Behind the Digital Screen
Assignment 1: Graphics

Deadline: Monday, 2/1, 3pm (one hour before class begins)

KEEP CALM AND CARRY ON

The assignment is written such that a person who has never "touched" a computer graphic can understand and complete the steps in full. There are *many* instructions in this assignment, however most correspond to a very quick action, so don't be alarmed by the number of steps!

Objectives:
- Become familiar with different types of web graphics.
- Understand the difference between raster and vector formats.
- Explore the relationship between a format and what it can represent.
  (Using examples: alpha channel, editing raw files, and color modes).

What to Turn in:

During the assignment you will need to save several files that you will later submit when turning in your work. The deliverable files below will make sense as you go through the assignment.

Labels refer to the **steps** in this document. You will obtain the text response for A42, for example, in step 42 of Section A, and so on.

Please **name these files** with the numbers on this list in the title to help us easily give you credit! (e.g., 1.png 2.svg 3.svg 4.png 5.png 6.png 7.png 8.png 9.svg 10.docx)

- ❑ 1. PNG file with transparency layer (step A37)
- ❑ 2. Raster image you found on the Internet (step A41)
- ❑ 3. PNG composited image (step A58)
- ❑ 4. SVG file containing rectangles, circle/oval, word, etc. (step B29)
- ❑ 5. SVG file that used to contain a single triangle (after text editor manipulations) (step B56)
- ❑ 6. color PNG (step C9)
- ❑ 7. grayscale PNG (step C11)
- ❑ 8. duotone (1-bit) PNG (step C16)
- ❑ 9. five-color PNG (step C20)
- ❑ 10. custom palette PNG (step C23)
- ❑ 11. your SVG graphic file (from part D)
- ❑ 12. your lab write-up (a Microsoft Word file)

Upload these files to the class Canvas site with a timestamp before the deadline.

Part Zero: Before you begin

What You'll Need to Complete This Assignment:
- A raster image editor: **GIMP** (from the class software page: http://313.niftyc.org/software)
- A vector image editor: **Inkscape** (from the class software page: http://313.niftyc.org/software)
- Internet access, a web browser, and a basic text editor such as one built-in to your operating system (e.g. Notepad, TextEdit).
- A place to save your work (a USB drive, Google Drive, your computer's hard drive, etc.)

Alternative Software:
> If you want to, you can use this alternative software. However this lab assignment will only contain instructions for the preferred software listed above.

- Instead of **GIMP**, you can use Adobe Photoshop
- Instead of **Inkscape**, you can use Adobe Illustrator

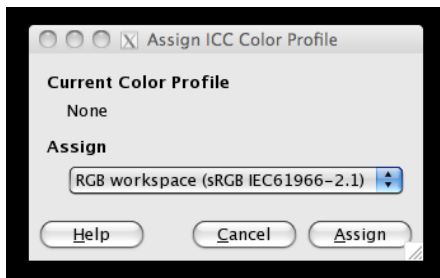## Part A. Bitmaps and transparency

OVERVIEW: In this section you will create a raster image with a transparency (alpha) layer, composite this image on a second image, duplicate the result, and manipulate its scale using the image editing software GIMP.

1. **Pick an image** to start with. Open a web browser and navigate to the following page: http://commons.wikimedia.org/wiki/Category:Images_uploaded_at_reduced_resolution This is a Wikimedia Commons page containing raster images that were uploaded at reduced resolution.

2. **Locate the sunflower** on this page, it is labeled '200px-Fleur-de-Tournes… 74,835 bytes'. Instead of visually searching this long page for a sunflower, use your web browser's built-in text find function. Activate the text find tool by pressing CTRL + F (on a PC) or Command (⌘) + F (on a Mac) at the same time. This text find tool is also accessible through the menus at the top of your browser (e.g. in Firefox you would go to Edit > Find). Enter "fleu" in the find box and press ENTER. This will take you to the proper image on the page.

3. Once you locate this sunflower image on the page, **click on the image**. The image is linked to another page where you can download a PNG image file named '200px-Fleur-de-Tournesol.PNG'.

4. **Download the file** 200px-Fleur-de-Tournesol.PNG to your local computer. Right click (or CTRL + right click) on the image and then choose "save image as…" and save the file to your local machine. Be sure to note where you save this file as you will be using it in the next steps.

5. On your computer, **open GIMP**, our image editing software. (GIMP is a free alternative to Adobe Photoshop containing many of Photoshop's most commonly used functions.)
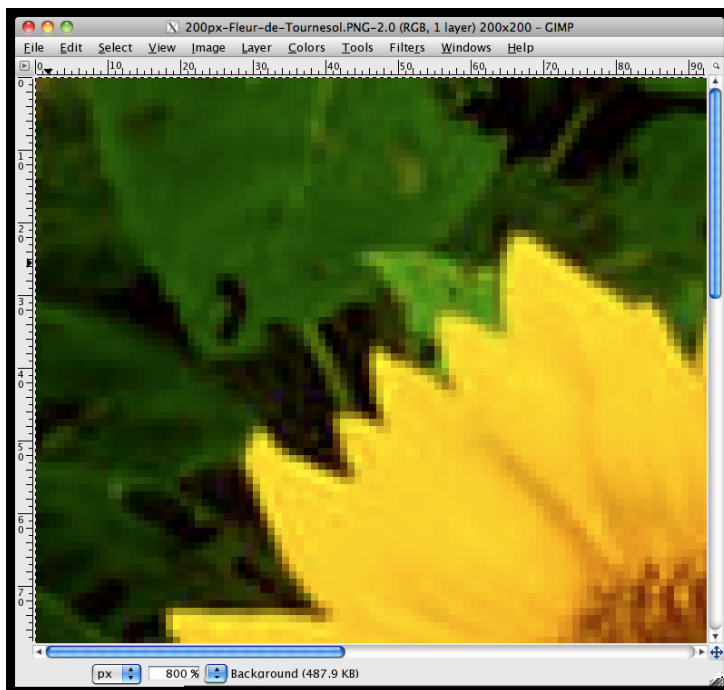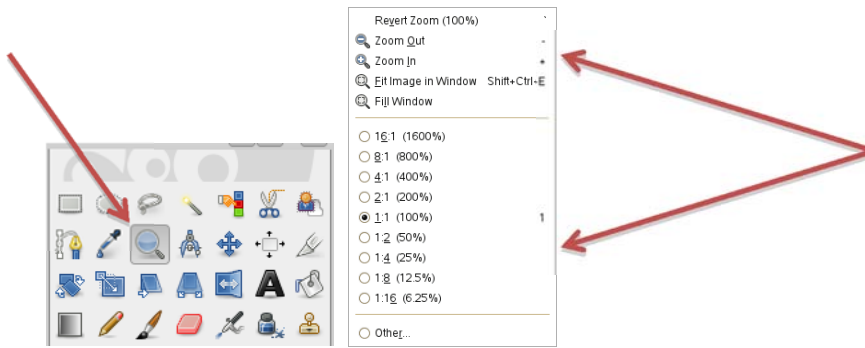
EXTRA HELP

By default, GIMP launches **three separate windows**: Image window, Toolbox window, & Layers window. In order to do anything in a different window (e.g. switch from using the Image window to selecting a new cursor tool in the Toolbox window, you must first select (click) on that window to activate it and then click *again* for your selection. This is only the case when you are moving from Image window to Toolbox to Layers and in between. So click to activate a GIMP window, then click again to make changes. This will make more sense as you use the program.

6. In GIMP, **open the file** by selecting File > Open and browse to the 200px-Fleur-de-Tournesol.PNG file stored on your local machine, the one you saved in the previous steps. (Alternatively, to open files in GIMP and most other applications you can use the file open shortcut CTRL + O (on a PC) or Command (⌘) + O (on a Mac).

7. Before the sunflower image contained in file 200px-Fleur-de-Tournesol.PNG opens in GIMP, a dialog box will prompt you to first **assign a color profile** to this image. The default color profile should be "RGB workspace (sRGB …)". If this appears in the Assign dropdown click on the Assign button. If not, select this 'RGB workspace…' color profile from the drop down list and then select the Assign button. If no color profile dialog appears just proceed to the next step anyways.
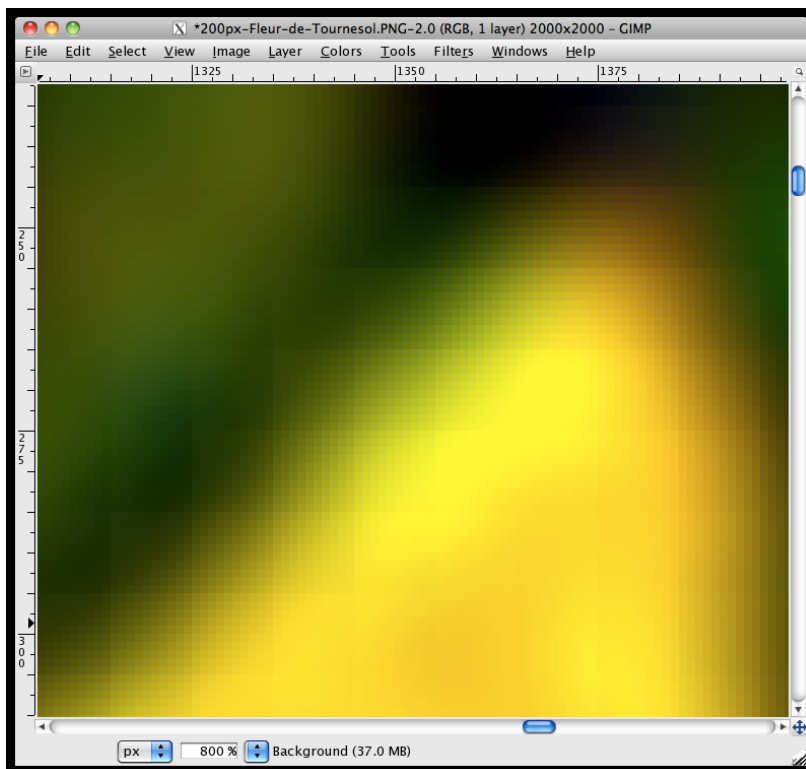

8. When the PNG bitmap image file opens in the GIMP Image window, **you should see the image containing a yellow sunflower** with green background appear in a new Gimp Image window.

9. In GIMP, perform the following edits to this PNG image file: From the drop down menus at the top of the GIMP Image window, select Image > Scale Image. A **Scale Image** dialog will appear revealing the Image Size in pixels. Notice the Width and Height are currently 200 pixels each. In the Scale Image dialog select Cancel without changing anything. (We just want to see how big the image is in pixels.)

10. Now view the 200x200 pixel image at **different zoom levels** in GIMP. You can do this a number of ways. One is to press the + ('plus') and – ('minus') keys. On some versions of GIMP you can also click on the up/down button located next to the zoom % level at the bottom of the GIMP Image window. You can also type a numeric value in the zoom % box next to the up/down button and press ENTER. Yet another method is to select the View drop down menu from the top of the GIMP Image window and select Zoom (x%) > then choose a zoom level. Still yet another method…(Get the idea? There are many ways to do the same thing. TMTOWTDI.) is to navigate the cursor to the Toolbox window and select the magnifying glass icon, and then with magnifying glass cursor left click (zoom in) or CTRL + left click (zoom out) on the image to alter the zoom.

11. **Zoom to 500%** using the zoom % box at the bottom of the screen: enter the value 500% and press ENTER. You should be able to see individual pixels in the sunflower bitmap image. Using your mouse scroll wheel function or the scroll buttons on the right and bottom of the GIMP Image window, navigate and pan around the image while zoomed in 500%.

12. Do the same for 1000%, 2000%, and higher %'s as you increasingly **notice the pixels and underlying raster grid** contained in the PNG file. Eventually all you should see on the screen are undecipherable squares of color. There are 200 of these squares in the vertical dimension and 200 in the horizontal dimension. In this bitmap example, each pixel corresponds to a unique (x, y) numerical address in the 200 by 200 pixel grid of the image file, and each of these pixels exhibits a single color value when displayed using the RGB workspace in GIMP.

13. **Play around with various zoom settings** until it is clear to you why this bitmap image has a resolution of 200 x 200 pixels and how these individual units combine to form the overall image.

14. Now select from the drop down menus at the top of the Image window: View > Zoom (x%) > **Fit Image in GIMP Image Window**. This will re-zoom the image so it fills your GIMP Image window and is easiest to work with. Previously when you were zooming in and out in GIMP you were simply commanding the software to render the image at a different pixel density on your computer's screen, but were NOT changing the actual stored resolution in your PNG image file (the pixels in the bitmap remained 200x200, you just zoomed in on your screen).

15. In GIMP, using the drop down menus at the top of the Image window, return to the Image > **Scale Image…** dialog.

16. Using the Scale Image dialog you are going to **"scale up" this sunflower image**. You'll add more samples (or resolution) to an image that has already been sampled. Enter the numerical values 2000 x 2000 (replacing 200 x 200) in the Width and Height boxes and then select the Scale button.

17. Notice: You have now 'scaled up' this bitmap image by **introducing new pixels** (this is very bad!) that were not previously stored in the image. For each of the previous pixels in the 200 x 200 bitmap image, you now have 100 new pixels corresponding to each original pixel. You have effectively 'exploded' each old pixel by coping it 99 times. Notice how the result is nothing like a crisp and clear 2000 x 2000 photograph that started at a high resolution.

18. With this scaled up image, zoom in to 1000% and then **scroll to the area of the image** where the exterior of the yellow sunflower meets the green background. You should be able to see the 10 x 10 blocks of pixels, most visible near the boundary of the yellow and green touching regions. For every 1 original pixel you added 99 more! Remember this is very bad.

19. Notice: While this scaled up image is technically 10 times larger in both spatial (height/width) dimensions, **the new pixels are just copies** ('clumps') of pixels resulting in a blurry yet technically 'high resolution' (2000 x 2000) image.

TIP: Changing a relatively low resolution raster (bitmap) image to a higher resolution image is almost always a bad idea and should be avoided.

---

20. An advisory: In the previous steps you changed a 'low resolution' bitmap/raster image to a 'high resolution' image simply by copying pixels. Notice the results of trying to add pixels to a bitmap/raster image: the computer is happy to let you do this, it will never stop you, however the resulting "larger" image looks much worse than the smaller original. In general, you should only *decrease* the resolution of a bitmap/raster image *never increase it* (never add new copies of existing pixels). You could for example go from a 200x200 image to 100x100 to reduce the size of the image without any additional loss in image quality. Under normal circumstances for displaying bitmap/raster images *you should never increase the resolution of a bitmap (raster) image*. Please re-read this last underlined statement, again and again, and make the following pledge: "I will never increase the resolution of a bitmap/raster image." Write it down, Tweet it, Blog it, Tumblr it, Snapchat it, make it your Facebook status, whatever it takes to remember this. There are not many **unforgivable things** when working in digital media, however 'scaling up' a raster image is one.

21. Now we want to revert to the original, unaltered, 200x200 sunflower image. You can simply **use the undo function** in GIMP by selecting from the top drop down menus in the Image window: 'Edit > Undo' or use keyboard shortcut CRTL + Z. Alternatively, you could also close the altered 2000x2000 image (do not save when prompted) and reopen the original 200x200 PNG bitmap file. If you accidentally resave the 2000x2000 image simply re-download it from the Wikimedia Commons.

22. With the original 200x200 sunflower PNG bitmap file opened in GIMP, using your mouse cursor, select from the drop down menus at the top of the Image Window: View > Zoom (x%) > **Fit Image in Window**. You can resize this Image window by dragging the bottom right corner, and then continue fitting the image to its size as helpful using the Fit Image in Window option.

23. **Add a transparency (alpha) layer** to your PNG image: From the drop down menu at the top choose Layer > Transparency > Add Alpha Channel. You will not see any visible changes at this time.

24. From the Toolbox window, using your mouse cursor **choose the Fuzzy Select Tool** to change your cursor's functionality.[1] This tool looks like a magic wand. It should be in the top row of the Toolbox near the middle of this row. The Fuzzy Select Tool in GIMP (and many other applications) is a quick and dirty tool for selecting contiguous groups of pixels based on their relative intensity/color values to one another in the selected region. You might use it if you are in a hurry or have very clear and distinct intensity/color boundaries in your image. For the sunflower image it works pretty well for what we want to do.

---

[1] GIMP's "Fuzzy Select" tool is called the "Magic Wand" in Adobe Photoshop.
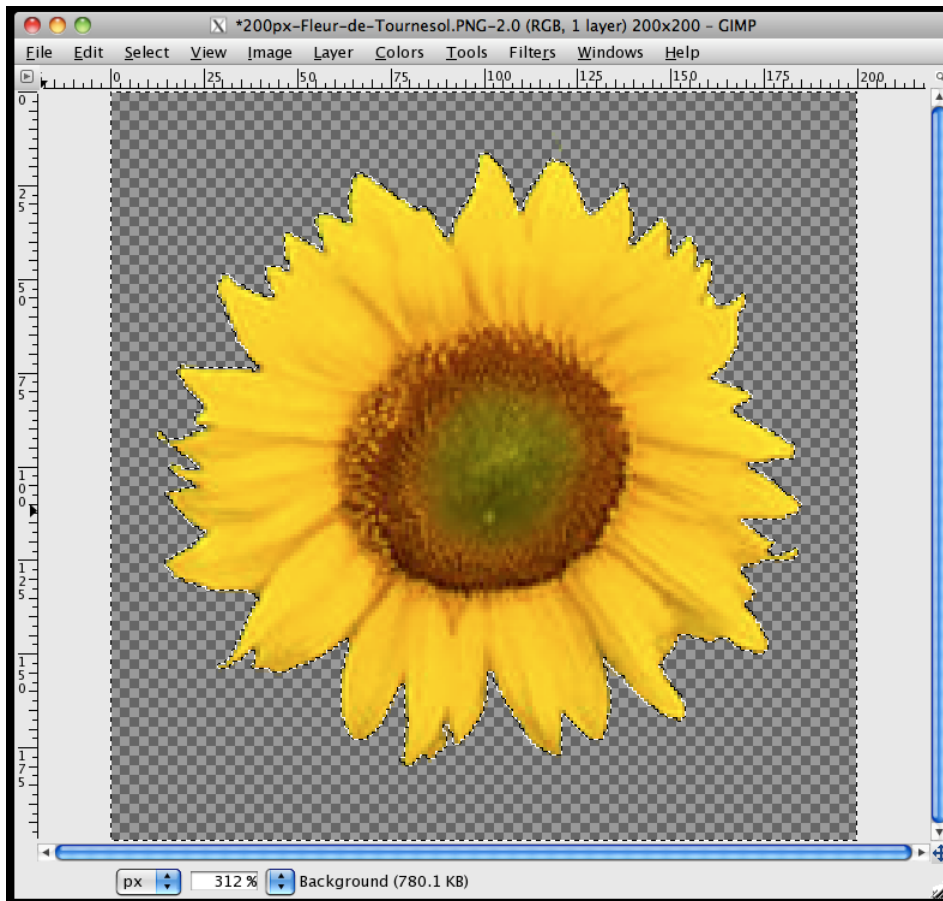
25. Note: Once you choose the Fuzzy Select Tool for your GIMP cursor, hover the cursor over the sunflower image. Observe how **the mouse cursor now looks like the Fuzzy Select** (magic wand) Tool icon. This is how cursor selection works in GIMP: your cursor will reflect the current Tool you have selected previously in the Toolbox.

26. With the Fuzzy Select Tool active, in the bottom half of the Toolbox window you can **find a few settings** that affect it (Antialiasing, Feather edges, etc.).

27. **Enter the following settings** for the Fuzzy Select Tool: check *Antialiasing* and uncheck *Feather edges*, check *Select transparent areas* and check *Sample merged*. Ether by using the slider or entering a numerical value, set the *Threshold* value to 115.0. The *Select by* drop down menu should be set to *Composite*.

28. On your sunflower image in the Image window, using the Fuzzy Select Tool, **left-click on an outer region** near the image's edge, somewhere not touching the yellow (the flower portion). For example left-click in the top-left corner of the image.

29. You have now selected a contiguous region of bitmap pixels based on color, using a Threshold of 115. **Notice the blinking dashed line** indicating your area of selection. Finding the proper Threshold is key to using this tool. To notice how Threshold works for this and other tools, **raise and lower this Threshold** value and select various regions of the sunflower image with your mouse curse at different Threshold values. Notice how higher Threshold values correspond to more pixels selected in contiguous regions and vice versa.

30. **Deselect all pixels** by going to the top drop down menu at the top of the Image window: Select > None.

31. With the Fuzzy Select Tool active, **reset its parameters** to those specified previously in step 27 (including setting Threshold at 115.0) and once again select an outer region of the image, somewhere in the green/black area and NOT on the yellow part of the sunflower.

32. With this background green/black portion selected (indicated by blinking dashed line), in the drop down menus at the top of the Image window: choose **Edit > Clear**.

33. All of the green/black background should disappear (or nearly all, depending on where you clicked the Fuzzy Select Tool). You have just **deleted the intensity/color information** for these pixels and as a result they are now transparent in GIMP as indicated by the white/gray checkered

pattern. Anytime you see this white/gray pattern it signifies that these pixels are empty and thus transparent.

34. Using drop down menu at top choose **Select > None**.

35. Depending on where in the green/black region you clicked using the Fuzzy Select Tool, you may have a few remaining non-flower pixels in your image. If so, from the Toolbox window **change your mouse cursor to the Erase Tool**. It looks like a pink eraser and should be in the fourth row near the middle, directly down a few rows from the Fuzzy Select Tool. Notice that once you select the Erase Tool the parameters in your Toolbox change. You can now set parameters for this Erase Tool. Changing the Scale alters the size of your eraser. Using the Erase Tool **remove any green/black pixels** that were not deleted. You can increase your precision by both zooming in and increasing/decreasing the size of your Erase Tool cursor.

36. Get ready: Once you have a yellow sunflower with a transparent (white/gray checkered) background, you will now save this image (to be used later) in a way that preserves this transparency. **Some raster/bitmap file formats do not allow transparency** layers and assign any transparent regions to white or some other color when they are saved (such as jpeg files). However PNG files allow for transparency (or alpha) channels.

37. **Save the new PNG file** with this transparency layer: File > Export As... Rename the file and select place to save the image. (Be sure you can find this location again!) From the Select File Type menu in the Export As…dialog, select the following option: File Type: PNG Image / Extension: png.

> **IMPORTANT**: This .png file is the **first file to be turned in** for this assignment. Save it in the folder where you will keep all of the files (e.g., on your USB drive) that you will turn in later. Please put a "1" somewhere in the filename (e.g., sandvig-1.png).
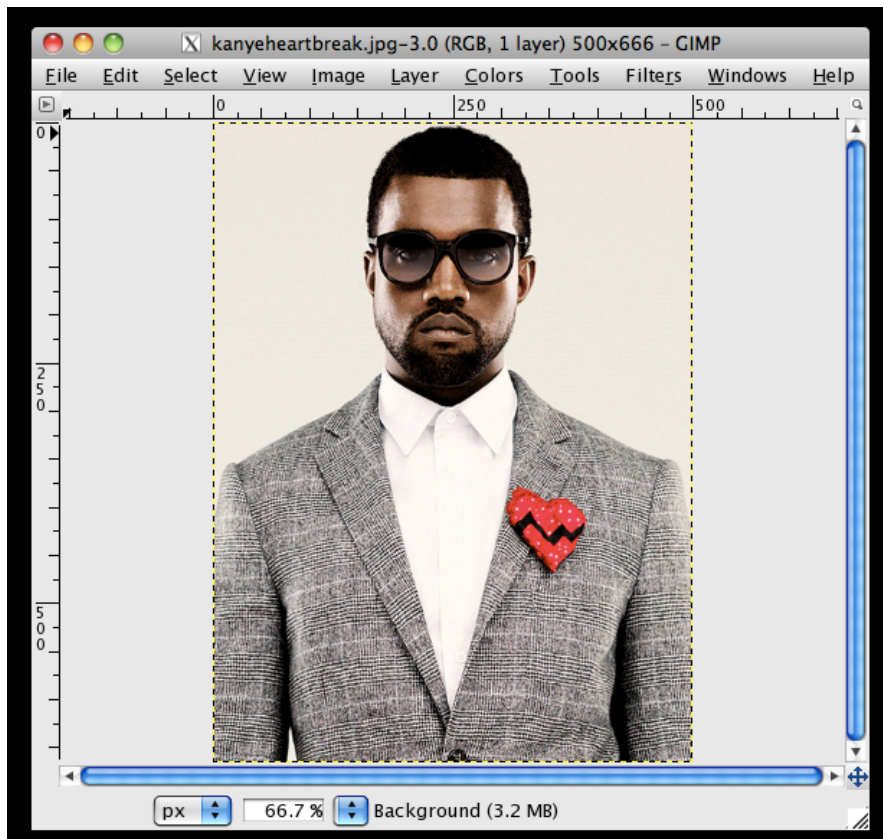
38. A Save PNG dialog will appear, you can usually **accept the defaults** which should be the following (if they are not change them): 4 boxes checked: *Save gamma*, *Save resolution*, *Save creation time*, *Save color values from transparent pixels* (this fourth one is most important for this exercise, it must be checked to preserve an transparency/alpha layer in your PNG file). Choose Save.

39. **Close the sunflower** image: drop down menu at top choose File > Close View.

40. Now **open your newer PNG file** with its transparency layer **using several applications** on your computer. Try Web browsers, photo/picture viewers (PC), Finder & Preview (Mac), etc. With this PNG file opened in your chosen web browser, zoom in as far as your browser allows. Notice how "pixelated" the image appears when viewed at increasingly larger screen resolutions. Many applications insert white for the transparent pixels, most web browsers do this. Each application

handles how transparent pixels are displayed, and some of them may display it differently -- using the white/gray checkered pattern, white, black, etc.

41. Using a web browser, **find and download a raster/bitmap image** (class appropriate: no pornography, violent/vulgar content, etc.). This can be a .jpg, .png, .tif or others as long as it is a raster/bitmap file and as long as it is at least 400 pixels in each direction (height/width), so minimum size 400x400. There are millions (billions? trillions?) of digital images accessible online, just pick one that you want to work with and save it to your local computer. Based on the number of images on the internet, no two students' images should be the same (do not use the same image as any of your classmates).

> **IMPORTANT**: The URL where you found your image is the **first written answer** in your lab report. You probably want to paste it into your lab report now. The original bitmap image is the **second file to be turned in** for the assignment. Save a copy of the image to the folder where you will keep your images to turn in, and please include a "2" in the filename.
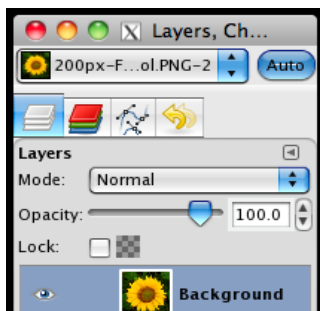
42. **Open this raster/bitmap image** in GIMP. (Kanye is our choice, yours should be different.)
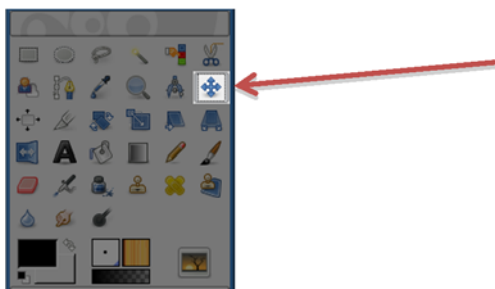

43. Also **open the modified sunflower image with transparency layer** that you created in the previous section. You will see two Image windows for these two images in GIMP. Notice how each Image window has its own drop down menus at the top (e.g. File, Edit, …), yet there remains only a single Toolbox window and Layers window. These Layers window correspond to

whichever Image window you last opened, clicked on, or altered and the Toolbox always corresponds to your current mouse cursor.
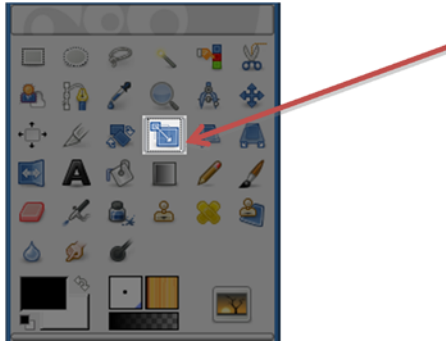
44. In the modified sunflower image, from drop-down menus at top of the Image window, choose **Select > All**. This selects all pixels including the transparent (empty) ones.

45. **Copy the entire sunflower image**: choose Edit > Copy.

46. With the sunflower image on your computer's clipboard, **click on the other Image** window in GIMP, the one displaying the image you chose yourself and downloaded from the internet.

47. **Paste the sunflower image into a new layer** in this image. From Image window of your chosen image: choose Edit > Paste as > New Layer.
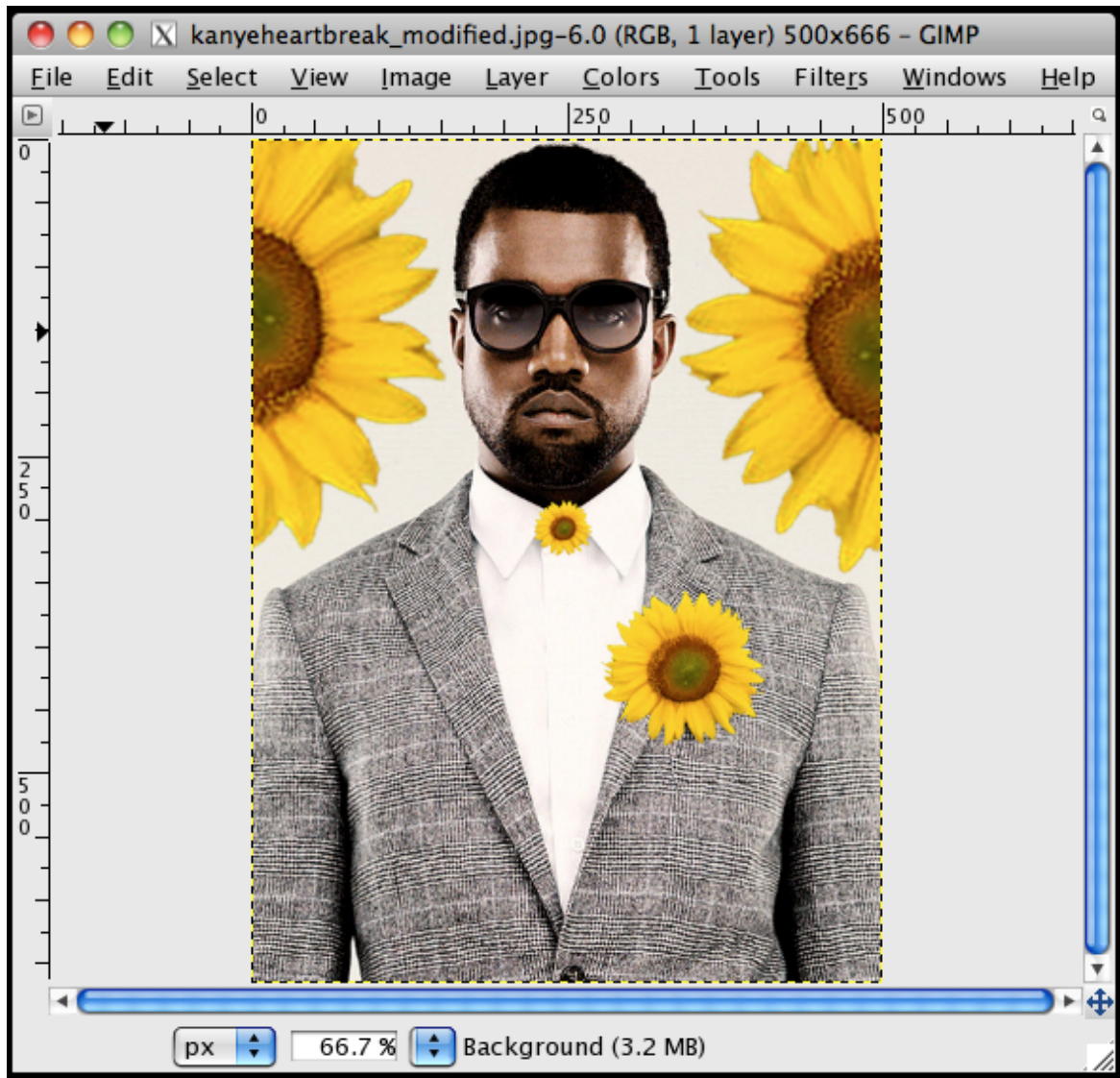

48. Notice: You should now see your sunflower image (with no background) appear somewhere 'on top' of the internet image you chose. You have just **composited two raster (bitmap) images**.

49. Also observe that **a new layer now appears** in the GIMP Layers window above your background layer. It should be above your background image on this list of layers. This new layer contains only the sunflower pixels and has a transparent background. It must be positioned above (on top) of your downloaded background image in this Layers window as GIMP 'projects' each layer in order starting from the top and moving to the bottom of this layers list.

50. Make sure in the Layers window you have **selected (highlighted) the sunflower layer**, it should be highlighted in blue. Whenever you have more than one layer you must select the appropriate layer that you want to work with by clicking on it in the Layers window before you can alter its contents.

51. In the cursor Toolbox, **click the Move Tool**, it looks like four arrows pointing in different directions, should be in the second row.

52. Using the Move Tool, left-click and hold on the sunflower image and **drag it to your desired location** within your larger base image.

53. **Click the Scale Tool** from the Toolbox, located in the third row, icon is two blue squares one scaling to the size of the other.

54. With the sunflower layer selected in the GIMP Layers window and the Scale Tool for your cursor, **scale the sunflower up or down** by left clicking and holding on the sunflower. (Despite the previous stated rule of NEVER scaling up a bitmap image and your previous pledge never to do so (!) it is okay for learning purposes in this exercise, after all there are exceptions to every rule.) Notice what happens when you hold CTRL while clicking and dragging to change the scale—the aspect ratio remains the same preventing you from skewing your layer out of its original proportions when scaling it. Also when you initiate the Scale Tool a Scale dialog appears allow you to alternatively numerically scale the layer to a specified pixel size, height/width.

55. In addition to scaling this layer up or down, you can copy and paste this layer again and again in the same image. Or alternatively, once you have scaled the sunflower as you would like, you can **Duplicate this layer** in GIMP to save time. To duplicate a layer highlight this layer and choose Layer > Duplicate Layer.

56. Copy/paste or **duplicate the sunflower** layer at least two more times, for a minimum of **three sunflowers** appearing on top of your chosen internet image.

57. You should now have at least three sunflowers appearing on your chosen image. Alter the position and size of these. You can **create as many sunflower layers as your heart desires**, with different scales and aspect ratios, just make sure the underlying background image is not completely covered so that it is recognizable from your original source image.

58. **Save the modified image** containing your internet image and sunflower layer(s) as a new PNG file to your local computer. File > Export As… > (use previous PNG saving instructions).

> **IMPORTANT**: This is the **third image you need to turn in** to complete this assignment. Please include a "3" in the filename.

59. **Double-check**: You should have three files from the previous steps as you will be turning these in. They include: 1) PNG modified sunflower image containing transparent background, 2) Your original chosen image you downloaded from the internet in its unaltered form, 3) The altered internet image containing at least three sunflowers. You should also have completed the first question in your lab report (the URL for the image you found.)
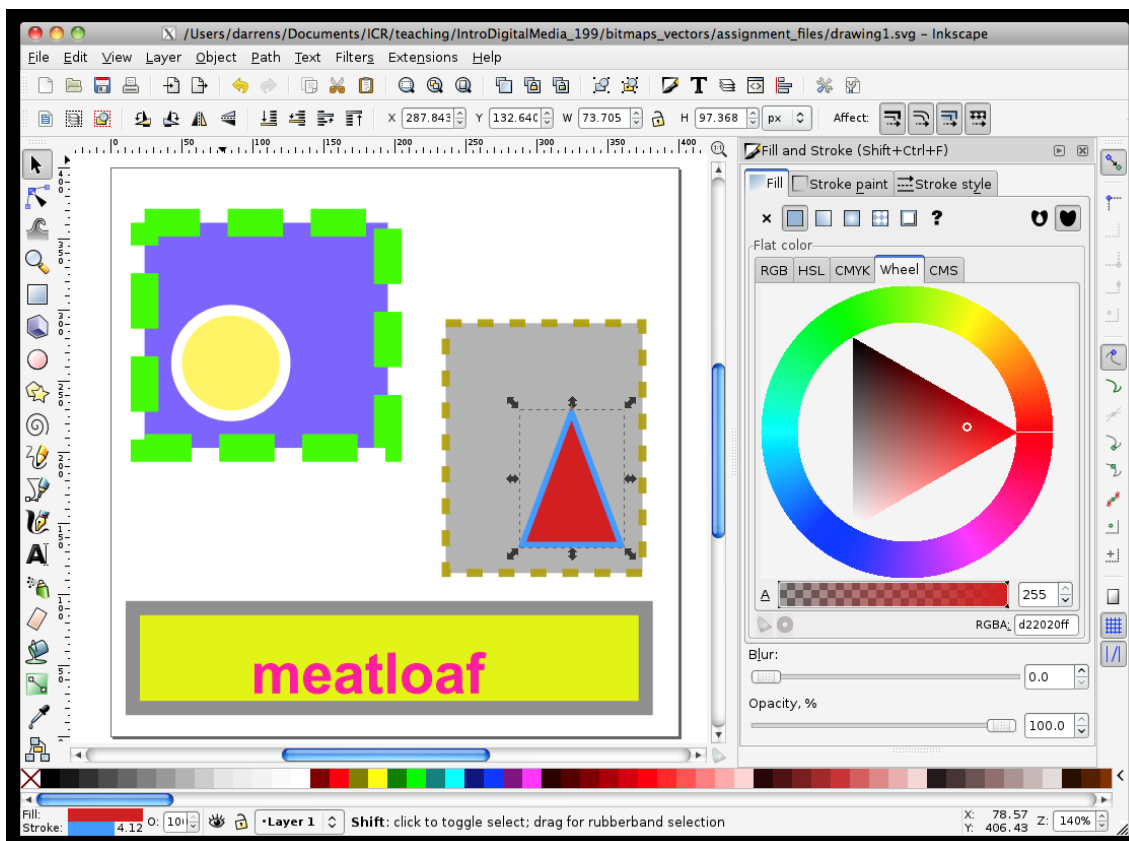

You're done with part A!

Part B. Vector graphics

OVERVIEW: In the previous section you were working exclusively with bitmaps/raster files (PNG, JPEG, etc.). In this section, B. Vector graphics, you will be working with an entirely different type of graphic file, a vector-based file. While bitmaps and vector images may sometimes appear similar when displayed, their underlying structure and corresponding strengths and weaknesses are very different. In this section you will create a vector graphic and manipulate it using the application Inkscape (as well as other methods).

1. If you've never used Inkscape before (which is likely), first **go through the Inkscape Basic tutorial** in full. The tutorial is accessed within the application itself, by first launching Inkscape and opening the tutorial using the menus at the top of the screen: Help > Tutorials > Inkscape: Basic.

2. **Open the application Inkscape**. (If the Inkscape Basic tutorial file is still open, close it now.)

3. Once the Inkscape application is open, **resize the window** as necessary by left clicking and dragging the bottom right corner.

4. Change the document page properties by choosing File > Document Properties, on the Page tab **change the Width and Height** so both are 400.00 px. You can just type these values in to the Width/Height boxes. Close the Document Properties dialog.

5. Double-check: You should see **a square, outlined box** in the middle of the Inkscape drawing window. You will create a graphic inside this bounding box.

6. Use your mouse cursor to **click the Create Rectangles and Squares tool** (a blue/white square icon) from the Toolbox on the left of the Inkscape application window. Notice a small square now appears attached to your cursor, signaling which mouse cursor Tool is currently active.

7. **Draw three rectangular non-touching shapes** within the bounding box using this Create Rectangles and Squares tool.

8. Next, from the Toolbox **click the Create Circles tool** with your cursor, this is the pink circle.

9. Inside one of your three rectangles **draw a circular or oval shape**.

10. From the Toolbox **click the Create Stars and Polygons tool**.

11. To set this Create stars and polygon tool to create a three sided shape, first at the top of the screen be sure the left yellow polygon is selected. Then to its right **set the number of corners** to 3.

12. Inside a different one of your three rectangles (one of the two without the circle/oval) **draw a triangle**.

13. For the third rectangle you will be creating *text* inside this box rather than a geometric shape. To do so first **click the Create and Edit Text Objects tool** from the toolbox on the left. This is the icon with a black A.

14. With the Create and Edit Text Objects tool active, **left-click inside your only remaining empty rectangle**. You should see a blinking cursor appear where you clicked.

15. **Type a word**. (Make sure it's a word you would say in front of your grandmother. Creators of any highly offensive words in this step or any other may be required to give a presentation to their lab section on the etymology and merits of their word.)

16. You can **change the font and size** of the text tool's output by adjusting these parameters in the drop down menus at the top of the Inkscape screen when this tool or any text is currently selected. Change the font and size so it is legible and fits inside your third empty rectangle.

17. From the Toolbox on the left, **click the black arrow (the Select and Transform Objects tool)** at the top of the Toolbox. This allows you to select graphic elements and manipulate them in various ways.

18. Use the Select and transform objects (arrow) tool to **move the text so that it is inside the box**. As needed, use this tool to ensure your circle/oval and triangle are also inside their respective rectangles. **Change the size of any of your shapes** or the text by choosing the Select and Transform Objects tool from the Toolbox and then clicking and dragging one of the black arrows that appears outlining the selected object.

19. Once you are happy with each shape's relative size, you will now alter the Fill and Stroke properties of your rectangles, circle/oval, and triangle, and change the color of your word. From the drop down menus at the top, open the Fill and Stroke parameters dialog by **clicking Object > Fill and Stroke**.

20. With the Select and transform objects tool (arrow) selected, **left click on one of your rectangles**. You will notice the black arrows extending outward from this rectangle, indicating that it is currently selected.

21. Notice: With this rectangle selected, in the Fill and Stroke parameters dialog, under the Fill tab **you should see five sub-tabs**: RGB, HSL, CMYK, Wheel, CMS. These sub-tabs allow you to alter the controls of the selected object using various color modes.

22. You will now **toggle between these sub-tab color modes** and alter the background of your three rectangles, circle/oval, triangle, and word.

23. With one of our objects/shapes highlighted, in the Fill and Stroke dialog select the Fill tab at the op left. Select the sub-tab RGB. Using the RGB channel controls **change the color of the fill of your selected shapes**. You can do this by manually entering a number between 0-255 in the four sections labeled R (red), G (green), B (blue), and A (alpha or transparency). Notice what happens to your shape as you alter these four numbers. As you might expect, setting R to 255, G to 0, and B to 0, produces a pure red color. In addition to typing in numeric values, you can also left click and drag side to side within the respective color gradients for RGBA.

24. Next, select the HSL sub-tab. The RGBA option corresponds to red, green, blue, and alpha/transparency parameters. HSL stands for Hue, Saturation, and Luminosity. Use the controls in the HSL sub-tab to **alter the hue, saturation, and luminosity** of your selected object.

25. Next, select the CMYK sub-tab. CMYK is more similar to RGB, with C (cyan), M (magenta), Y (yellow) color controls, but also with the addition of K (black) control as well as alpha control. **Change the color of your selected object using the CMYK sub-tab**.

26. Next, select the Wheel sub-tab. The Wheel color changing tool has three main controls. The first is the color to which the line extending out from one of the triangle's vertices is touching. This setting determines the hue. **Left click on the color spectrum ring to change the hue**. Next you should see a small white or black circle inside the triangle. **Click on this circle and drag it around** within the triangle. Notice how the color changes in intensity and saturation. Finally, there is a basic alpha control at the bottom of Wheel labeled "A."

27. In this same Fill and Stroke dialog, you will also notice two additional tabs at the top (in addition to Fill): they are Stroke paint and Stroke style. Stroke refers to the outline/border of your shape. **Change the Stroke paint parameters** for your rectangles, circle/oval, and triangle to alter the stroke colors for these shapes. **Change the Stroke style** of these shapes as well.

28. Notice that each time you must use the Select and transform objects (arrow) tool to indicate which item to change via the Fill and Stroke parameters dialog. You can also **hold down the shift key to select multiple objects**, and then change the Fill and Stroke of these items at the same time.
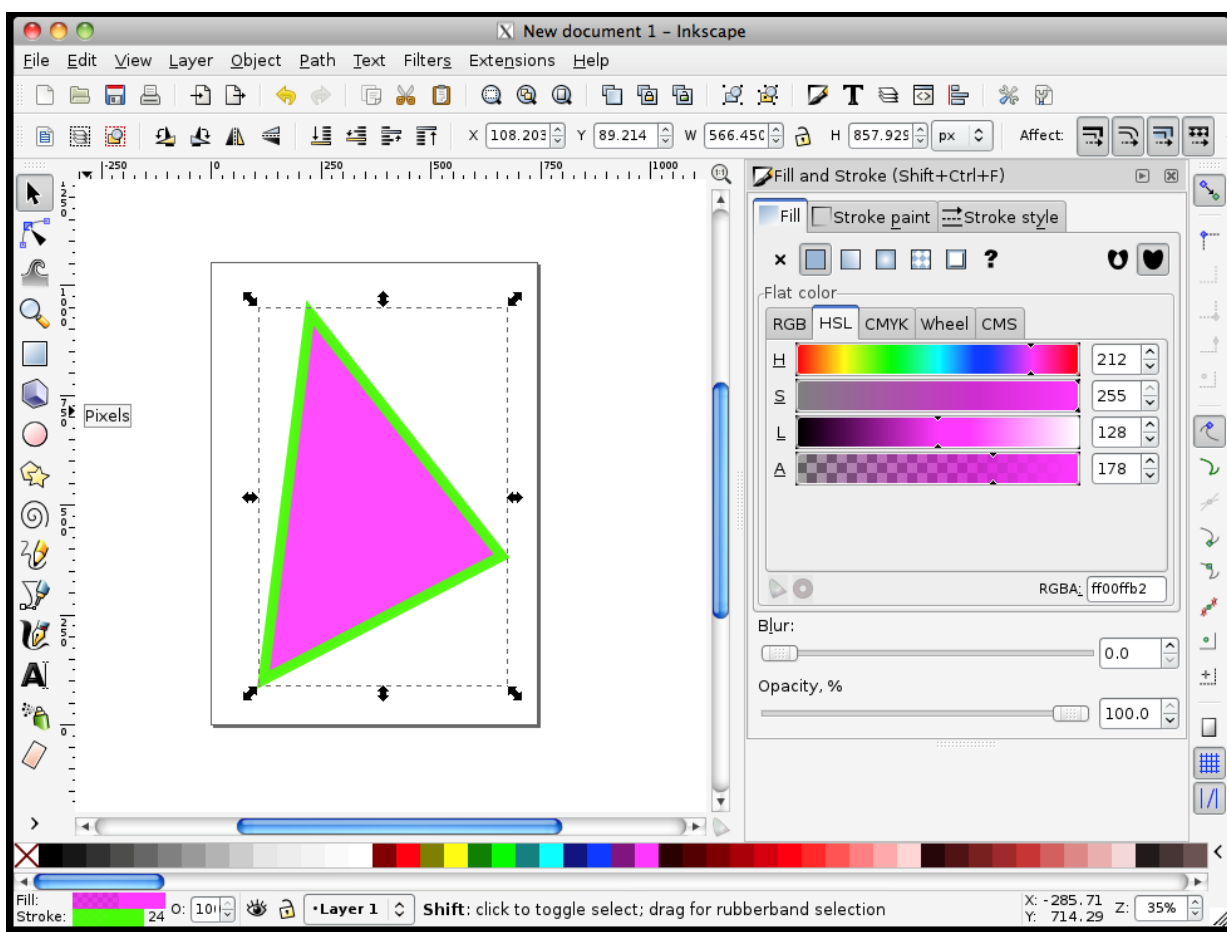

29. **Save your vector-based creation** as an SVG (Scalable Vector Graphics) file. Choose File > Save As…. The Select file to save to dialog will appear. From the drop down on the bottom right corner, make sure Inkscape SVG (*.svg) is selected. Name and save the file to your local

machine. You will need this file later.

> **IMPORTANT**: This is the **fourth file you will turn in**. Save a copy of it now. Please use a "4" in the filename.

30. In Inkscape you will now create a new file. **Close the SVG file** you created in the previous step and Choose File > New > Default.

31. In this new Inkscape file, **draw a single triangle** of any size. Alter its size as you wish, just as long as it remains inside the bounding box. Using the Fill and Stroke dialog alter these color and line properties as you wish.

32. Save this single triangle as a new SVG file—however this time **save it as a Plain SVG** rather than an Inkscape SVG (this will remove a lot of lines of code from the file). Choose File > Save As… then in the bottom right corner select Plain SVG (*.svg) as the file type.

33. **Close Inkscape** and ignore the message about saving a file "that may cause data loss".

34. You will now **open and view both SVG files with a web browser**. Open a web browser and in this application open your first SVG file, the one with multiple rectangles. (e.g. with Chrome you can drag the file into the browser window.)

> **Pitfall**: For this to work, you need to use an up-to-date version of your Web browser. For instance, IE 8 or below will not work.

35. Now **use this web browser's zoom** (or view) function to zoom in and increase the size of your SVG file on the screen. Continue zooming in as far as your browser will allow. Notice that the elements in your SVG file (circles, borders, text) scale up in a way that does not distort their quality; there is no pixelation. Again, this is one of the great advantages of vector graphics (non-rasterized graphics) when compared to bitmap (raster) graphic file formats.

36. In a web browser, **go the following URL**:
    http://www.w3schools.com/svg/tryit.asp?filename=trysvg_polygon
    (If you are not already familiar with the w3schools website, this is a great place to learn web design and web programming languages)

37. The "code" that makes up an SVG image can be written as plain text. This is an interactive page that allows you to **manipulate the contents of an SVG's code** on the left, then see the output on the right using the "See Result" button at the top-right of the text window.

38. Ignore the rest of the left window's code for now, but notice that **there is a tag named "svg."** It lists the size of the bounding box (height="210" width="500") then it contains **another tag named "polygon."** Use your browser's "Find in page…" command to find "svg" and "polygon" if necessary to ensure you understand the text we are interested in.

39. Notice: The triangle shown is described as **a "polygon" drawn between three anchor points**. These points are listed as x-y coordinates: polygon points="200,10 250,190 160,210" – there is also additional information about the color and outline of the polygon listed as style="fill:lime;stroke:purple;stroke-width:1".

40. Each of the three sets of coordinates for an anchor point is separated by a space. For instance, "200,10" is the first anchor point, at x=200 and y=10. **Change the three anchor points** by replacing these numbers with new ones. Clicking on the "See Result" button each time.

41. **Notice the "style" description.** This SVG file uses worded colors rather than numeric values. Try entering popular color names, spelled correctly of course. (Since we are just guessing, some color names may not work.) For these color fields you may also enter a six character RGB hex triplet such as FF0000 (pure red). Hex triplets consist of six character strings where the first two characters represent the red value, the second two characters the green value, and the third two characters the blue value. Each character must be either between 0-9 or A-F, where 0 is lowest and F is highest value (see http://en.wikipedia.org/wiki/Hex_color). These are the same values that we edited in step B23.

42. **Change the style elements** and update the visual display on the right each time using the update button.

43. Using a web browser, **open the second SVG file** you previously created in Inkscape, the one containing a single triangle.

44. **Zoom out so that you can see the entire triangle** with plenty of white space around it (so the triangle appears relatively small in the browser window).

45. Keeping the triangle SVG open and visible in the web browser, **open a simple built-in text editor** application on your computer. (For example: Notepad, TextEdit.)

46. Using this text editor, **open the same SVG file** that is simultaneously open in the web browser, the one you made containing the single triangle.

47. In the text editor, **you should see 30-40 lines of XML** format code.

    IMPORTANT: This is your **second lab report answer** to be turned in.

48. In the text editor, **locate the portion of this file in the text editor that begins <path d**=" This will be followed by the three anchor points of your triangle. It should resemble something like <path d="M 100.42855,415.21934 431.64645, (but with different numbers).

49. Alter one of these three numbers, **try to use a new number that is within 100 of the existing numbers**, at least at first. After you change one of these numbers, in the text editor save this file.

50. Then back in the web browser, **reload/refresh the page in the browser** (e.g. in Firefox choose View > Reload). Notice how you have changed the SVG vector file by simply altering these numbers in a text editor. (An SVG image is really just this list of codes and numbers.)

51. Back in the text editor, with the triangle SVG file still open, continue to **change the visual elements of your SVG file**. Note that when changing the polygon anchor points, it is very easy to make a triangle no longer a triangle based on where you position your points in space.

52. **Change the color of the fill** by altering the six character hex triplet that comes after the # using the text editor. For example, if your original file contained fill:#ffff00 you could change this to fill:#23acf5 (any six character hex triple containing 0-9 or A-F for each digit). Re-save this SVG file after each change and then reload your web browser to view what you changed.

53. **Change the opacity** of your triangle's fill using the text editor. For example, if it was fill-opacity:1 you could change this to fill-opacity:0.25 (opacity ranges from 0 to 1, 0 completely transparent and 1 completely opaque).

54. **Change the color of the stroke** using the text editor. For example if you have stroke:#ff2100 you could change this to stroke:#8888aa, and so on.

55. **Change the stroke-width** using the text editor.

56. In the text editor with your **altered** SVG XML text displayed, select all of this text and copy/paste it into your lab report.

    IMPORTANT: **This answer** is part of your lab report. Also, this file is **the fifth file** you will turn in for this assignment. Please name it with a "5" in the title.

57. Double-check: Before moving on, you should have **two SVG** files you have created and **two text responses** in your lab report.

You're done with part B!

Part C. Color modes

OVERVIEW: In this section you will toggle between color modes, altering the contents of a raster/bitmap image using GIMP.

1. Using a web browser, **navigate to the following URL**:
   http://www.flickr.com/photos/library_of_congress/sets/72157603671370361/

2. Using this Library of Congress Flickr project, you will be downloading a single bitmap image from the collection '1930s-40s in Color'. There are 1,615 color photos in this set, viewable on 23 different gallery pages (browse from page to page using page numbers at the bottom of any page). **Choose an image from the specific gallery page that corresponds to the number of your birth month plus 10**. So if you were born in January, choose an image on page 11 (10 + 1), June birthdays choose image on page 16 (6 + 10), and so on.

3. When you have decided on your bitmap image from this collection, **download the Medium 500 JPEG version** of your image by doing the following: From the grid of small square images, click on your chosen image. This will take you to a page with a larger view. At the top of this page you should see an Actions tab. Choose Actions > View all sizes. Also, enter the URL for this webpage under Response C3.

4. On the View all sizes page for your image you should see various bitmap files listed by size. **Click on the link to Medium 500**. This will take you to a 500x____ resolution version of this bitmap image. Once there right click on the image and choose Save Image As…

5. **Save this** Medium 500 bitmap file to your local computer.

6. **Open the application GIMP**.

7. In GIMP, **open the JPEG bitmap file you just downloaded** from the 1930s-1940s in Color collection.

8. **Assign the default RGB workspace** color profile to this image.

9. **Save this file as a PNG file**. Choose File > Save As… and select PNG file format in the Save dialog.

   IMPORTANT: This is **the sixth file** (RGB color) **you will turn in** for this assignment. Please name it with a "6" in the title.

10. In the drop down menu at the top, **choose Image > Mode > Grayscale**. Notice the image now contains no color displayed but only shades of gray. You have converted it to a black and white image.

11. Use "Save As…" to **save this grayscale version as another new PNG** bitmap file to your local computer (do not re-save over the color PNG file you created as you will need this later).
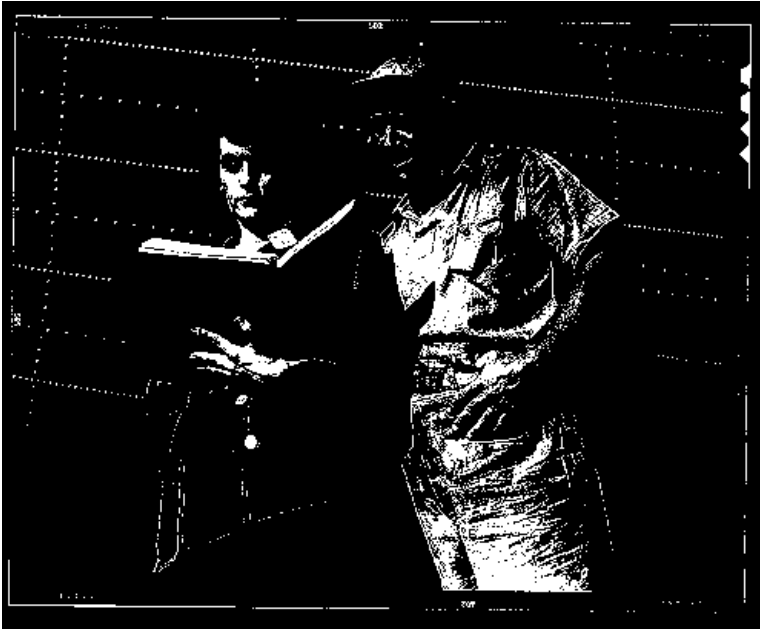
    IMPORTANT: This is **the seventh file** (grayscale) **you will turn in** for your assignment. Please name it with a "7" in the title.

12. To revert to the color PNG bitmap file you created, either **undo one step** (CTRL + Z, or Edit > Undo), or you may close the grayscale image and re-open the color PNG file you made.

13. With the **color** PNG file opened in GIMP, choose **Image > Mode > Indexed**…

14. An Indexed Color Conversion dialog will appear. Indexed color images specify each specific color that they contain in a "colormap." For your new Colormap **select the option Use black and white (1-bit) palette** and select the Convert button at the bottom right of this window.

15. Notice: You have now converted the original color image to a truly black and white only (not grayscale) bitmap image. **There are no shades of gray** in between because you specified the colormap contains only completely black or completely white. This is also called a 1-bit or duotone (each pixel is either on or off, a 1 or a 0, hence: 1-bit).

16. **Save this 1-bit image** as another new PNG bitmap file (again do not re-save over the other color and grayscale PNG files, you will need them later).

> **IMPORTANT**: This is **the eighth file** (1-bit) **you will turn in** for your assignment. Please title it with an "8" in the filename.

17. On your local computer, browse to the location where you saved the color, grayscale, and 1-bit (duotone) bitmap PNG image files. Look at the file sizes. **Notice the large disparity in the respective files sizes of these three files**, with the color likely twice or more the size of the grayscale and the duotone image incredibly small. Consider how this relationship between color mode and file size operates. Note the file sizes for each of the three images.

> **IMPORTANT**: This **written response** needs to be included in your lab report. Type it in now.

18. Either undo back to your color PNG file or **reopen the color PNG file**.

19. Choose Image > Mode > Index… and this time for your new Colormap **select Generate optimum palette** and for Maximum number of colors enter the value 5 and choose the Convert button on the bottom right corner of this window.

20. You have just converted your bitmap image to an image with a 5 color colormap. Notice the effect. **Save another new PNG bitmap file** from this 5 color image.

IMPORTANT: This is **the ninth file** (an image with a 5-color colormap) **you will turn in** for your assignment. Please name it with a "9" in the filename.

21. Once again, either undo or reopen your full color PNG image.

22. Select Image > Mode > Indexed… and select Use custom palette for your Colormap. Then from the small colored box beneath this option, left click on this box to expand a list of color palette options. Choose any option you like and then select Convert. Notice the effect on the image. (Play with these custom palettes, applying them and undoing, until you find one that you want to use for your image).

23. **Save this custom color palette bitmap** image as another new PNG file.

>   **IMPORTANT**: This is **the tenth file** (custom colormap) **you will turn in** for your assignment. Please name it with a "10" in the filename.

24. **Double-check**: You should have five image files and two answers completed in your report for this section.

You've finished part C!

Part D. Your Own Graphic

This last stage of the assignment **is open-ended** and is intended to allow you to gain further skills with vector graphics. Please create an SVG graphic for a purpose of your choice. For instance, you might want a graphic to **illustrate a flyer** for an upcoming event you are hosting, **a T-Shirt design** for a group you belong to, or **a logo** for your own (perhaps imaginary) consulting company.

REQUIREMENTS: Your own graphic…
- must be a SVG file
- must have a transparent background
- must contain text (at least one letter)
- must contain at least one other graphical element
- *and* must demonstrate **1 additional Inkscape vector graphics technique** that you teach yourself using the relevant tutorial. The choices are:

Tutorial Title (in Help > Tutorials)	*Technique (choose one):*
shapes	3-D composition using snap resize handles on rectangles
advanced	editing paths to make a complex path
	boolean operations/combining paths to make a complex path
	offset/inset/outset paths
tips and tricks	irregular gradients (radial or non-linear)
	radial tile clones
interpolate	interpolate
calligraphy	calligraphy (only if you already know something about calligraphy!)

Your file must demonstrate this technique. E.g., if you choose "editing paths," you should have a path that you edited in the final product.

> **IMPORTANT**: The name of the technique you chose is an answer in your lab report.

You are only graded on completion of these very basic content requirements and that the logo is submitted in a working SVG file. If it is fun for you to put more effort into this last section go for it, but all submissions that meet the basic requirements will receive credit. You are not graded on the aesthetic appeal or the extravagance of your graphic. You can receive an "A" on this part of the assignment based on the technical requirements alone.

EXTRA CREDIT. Even though you can receive an "A" based on the technical requirements alone, extra credit may be awarded for a particularly impressive graphic that showcases skills developed elsewhere in this assignment and can be used in the class as an example for students in future years.

Once you complete your own graphic in Inkscape, save it as an SVG file. Keep this file for including in your assignment submission.

> **IMPORTANT**: This is the eleventh **file you will turn in** for this assignment not counting your lab report.

Now complete your lab report. After you finish, use the checklist on page 1 to be sure you've got everything. Then turn in the assignment by uploading it to Canvas with a timestamp before the deadline.

> **IMPORTANT**: Your lab report is the final **file you will turn in**.

</assignment1>

BONUS WORK:

Lab assignment 1 is over, but if you are interested in learning more about vector graphics, or the assignment was too easy for you, you can receive extra credit for *bonus work*. For this assignment, the bonus work will be to teach yourself additional techniques from the Inkscape tutorials or from YouTube (or other) videos about Inkscape on the Web. You can use the list in Part D, or you can find your own additional technique on the Web that you would like to learn. You can decide how to demonstrate you have learned the technique. For instance, you might **upload an additional file** and **write a very short note about what you did** at the end of your lab report.

For this assignment each technique can receive up to +5% extra credit on this assignment, to a maximum of +40%.

> **IMPORTANT**: If you are submitting bonus work, be sure you make a note of this on the bottom of your lab report so that you receive credit for it.

kbai.