the outline to RBG Red which is the cutting colour for the laser cutter. We can leave the "Stroke style" width as a visible width for now i.e. 0.1mm.

If you forgot to draw the hexagon in the "Base" layer you can right-click on the object and move it to this layer. To check, click the eye next to the "Base" layer and the hexagon should disappear. Click the eye again and it should reappear.

Using copy and past, make a duplicate copy of the hexagon, changing its colour to RBG Blue.

Position the two hexagons on top of each other either by using the snap-to, and associated icons, or align (Shift-Ctrl+A) options. With the blue hexagon selected (you might need to move it to the top, or the red one to the bottom (Object -> raise and lower options) in order to select it) choose Path and the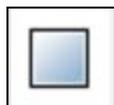n Dynamic offset (Ctrl-J). If you have snapping enabled then turn it off by unselecting . Click and drag the offset box, , to create your desired engraved offset. Drag a selection box around both hexagons and press Ctrl-G to group them.

We now need to add the slit for the upright part of the trophy to sit in. This is where the kerf comes into play. As we are using 3mm acrylic we need the drawing's hole to be slightly narrower than 3mm in order to accommodate the material that will be vapourised. If we make it exactly 3mm, the fit will land up being too loose; if we make it too small however the fit will be too tight. At the end of the day the exact kerf value needs to be determined through trial and error and will be different for different materials and lasers. This said, the following provides some guidelines: http://www.cutlasercut.com/resources/tips-and-advice/what-is-laser-kerf.
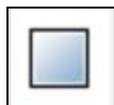
Using the rectangle icon, , create a red rectangle that is 25mm x 2.8mm. Select the hexagon group and then while holding Ctrl, select the rectangle. From the "Align and Distribute"
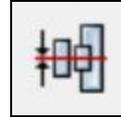
properties, centre on both vertical, , and horizontal, , relative to "First selected". Select the rectangle and hexagon group and group them all. Move the new group to one of the corners of your page so that it is out of the way. You can now lock the "Base" layer" and even hide it if you wish.
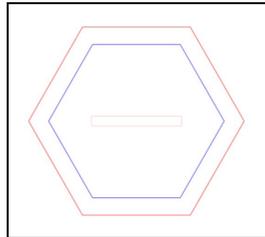

Creating the upright - part 1

Note: I would normally use a CAD program like LibreCAD to create the following as it is much easier and quicker to accurately create these sorts of shapes in a CAD programme. Once done I would export it from the CAD programme to a SVG file which I then import into Inkscape. This is a simple shape and so we will keep everything within Inkscape. In short I usually create as much as I can in LibreCAD, export the file to an SVG and then finish it off in Inkscape.

Create a new layer called "Upright" and make sure that it is selected.

Create a rectangle box (stroke red with no fill) , 15mm wide by 60mm high. We now need to convert this object to a path. With it selected, go to Path -> Object to
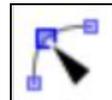
path or Shift+Ctrl+C. Now click the "Edit path" icon, . While holding the Ctrl key down, click and drag the top, left node in order to create the shape on the right. Holding the Ctrl key allows you to lock the horizontal position.
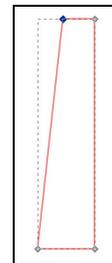
Now create a 2nd triangle. This is going to be the part that fits into the whole. Make it 25/2-0.1 = 12.4mm (half the width of the hole minus half the kerf allowance). As you may have worked out, we are busy creating half the shape which we will then mirror. Using snapping, align the two shapes as on the right. Also convert this object to a path; we need to convert objects to paths if we wish to edit their nodes.
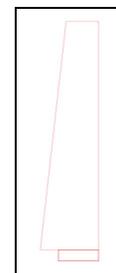
With the "Edit path" icon selected, click on the new, bottom rectangle and then
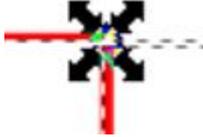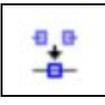
select the top, left node. With this node selected, click "Break bath at selected node", .

Do the same for the top, right node of this shape. Once both nodes have been broken apart, you will be able to select the top light and press the "Delete" key to remove it.

Now select the previous shape, breaking apart the bottom left node. We now need an extra node created in the same place as the top left node of the bottom rectangle. With the top node still selected, simply double-click in more or less the position that this needs to be (zoom in to get this as accurate as possible). Now break this node apart and delete the line segment above the bottom rectangle.

The two shapes now need to be merged together (not grouped). The best way that I have found to do this is to join the nodes. With "Edit path" still selected, select both shapes. Drag over two

of the overlapping nodes,   , to select them and click the "Join

selected nodes" icone,   . Repeat for the opposite pair of nodes. Having just completed this, you will see that we did not need to join the right-most nodes, but let's continue. We now need to remove the right-most horizontal line. Following the above approach, you can remove the right horizontal to obtain the drawing on the right. Duplicate the

resulting shape and flip it on the horizontal,   .

Use the snapping tool and the above approach to join the various nodes in order to obtain the shape on the right.
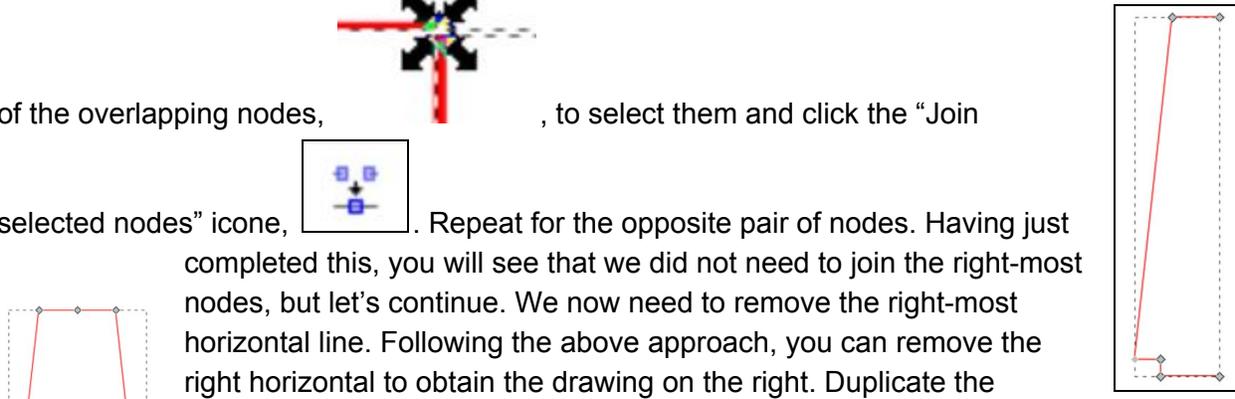
We now have the tools to create the shape on the right.
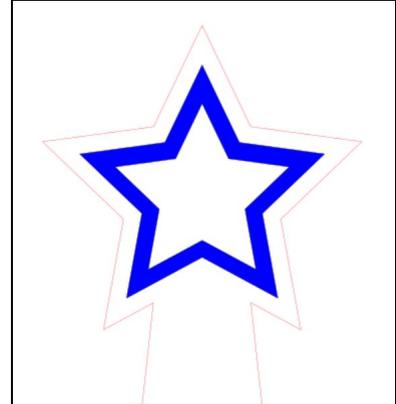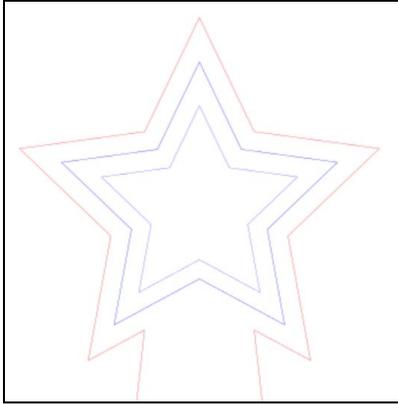
Hints and reminders

- Convert objects to paths to edit and join them using
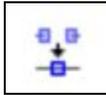
      and   , while adding extra nodes when needed.

- Add the star using   .
- Use alignning to position shapes off of each other.
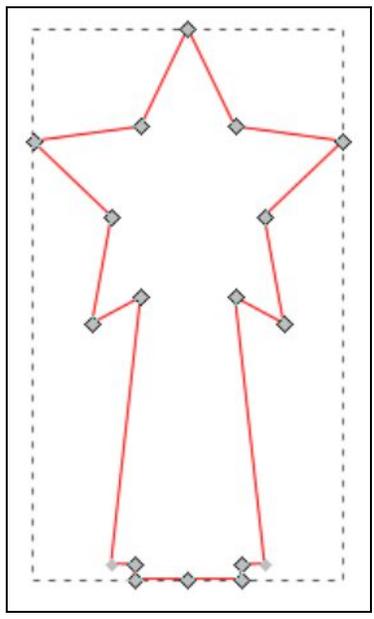
Creating the inner etched star

Create two blue stars as below (left)

With both selected, go to "Path -> Exclusion" (Ctrl+ ^). Now set the "Fill" to blue and the "Stroke" to black (I have always found engraving highlights an etched area very nicely). You will now have the shape as shown above on the right.

The blue etching star can now be grouped with the rest of the upright.

Creating the upright - part 2

Adding the arms

We now need the muscles arms. Using google, search for black and white, line art that contains the word "muscles". I found the following which is free to use

(https://www.clipart.email/clipart/muscles-clipart-png-443807.html).

Import the image into the Inkscape file, accepting the suggested defaults. Resize and position as on the left. Once positioned, it makes things easier to create a new layer (say called "Arm"), move the arm there and hide the other layers for now. I also usually lock the layers that I am not working in; just to protect them.

Converting an image to a vector image

This needs to be done so that you can tidy up the image while getting it into a format that can be used with the laser cutter.

With the arm selected, go to "Path -> Trace Bitmap" (Shift + Alt + B). Usually you do not need to change the default settings so just click "Update" and "OK". You can now close the "Trace Bitmap" window. Nothing will appear to have changed. If you however drag the image off to one side you will see that you now have two images. On close inspection, one is the original image and the other is the editable vector drawing. To work out which is which, select each one using
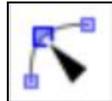
the "Edit path" icon, . Delete the original drawing, leaving the vector one.

From the "Fill and Stroke" property box, leave the fill black and set the stroke to blue.

Making the arm fit

Leaving the "Upright" layer locked, make it visible and if moved, reposition the arm back in the desired place.

Using "Draw Bezier", , draw the following shape (as shown on the right) so as to cover the part of the arm that we want to remove.
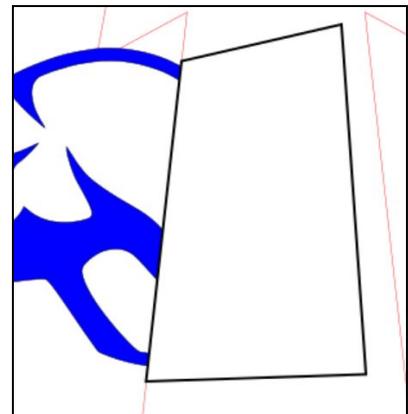
Now with both images selected, i.e. the arm and the bezier box, select "Path -> Difference" (Ctrl + -).

Duplicate the arm, flip it and place the copy on the other side.

Select both arms and combine them using "Path->Union" (Ctrl + +) .

Move the arms back to the"Upright" layer, unlocking the layer.

Completing the main cutout line

We now need to create the line that will result in the laser cutting out around the arms while changing the parts of the upright that are no longer on the outside, from red to black.

Copy and paste the arms. Remove the fill and change the stroke to red. Using snapping, drag the red arms so that they lie right on top of the blue ones.

With the red arms selected, perform another "Dynamic Offset", dragging the node up to the desired position; see image on the right.
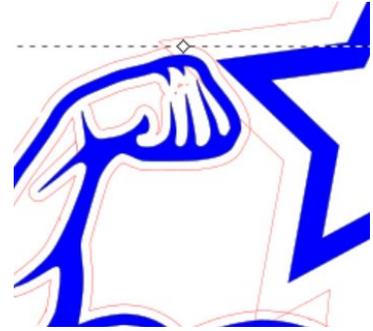
Convert the red arms back to a path again (Shift + Ctrl + C); selecting the inner nodes and deleting them in order to remove the inner lines. Simply drag over the inner nodes (or select individual ones one at a time) and press delete. In hindsight it would have been quicker to do this before creating the mirrored one. The final result is shown in the right image.

Now comes the slightly more fiddly part. We need to remove the red sections that we no longer need and change the lines that we still need but that must no longer be cut right through, from red to black. This is done by:

- Adding nodes
- Splitting nodes
- Removing line segments
- Merging nodes

All as done previously.
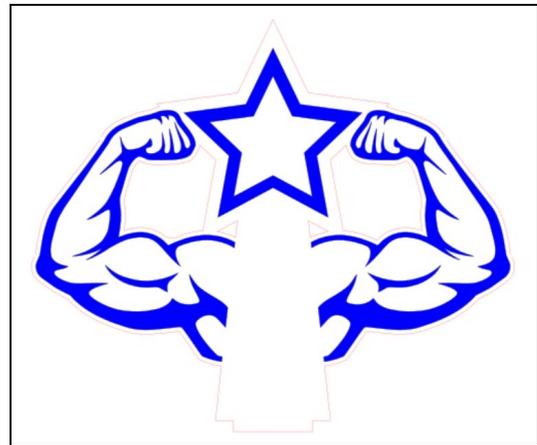
Adding the text

Text is added using the "Create and edit text objects" icon, and as above the same colour and manipulation rules apply. As such simply add and position your text as desired.

There are however two points worth making a special mention of.

Ensuring fonts are not lost

If you open an Inkscape file on a computer that does not have the same fonts installed as the one where the file was created, the font will effectively be lost. In order to prevent this from happening it is worth converting all text to paths. Of course once this is done it is no longer possible to change the font or easily modify what has been typed. As such it is best to only do this at the very end (maybe keeping a copy of the file before this step is performed as a preflight backup).

Cutting out letters

This becomes obvious the first time that you try to cut out some letters in a sign. Unless the font is of a stencil family, the middle bits of the letters will fall out e.g. a, e, o etc. If you are wanting to cut out a font that does not have a stenciling format then you will need to convert it to a path and then add the stencil bits in. Below illustrates what I mean; the text to the right of the arrow shows the resulting cut.

Font with no stencilling
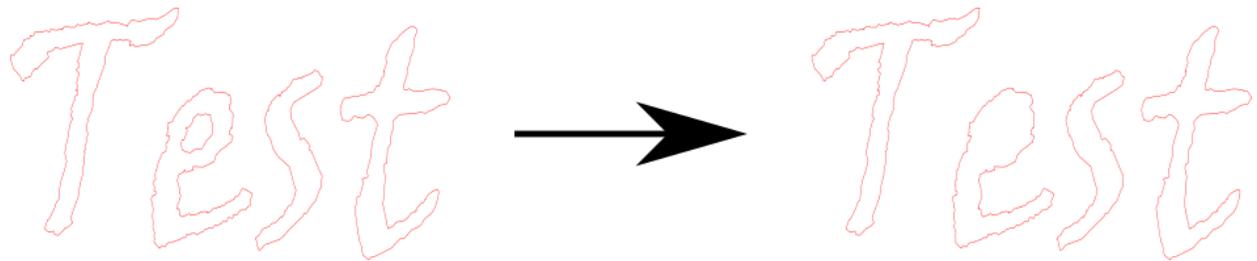
Font with stencilling added
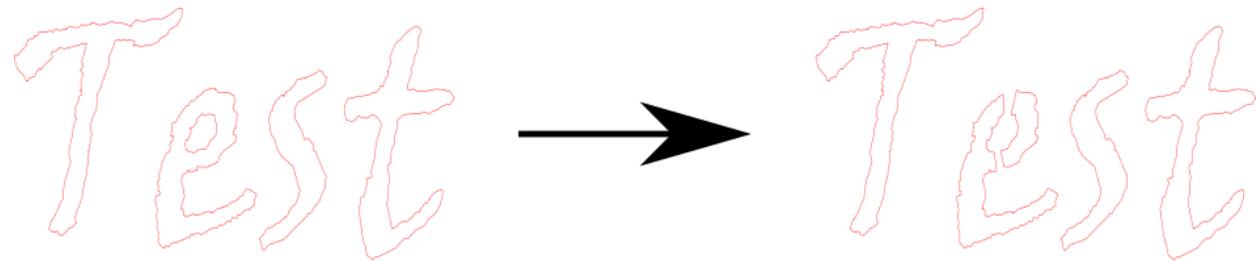
Final Step

Select everything and set the stroke thickness to 0.001mm under the "Stroke Style" tab in the "Fill and Stroke" properties box. All lines will now be invisible but will show in the laser cutting interface.