

Building an Digital Clock in Excel – part #1 –

creating the “digit” sprites *by George Lungu*

Sprites: *In computer graphics a sprite is a two-dimensional image or animation that is integrated into a larger scene (Wikipedia). In a 3-dimensional scene representing remote objects as simple 2D effects results in saving memory and processor power. Since there are just ten different digits (0, 1, 2, 4, 5, 6, 7, 8, 9) we can create ten different images of the digits and selectively bring into view on a chart just the images of the digits corresponding to the current time.*

- There are in total 8 digits on a digital clock face, two for each of the following categories:

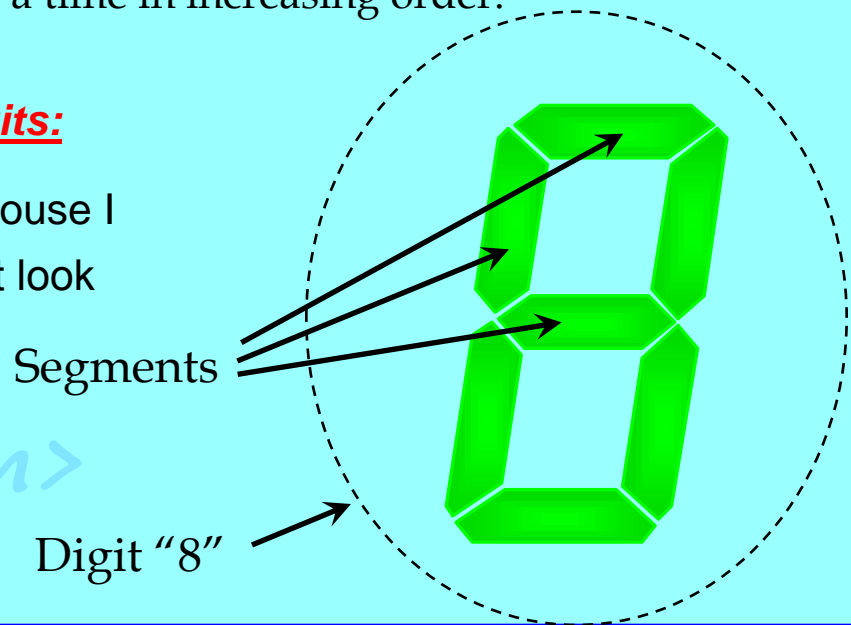
hours, minutes, seconds.

- To show how the sprites work let's create the ten sprites and set up a simple macro to bring them into view on a chart, selectively, one at a time in increasing order.

Creating the sprites for the clock digits:

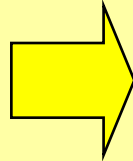
After doing some research around the house I managed to figure out that digit “8” must look something like the this:

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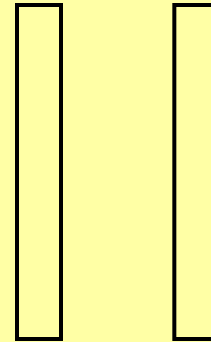


Make sure you bring up the "Drawing" menu from View ->Toolbars - > Drawing

- Create a vertical rectangle:

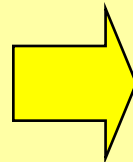
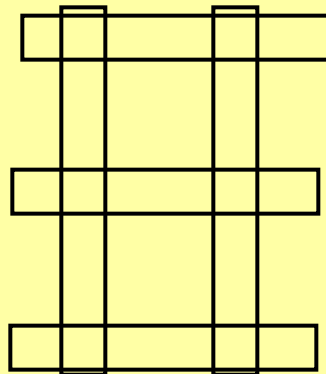


and copy it:

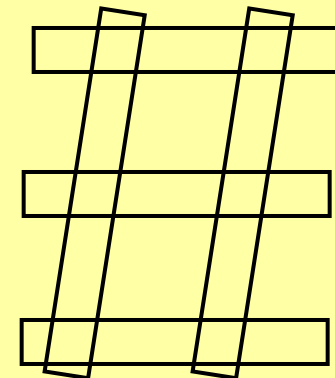


-Select a rectangle and copy and paste it three times, then rotate them.

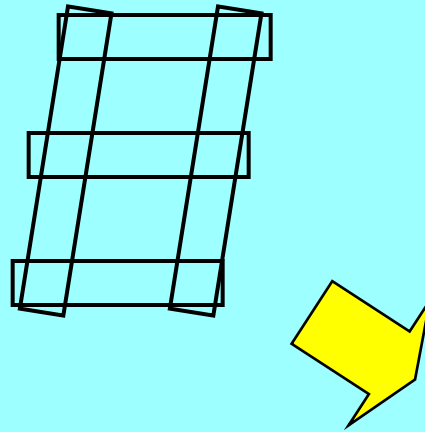
- After some rearrangement we get:



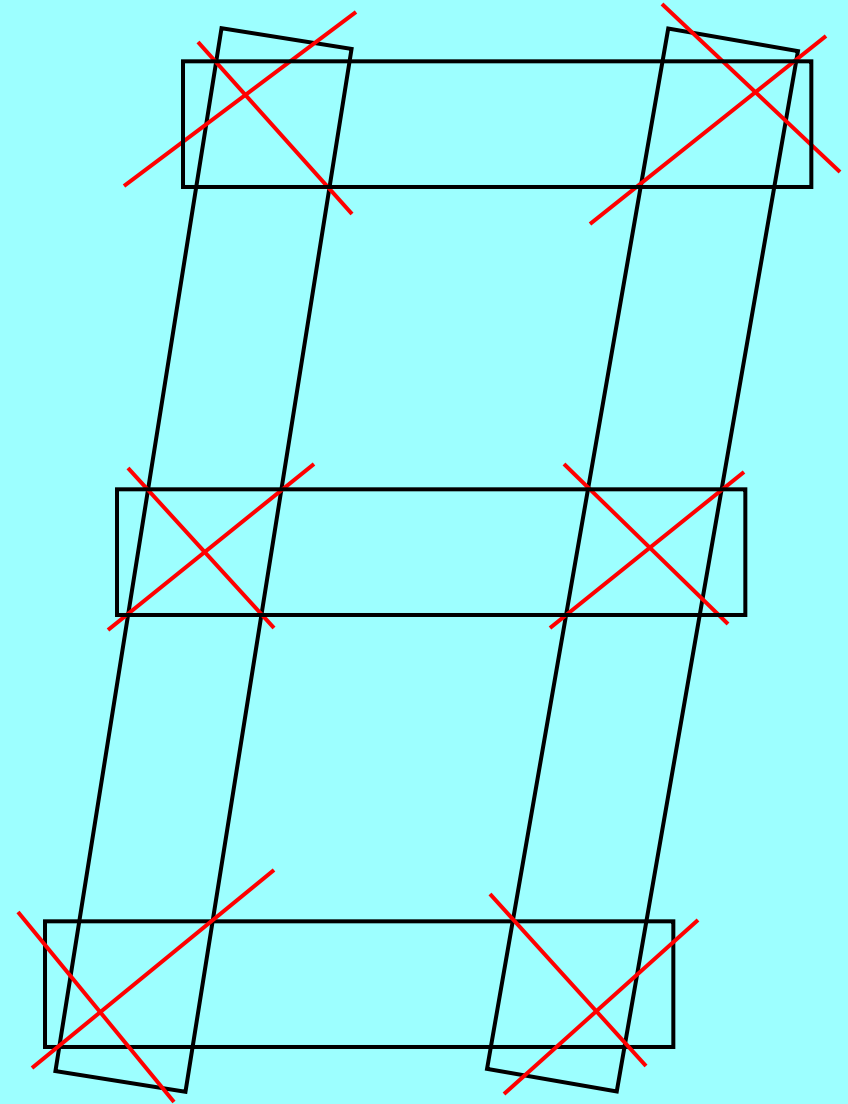
Select the vertical rectangles and rotate them around 20 degrees to the right:



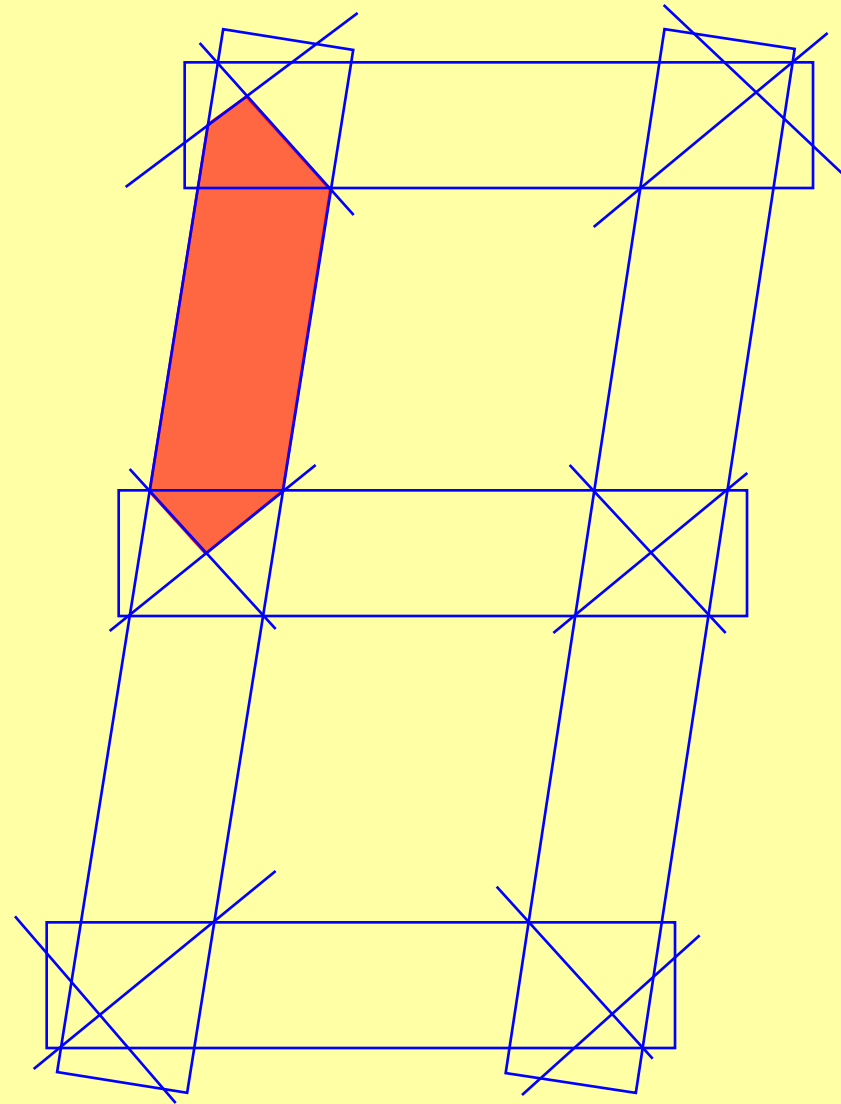
- Shorten the horizontal rectangles:



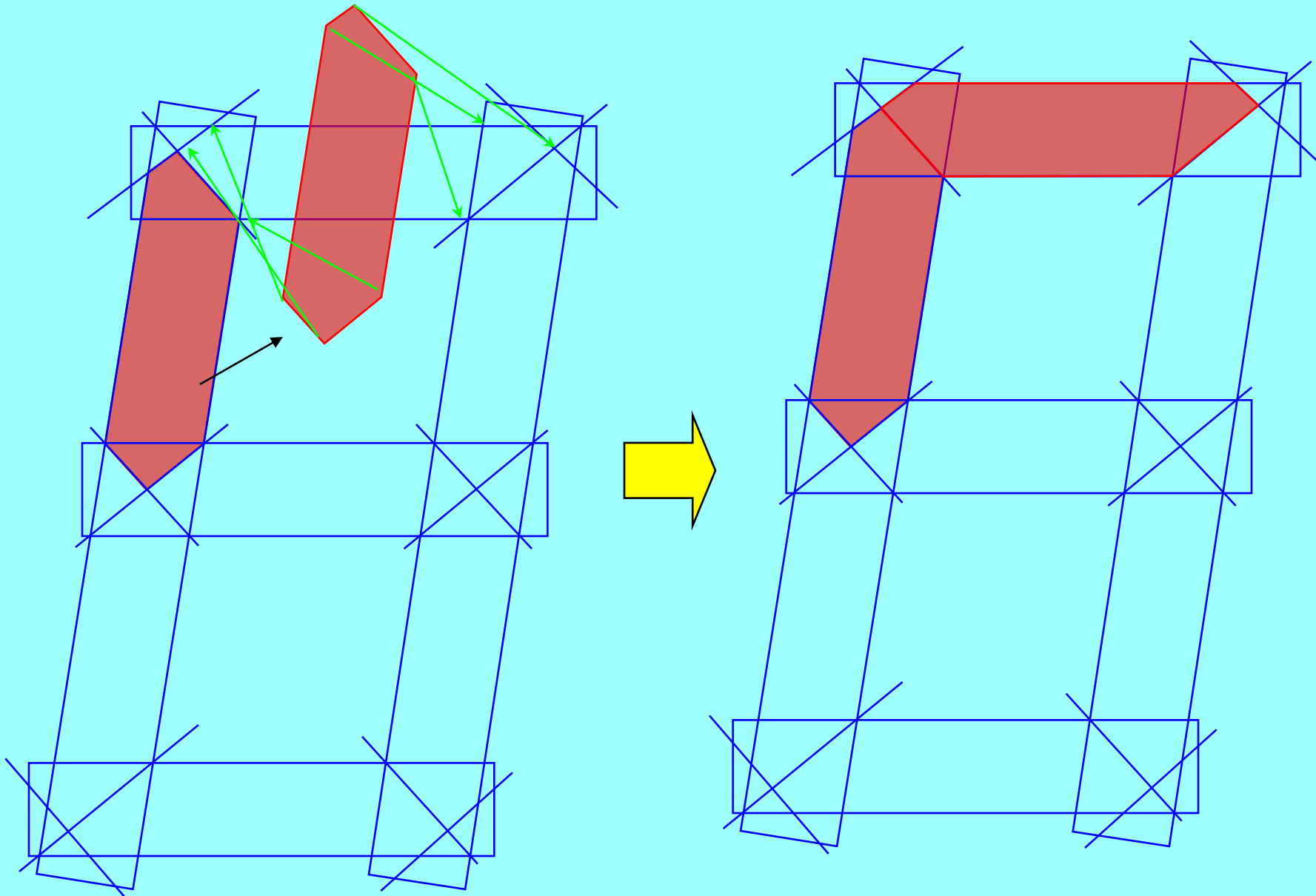
-Group the five shapes, zoom in to max (400%) and add the following **twelve short lines**:
(here you need to experiment and put some time if you want the final digits to look good)



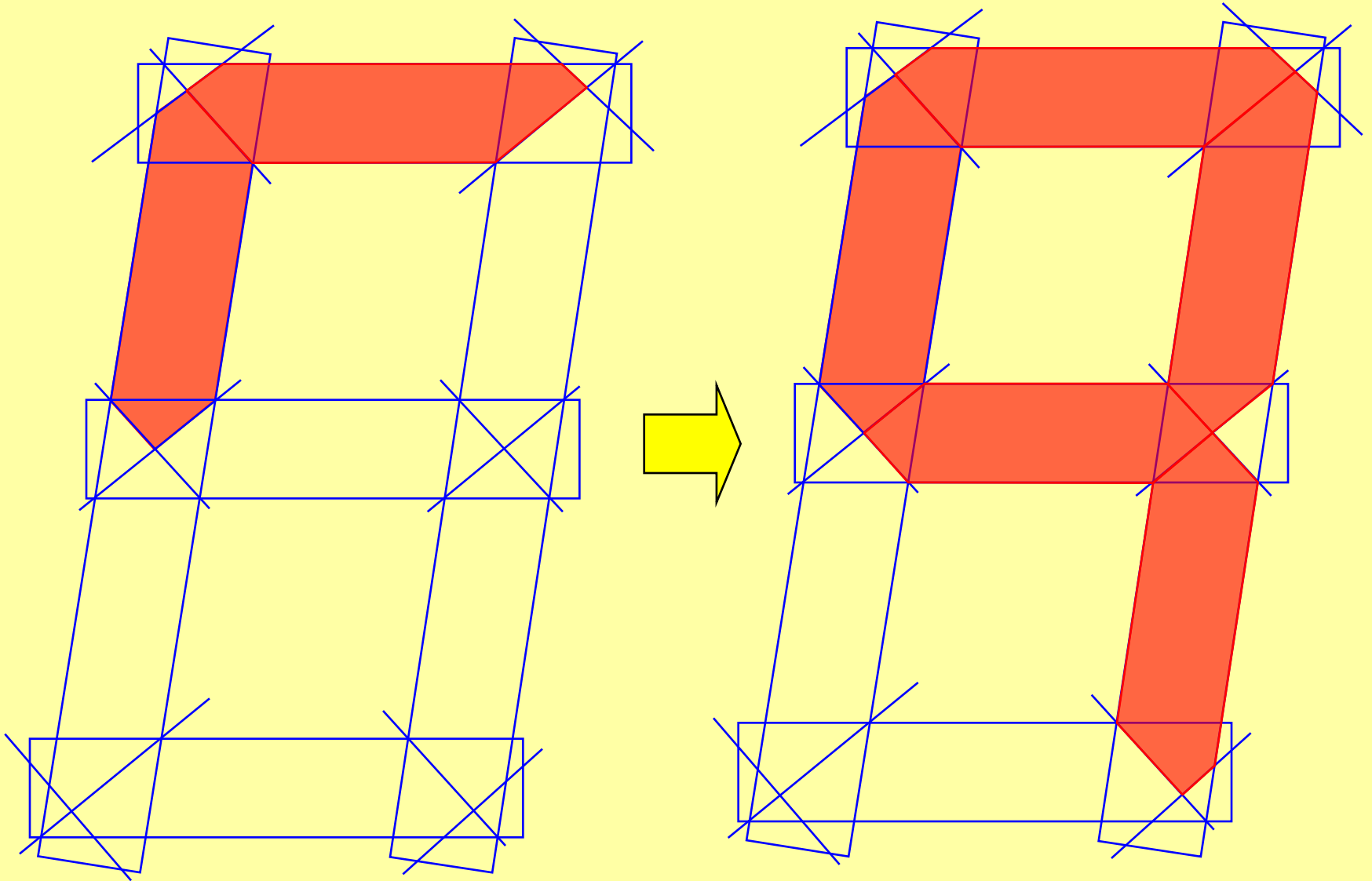
- Change the color of all the lines to blue and group everything together. Now we have a drawing template.
- In the “Draw” menu make sure to uncheck the “Snap-to-grid” option to provide the densest grid.
- Now we are ready to draw the seven segments using the previous lines as a template (AutoShapes -> Line -> Freeform).
- Again increase the zoom and work carefully trying to click on the vertices of the template (we are drawing the segments on the top of the template). After I draw it, I like to give 50% transparency to the shape so that I can see the template lines underneath for fine tuning.
- **You don't need to start very accurately since after the 6-vertex shape is drawn we can select it, right click it and use the “EditPoints” options to finely adjust the position of the vertices.**



- Copy and move the red shape (you could as well crate a new one if you think it's easier).
- Select it -> Right Click -> Edit Points

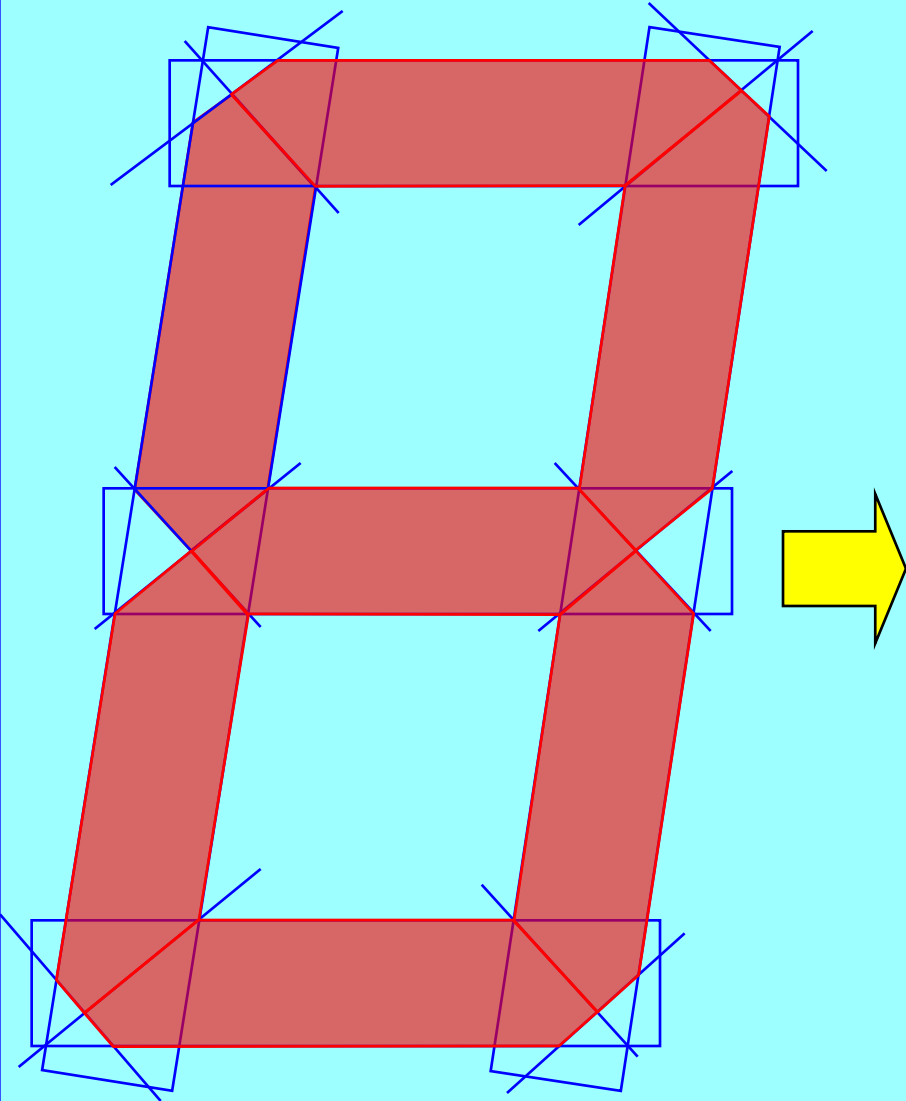


- Continue the Copy -> Paste-Move -> EditPoints series of operations:

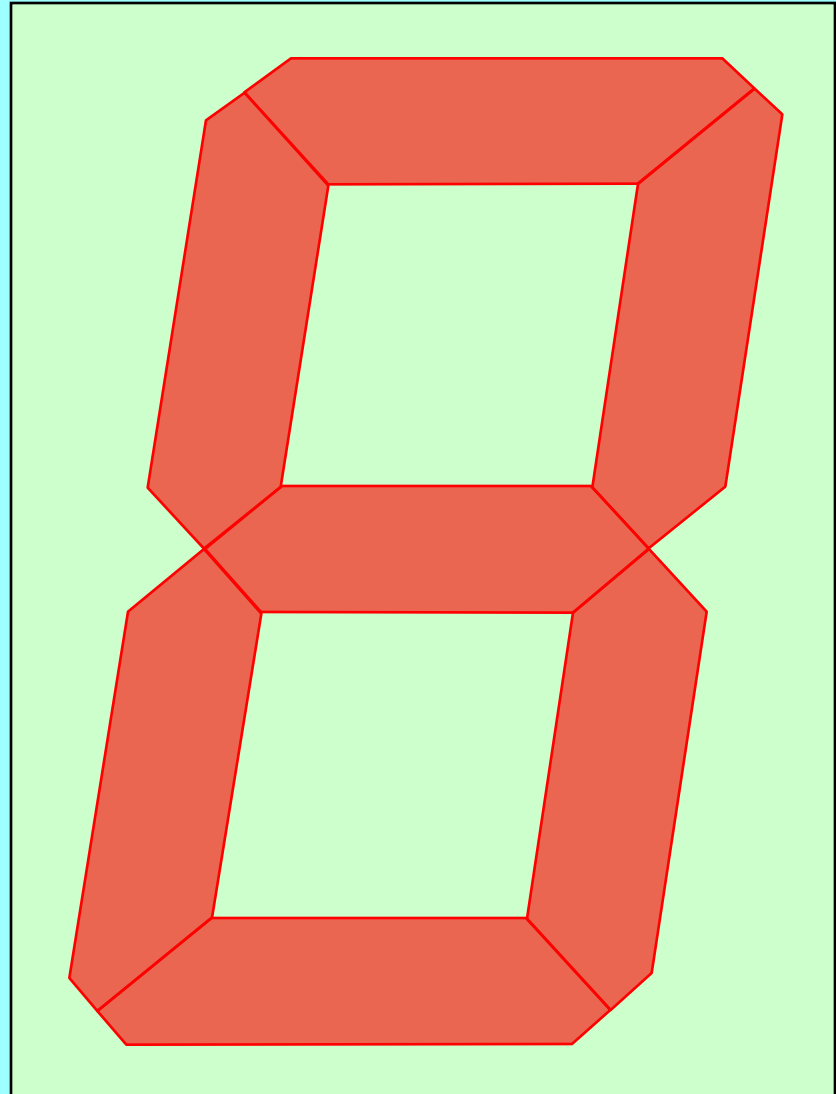


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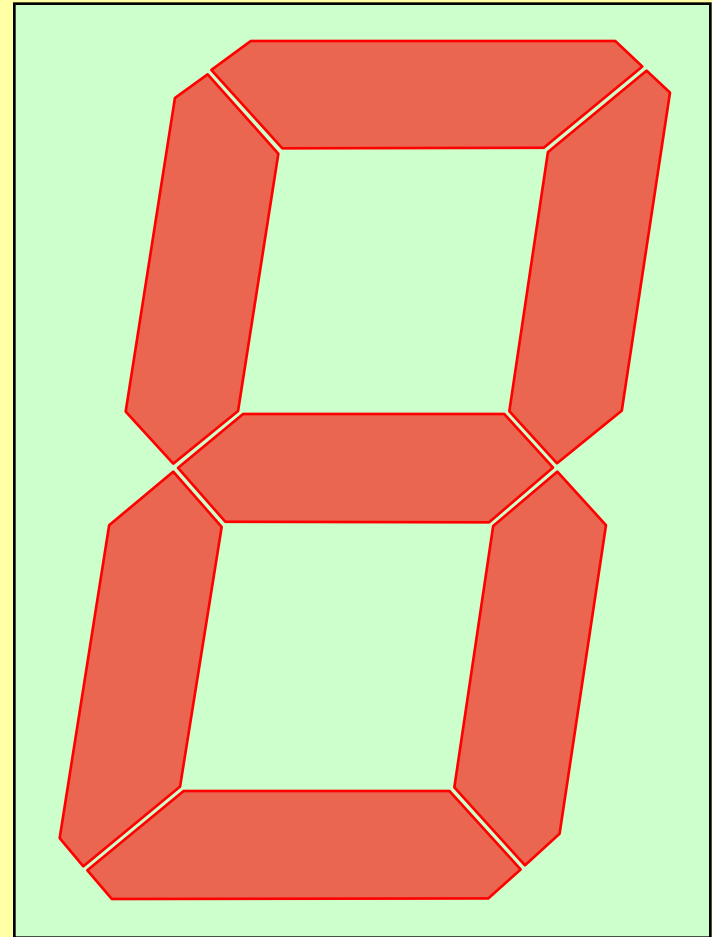
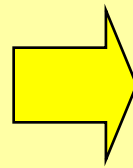
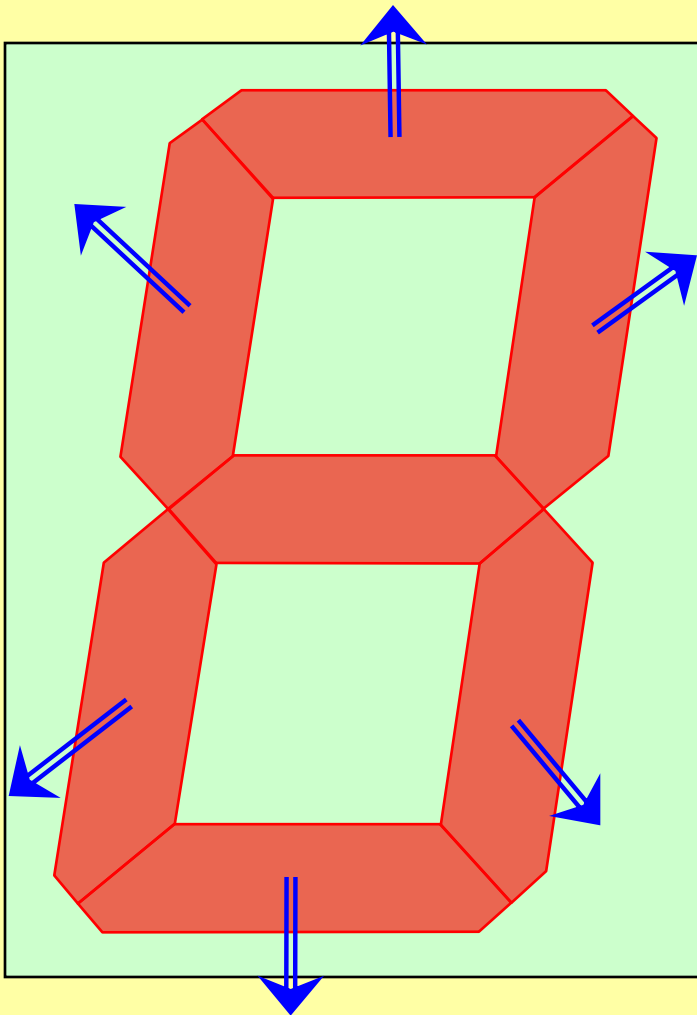
- Finish up the number "8":



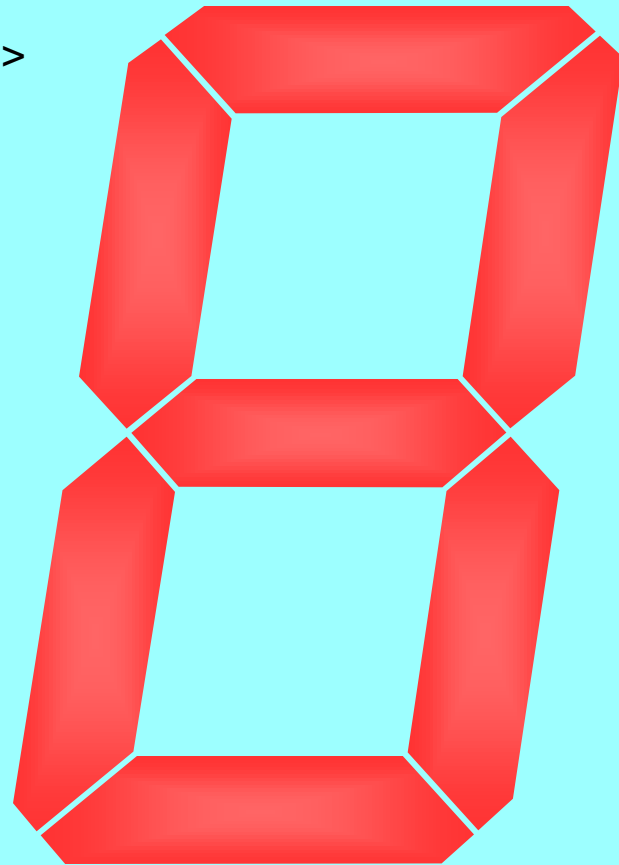
- Then remove the blue template and add underneath a rectangle slightly larger than the number "8" and roughly centered with the red segments.



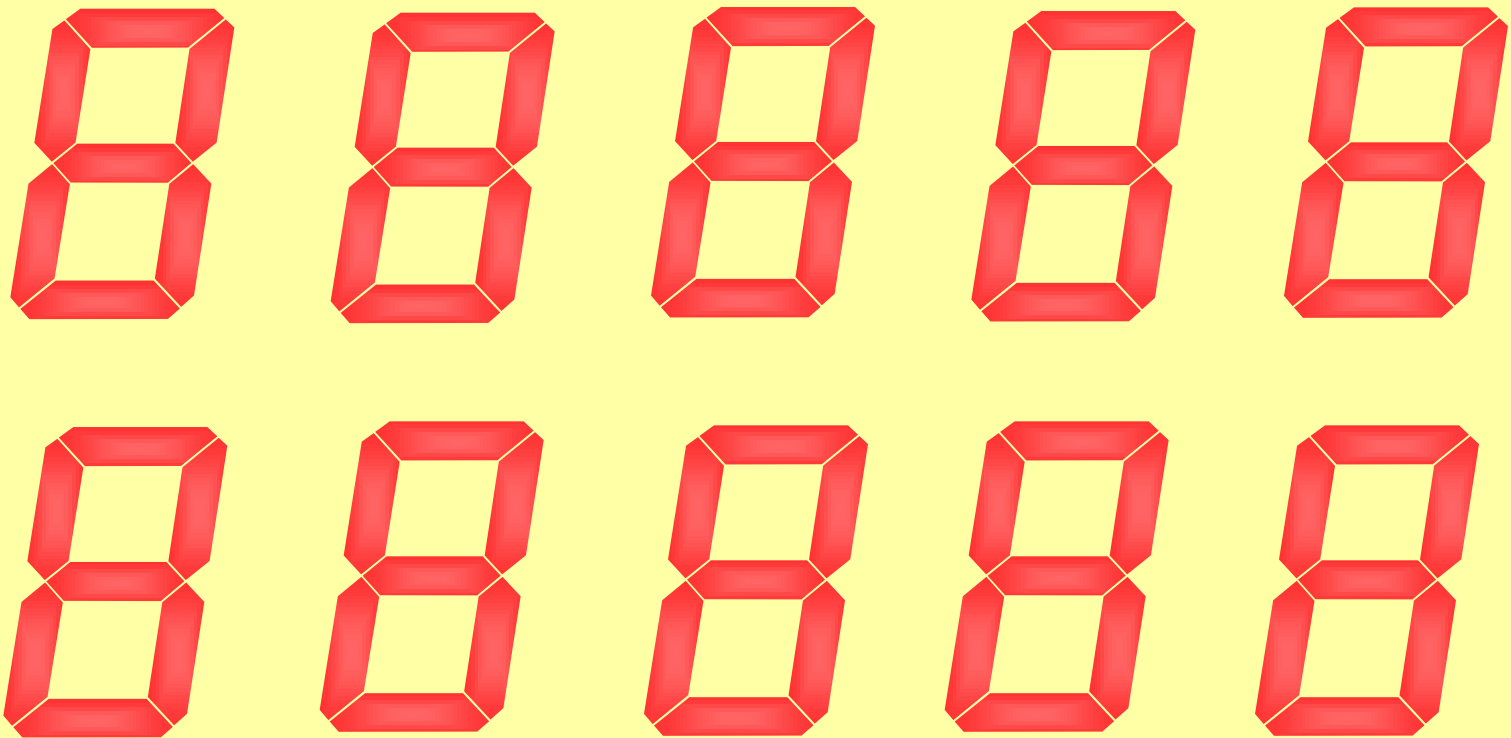
- The reason why the rectangle has to be slightly larger than the number “8” is that the sprites have to always have the same dimension regardless of the digit (we get different digits by deleting segments but keeping the rectangle underneath). This way, sprites will be registered (aligned) to one another.
- Slightly move the segments (by using the arrow keys) as to generate small but equal spaces between them (like in a real digital display).



- Make sure to create as even spaces as possible and about the right size. You can study a real digital display for this.
- After this, convert the rectangle in a transparent borderless rectangle (no fill / no line), eliminated the transparency of the segments and slightly adjusted the color to a pale red.
- You can also use a 2 color scheme for the fill in order to model the fringing effects of LED segment illumination (I did this here – as you can see the border of each segment is solid red and the center is a little pale red).
- Remove the border of each segment (double click -> -> line -> color -> no line)
- When you finish **“group”** everything (all 7 Segments plus the invisible rectangle underneath) !!!



- Now you can resize the grouped shape and copy it 9 times.



- Ungroup EVERYTHING and start deleting segments being careful not to move anything.



- After this, group each digit separately (segments plus their underlying rectangle), and we have the sprites ready to be used. **Again, be very careful not to move anything as the slightest movement of a single segment will destroy the sprite registration and will result in a jitter of the segment !!!**

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Conclusions:

- A method for creating sprites was explained.
- For obtaining good quality, registered sprites the following steps must be followed:
 1. Generate a template
 2. Fill the template with “segment” shapes, then remove the template
 3. Add a bottom transparent rectangle and group everything
 4. Copy the composite shape as many times as you need
 5. Ungroup all, then delete selectively some of the segments
 6. Regroup the shapes each to the original “family” of objects (make sure to include the transparent rectangle in the group)
- *Next presentation will show how to use the sprites we built in a chart to generate a clock animation.*