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| --- | --- |
| Room & Board: | $1251.21 |
| Tuition: | $1350.34 |
| Books | $635.33 |
| Misc: | $538.78 |
| Total: |  |

**RASTER AND VECTOR IMAGES**
The first classification method divides images into either raster or vector graphics. Raster graphics, also called bitmap graphics, refer to images where the color value of each pixel is stored. Examples of programs that operate on raster graphics are Microsoft Paint and Adobe Photoshop. Vector graphics refer to graphic images where the graphics are stored as objects (e.g., lines, ovals, and rectangles). Examples of programs that operate on vector graphics are Microsoft Word, Adobe Illustrator, and Macromedia Flash.

With raster images, as they are zoomed or magnified they become blurry, unclear, or pixilated. Vector images, on the other hand, appear clear regardless of how many times they are zoomed, since they are redrawn at the appropriate resolution. See examples of [zooming in on raster and vector images](http://arapaho.nsuok.edu/~rosener/papers/graphics/images-raster-vector). Furthermore, the information in raster images cannot be easily edited or searched since they simply contain the color value of each pixel needed to display the image. Vector images, however, are typically stored in plain text format which makes them easier to be read and modified by software applications. At the same time, since vector images are stored in plain text format they can be more easily indexed and searched.

**Raster Formats**
GIF - Graphics Interchange Format. GIF is a raster image format this is widely used on the Web. Files stored using this format are limited to 8 bits/pixel or 256 colors. The GIF format works well on line drawings and simple cartoons. The LZW compression algorithm is used which was patented in the USA by Unisys. (This patent expired in the USA in 2003).

JPEG: Joint Photographic Experts Group. JPEG is a standardized raster format that works well on natural, real-world scenes like photographs, naturalistic artwork. This format stores full color information 24 bits/pixel (16 million colors). JPEG is the most commonly used format for storing and displaying photographic images on the Web.

[A comparison of GIF and JPEG formats](http://arapaho.nsuok.edu/~rosener/papers/graphics/images-gif-jpeg) illustrates that with real-world scenes the quality of the JPEG images is superior to the GIF images. At the same time the JPEG images require less storage space. On the other hand, notice that with line drawings, the GIF images require less storage space and result in a sharper picture.

PNG (Portable Network Graphics) - PNG is standardized raster format created as an alternative to GIF. PNG is supported by all major graphics software and is now very widely used. It has become an open file format standard.

TIFF (Tagged Image File Format) - TIFF is a raster file format for digital images. It is owned by Adobe Systems and is supported by most image scanning and editing software. TIFF is a de-facto standard graphics format for high color depth (32-bit) graphics.

**Vector Formats**
Microsoft Word, Adobe Illustrator, and Macromedia Flash are some examples of applications that operate on vector images. These applications store images as objects (e.g., lines, ovals, and rectangles). For example, depending on the application, the yellow circle shown below might be stored using the following attributes.

|  |  |  |  |
| --- | --- | --- | --- |
| http://arapaho.nsuok.edu/~rosener/papers/graphics/yellow-circle.gif |        | fill-color:  | yellow  |
| line-color:  | black  |
| line-style:  | solid  |
| line-weight:  | 3 pt  |
| height:  | 0.75"  |
| width:  | 0.75  |
| rotation:  | 0 degrees  |
| transparency:  | 0 percent  |

Another approach that is starting to gain momentum is Scalable Vector Graphics (SVG). SVG is an open source, XML grammar for defining vector-based 2D graphics for the Web. SVG uses geometrical primitives such as points, lines, curves, and polygons to represent images in computer graphics. Like Flash, in order to view SVG documents in your browser, you must first install a viewer. Unfortunately very few people currently have the SVG plug-in or viewer installed.