CITS1231 Web Technologies

Working with Colors and Images
Static 2D images

• Images constitute a significant component of most web documents for many reasons:
  – Graphical representation speaks a thousand words, they can be understood more easily and quickly than textual information
  – They are often rich in information content
  – They break the monotonic tone of text-based document
  – They are often attractive and can improve presentation

• However, images require more “bandwidth” to transmit and therefore require different techniques to storage, transmission and presentation.
Colours in Web Pages

• The simplest form of images is a block of colour.

• Any color can be thought of as a combination of three primary colors: red, green, and blue. By varying the intensity of each primary color, you can create almost any color and any shade of color.

• This principle allows a computer monitor to combine pixels of red, green, and blue to create the array of colors you see on your screen.
Adding the Three Primary Colors

Primary color model for light

- BLUE
- CYAN
- GREEN
- MAGENTA
- YELLOW
- RED
Cathode Ray Tubes

RGB color model for display monitors
1-bit black/white display

One-bit black and white display

Each screen pixel is represented by one bit (0 or 1) of memory.
8-bit display

$2^8 = 256$
24-bit display

2^16 = thousands  
2^24 = millions
Working with Color in HTML

• Using color will make your web pages:
  – visually interesting
  – eye-catching for the reader

• HTML identifies a color in one of two ways:
  – by the color value
  – by the color name
Using Color Names

- aqua, black, blue, fuchsia, gray, green, lime, maroon, navy, olive, purple, red, sliver, teal, white and yellow.

- To have more control and more choices, specify colors using color values.
Using Color Values

• A **color value** is a numerical expression that precisely describes a color.

• RGB specifies three intensities that can be varied and “mixed” to represent different colours, namely, Red, Green and Blue:

  ```html
  em {color: rgb(255,255,255)} /* white */
  em {color: rgb(0,0,0)} /* black */
  em {color: rgb(255,0,0)} /* red */
  em {color: rgb(100%, 0%, 0%)} /* red */
  ```

• Colours in hexadecimal RGB specification

  ```html
  em {color: #ff0000} /* #rrggb (red) */
  em {color: #ffff00} /* #rrggb (yellow) */
  ```
RGB (Red, Green, and Blue) Triplets

• Software programs, such as your Web browser, define color mathematically.

• The intensity of each of three colors (RGB) is assigned a number from 0 (absence of color) to 255 (highest intensity).

• In this way, $255^3$, or more than 16.7 million, distinct colors can be defined.

• Each color is represented by a triplet of numbers, called an **RGB triplet**, based on the strength of its Red, Green, and Blue components.
RGB Triplets Examples

• White has a triplet of (255,255,255), indicating that red, green, and blue are equally mixed at the highest intensity.

• Yellow has the triplet (255,255,0) because it is an equal mixture of red and green with no presence of blue.
A Typical Colours Dialog Box

- In most programs, you make your color choices with visual clues, usually without being aware of the underlying RGB triplet.

- This figure shows a typical dialog box in which you would make color selections based on the appearance of the color, rather than on the RGB values.
Hexadecimal Numbers

- Decimal numbers have ten symbols 0-9 (base 10).
- Value of decimal numbers:
  \[56 = 5 \times 10^1 + 6 \times 10^0\]
- Hexadecimal numbers have sixteen symbols (base 16):
  0 – 9, A, B, C, D, E, F (lower case ok)
- Value of hexadecimal numbers:
  \[a6 = 10 \times 16^1 + 6 \times 16^0 = 166\]
  \[ff = 15 \times 16^1 + 15 \times 16^0 = 255\]
- red = rgb(255,0,0) = #ff0000
Web Safe and Pantone Colours

• When specifying colours and designing images, it is important to keep in mind that there are only 216 colours that are guaranteed to appear the same on PC, Macintosh, and X-Windows platforms. This is more true for smaller hand-held devices, such as mobile phones.
  – Red
    • 00, 33, 66, 99, CC and FF
  – Green
    • 00, 33, 66, 99, CC and FF
  – Blue
    • 00, 33, 66, 99, CC and FF
• Any combination: 6*6*6=216
  – color="#0033cc"
  – Refer to this site for web safe colour table: http://www.colostate.edu/Depts/CoopExt/SITE/colortab.html
Using Color Names

- Using the basic color names allows you to accurately display them across different browsers and operating systems.

- The list of only 16 colors is limiting to Web designers.
  - In response, Netscape and Internet Explorer began to support an extended list of color names.
The 16 Basic Color Names

The 16 basic color names that are recognized by all versions of HTML and XHTML.

<table>
<thead>
<tr>
<th>Color Name</th>
<th>RGB Triplet</th>
<th>Hexadecimal</th>
<th>Color Name</th>
<th>RGB Triplet</th>
<th>Hexadecimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqua</td>
<td>(0,255,255)</td>
<td>#00FFFF</td>
<td>Navy</td>
<td>(0,0,128)</td>
<td>#000080</td>
</tr>
<tr>
<td>Black</td>
<td>(0,0,0)</td>
<td>#000000</td>
<td>Olive</td>
<td>(128,128,0)</td>
<td>#808000</td>
</tr>
<tr>
<td>Blue</td>
<td>(0,0,255)</td>
<td>#0000FF</td>
<td>Purple</td>
<td>(128,0,128)</td>
<td>#800080</td>
</tr>
<tr>
<td>Fuchsia</td>
<td>(255,0,255)</td>
<td>#FF00FF</td>
<td>Red</td>
<td>(255,0,0)</td>
<td>#FF0000</td>
</tr>
<tr>
<td>Gray</td>
<td>(128,128,128)</td>
<td>#808080</td>
<td>Silver</td>
<td>(192,192,192)</td>
<td>#C0C0C0</td>
</tr>
<tr>
<td>Green</td>
<td>(0,128,0)</td>
<td>#008000</td>
<td>Teal</td>
<td>(0,128,128)</td>
<td>#008080</td>
</tr>
<tr>
<td>Lime</td>
<td>(0,255,0)</td>
<td>#00FF00</td>
<td>White</td>
<td>(255,255,255)</td>
<td>#FFFF00</td>
</tr>
<tr>
<td>Maroon</td>
<td>(128,0,0)</td>
<td>#800000</td>
<td>Yellow</td>
<td>(255,255,0)</td>
<td>#FFFF00</td>
</tr>
</tbody>
</table>
## Partial List of Extended Color Names

Partial list of extended color names

<table>
<thead>
<tr>
<th>Sample</th>
<th>Name</th>
<th>RGB</th>
<th>Hexadecimal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>alicebule</td>
<td>(240,248,255)</td>
<td>#F0F8FF</td>
</tr>
<tr>
<td></td>
<td>antiquewhite</td>
<td>(250,235,215)</td>
<td>#FAEBD7</td>
</tr>
<tr>
<td></td>
<td>aqua</td>
<td>(0,255,255)</td>
<td>#00FFFF</td>
</tr>
<tr>
<td></td>
<td>aquamarine</td>
<td>(127,255,212)</td>
<td>#7FFFD4</td>
</tr>
<tr>
<td></td>
<td>azure</td>
<td>(240,255,255)</td>
<td>#FFFFFF</td>
</tr>
<tr>
<td></td>
<td>beige</td>
<td>(245,245,220)</td>
<td>#F5F5DC</td>
</tr>
<tr>
<td></td>
<td>bisque</td>
<td>(255,228,196)</td>
<td>#FFE4C4</td>
</tr>
<tr>
<td></td>
<td>black</td>
<td>(0,0,0)</td>
<td>#000000</td>
</tr>
<tr>
<td></td>
<td>blanchedalmond</td>
<td>(255,235,205)</td>
<td>#FFEBCD</td>
</tr>
<tr>
<td></td>
<td>blue</td>
<td>(0,0,255)</td>
<td>#0000FF</td>
</tr>
<tr>
<td></td>
<td>blueviolet</td>
<td>(138,43,226)</td>
<td>#8A2BE2</td>
</tr>
<tr>
<td></td>
<td>brown</td>
<td>(165,42,42)</td>
<td>#A52A2A</td>
</tr>
<tr>
<td></td>
<td>burlywood</td>
<td>(222,164,135)</td>
<td>#DEB887</td>
</tr>
</tbody>
</table>
Foreground and Background Colors

- Foreground color definition:
  - `color: color`
  
  `<color>` is either the color value or the color name

- Background color definition:
  - `background-color: color`

- You can apply foreground and background colors to any page element
Foreground and Background Colors

foreground color

background color

<body style="color: rgb(153,102,102); background-color: white">
<p style="text-align: center">
<a href="about.htm">About Arcadium</a> &nbsp;&nbsp;&nbsp;&nbsp;
<a href="map.htm">Park Map</a> &nbsp;&nbsp;&nbsp;&nbsp;
<a href="water.htm">Water Rides</a> &nbsp;&nbsp;&nbsp;&nbsp;
<a href="karts.htm">Go Karts</a> &nbsp;&nbsp;&nbsp;&nbsp;
<a href="rides.htm">Roller Coasters</a>
</p>
Image Formats

- Most browsers support the three common types of images which are:
  - GIF (Graphics Interchange Format) GIF87 and GIF89A
  - JPEG (Joint Photographic Experts Group format)
  - PNG (Portable Network Graphics)
- We will discuss special effects supported by GIF and JPEG, and their compression techniques.
Choosing an Image Format

• **GIF (Graphics Interchange Format)** - most commonly used.
  - Compatible with virtually all browsers.
  - GIF files are limited to displaying 256 colors.
    - Each pixel is represented in at most one byte (8 bits).

• The number of colours affect significantly the space required to store the file. The fewer the colours, the smaller the file size.

• GIF works best on images with **few colours**, such as blocks of single colours, icons, buttons, logos, clip art images and line drawings (tracings).

• Images that require more color depth, such as photographs, can appear grainy when saved as GIF files.
GIF

- GIF uses a patented LZW (Lempel-Ziv-Welch) compression and supports:
  - Multiple images in a single file
  - Interlacing (GIF89A)
  - Transparency (GIF89A)
  - Animation (GIF89A)
GIF89A Interlacing

• Conventionally, images stored as sequential series of strips, where rows of images are stored one after another (1, 2, 3 ...).
  – Image displayed one line at a time from the top.
  – For large size images, this may take some time.

• Interlacing means rows stored non-sequentially so that portions of the whole image can be displayed first

• Interlacing is an effective format if you have a large graphic and want to give users a preview of the final image as it loads.

• Interlacing can increase the size of a GIF file by anywhere from 3 to 20 kilobytes, depending on the image.
## GIF89A Interlacing Scheme

<table>
<thead>
<tr>
<th>Row Number</th>
<th>Interlace Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>4</td>
</tr>
<tr>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>19</td>
<td>4</td>
</tr>
</tbody>
</table>

Group 1: Row 0, 8, 16, ... (Pass 1)
Group 2: Row 4, 12, 20, ... (Pass 2)
Group 3: Row 2, 6, 10, ... (Pass 3)
Group 4: Row 1, 3, 5, ... (Pass 4)
Noninterlaced Graphic

A noninterlaced GIF appears as it is slowly retrieved by the Web browser.

If the graphic is large, it might take several minutes for the entire image to appear, which can frustrate the visitors to your Web page.
Interlaced Graphic

The graphic starts out as a blurry representation of the final image.

It gradually comes into focus.

Noninterlaced graphic is always a sharp image, but may take time to display complete image.

- a rough image appears first
- image starts to show more detail
- final image is crisp and detailed
GIF Interlacing (example)
Transparent GIFs

- A **transparent color** is a color from the image that is not displayed when the image is viewed in an application.

- In place of a transparent color, the browser will display whatever is on the page background.

- Creating a transparent colour depends on the graphic software used.

- Many applications include the option to designate transparent colour when saving the image i.e. PhotoShop, GIMP, ImageMagick.
GIF89A Transparency

- GIF89A allows the declaration of one colour as “transparent”, which allows the background (behind the image) to be seen through the image.

- The colour selected is typically the background colour of the image and not used in the “content” part of the image.

- JPEG does not support transparency. The only standard that does is PNG.
GIF Transparency

Plain GIF graphic

Transparency

Transparent color

Transparent GIF graphic (all blue color disappears)

Transparency
Animated GIFs

- One of the most popular uses of GIFs is to create animated images.
- Animated GIFs are easy to create and smaller in size.
- An **animated GIF** is composed of several images that are displayed one after the other in rapid succession.
- Animated GIFs are an effective way to compose slide shows or to simulate motion.
GIF89A Animation

- “Animated” GIF created by storing series of GIF images in one file.

- If a browser fully supports GIF89A, it will wait the specified delay between images.

- Animated GIFs are both a curse and a blessing on many web pages. Once can reduce the stress caused by constant changing images by using JavaScript’s mouseover event (see later).

- Create animated images using image creation tools (eg GIFCON – GIF Construction Set).
Animated GIFs

• Animated GIF files are typically larger than static GIF images.

• Animated GIFs can greatly increase size of a Web page.

• Be careful not to overwhelm user with animated images.

• Animated GIFs are limited to 256 colors and can use transparent colors.

• Early browser versions may not support animated GIFs.
JPEG

- JPEG ("Jay-Peg") is designed specifically for storing full-colour or greyscale images of real-world scenes (e.g. photographs).

- Smooth variations in colour are represented more faithfully and compactly as compared to GIF.

- Can store 24-bit colour pictures, offering over 16 million colours.

- JPEG’s default lossy compression can faithfully store an image with compression ratio of about 10:1 or 20:1 compared to the best lossless compression ratios of about 2:1.
Compression

• GIF uses Terry Welch’s LZW compression scheme.
  – If a symbol has previously occurred, a reference to that symbol is stored rather than the symbol itself.
  – LZW is used in the Unix `compress` program.
  – Lossless means that the original data can be recovered verbatim.

• JPEG uses lossy compression.
  – Discrete cosine transformation to produce sliding scale of graphics compression.
  – You can choose the degree of compression.
  – The more you squeeze a picture with JPEG compression, the more you degrade its image quality.
JPEG Compression (cont.)
PNG

- PNG, “Portable Network Graphics”, addresses several limitations of GIF and can be seen as an improved version of GIF:
  - PNG uses a free algorithm for compression (“PING”)
  - PNG images are generally smaller than GIF images
  - PNG supports greater colour depth.
  - PNG supports colour and gamma correction.
  - PNG supports 8-bit transparency, meaning image can “fade-in” through partial transparency.
    - GIF – each pixel can be either fully transparent or opaque
    - PNG allows up to 254 levels of partial transparency in between for "normal" image.
    - Allows for illusion of smooth curves.
    - Makes rounded/curved images look good against any background.
Summary

- JPEG files have the .jpg or jpeg extension, while GIFs are .gif.
- JPEG is for photographic images and is generally lossy. JPEG caters for 24-bit colour, varying qualities, and space efficient compression. JPEG is slow to decode and is unsuitable for images with few colours.
- GIF is for line drawings and is lossless. GIF caters for 8-bit colour, and is reasonably space efficient with LZW compression. GIF is fast to decode, but is unsuitable for photographs. GIFs can be made transparent, can be interlaced, and can be animated.
- PNG for higher quality images, but file sizes larger.
- Reference:
Floating an Image

- The `float` attribute specifies how a box floats.

**float: position**

- position can have values `left`, `right`, `none`, `inherit`.
Controlling Image Alignment

- The `vertical-align` property can control the alignment of any element.
- To vertically align an image:

  ```css
  img {vertical-align:“position”}
  ```
## Vertical-align Values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>length</td>
<td>Raises or lower an element by the specified length. Negative values are allowed.</td>
</tr>
<tr>
<td>%</td>
<td>Raises or lower an element in a percent of the &quot;line-height&quot; property. Negative values are allowed.</td>
</tr>
<tr>
<td>sub</td>
<td>Aligns the element as it was subscript.</td>
</tr>
<tr>
<td>baseline</td>
<td>Align the baseline of the element with the baseline of the parent element. This is default.</td>
</tr>
<tr>
<td>super</td>
<td>Aligns the element as it was superscript.</td>
</tr>
<tr>
<td>top</td>
<td>The top of the element is aligned with the top of the tallest element on the line.</td>
</tr>
<tr>
<td>text-top</td>
<td>The top of the element is aligned with the top of the parent element's font.</td>
</tr>
<tr>
<td>texttop</td>
<td>Aligns the object to the right of the surrounding text. All subsequent text flows to the left of the object.</td>
</tr>
<tr>
<td>middle</td>
<td>The element is placed in the middle of the parent element.</td>
</tr>
<tr>
<td>bottom</td>
<td>The bottom of the element is aligned with the lowest element on the line.</td>
</tr>
<tr>
<td>text-bottom</td>
<td>The bottom of the element is aligned with the bottom of the parent element's font.</td>
</tr>
<tr>
<td>inherit</td>
<td>Specifies that the value of the vertical-align property should be inherited from the parent element.</td>
</tr>
</tbody>
</table>
Margins

• Control your margins with the following four styles:
  – margin-top: length
  – margin-right: length
  – margin-bottom: length
  – margin-left: length

• Margin values can also be negative- this creates an overlay effect by forcing the browser to render one element on top of another

• You can also combine the four margin styles into a single style
Inserting a Background Image

- The **background** attribute allows an image file for the background of a Web page.

- The syntax for inserting a background image is:
  
  - `background-image: url(url)`
  
  - **URL** is the location and filename of the graphic file you want to use for the background of the Web page.

  - For example, to use an image named "bricks.gif" as a background image, you would use the tag: `<body style="background-image:url(brick.gif)">`
Background Image

- In choosing a background image, you should remember the following:
  - use an image that will not detract from the text on the Web page, making it hard to read
  - do not use a large image file (more than 20 kilobytes)
    - large and complicated backgrounds will increase the time it takes a page to load
  - be sure to take into consideration how an image file looks when it is tiled in the background
Background Image Options

background-repeat: type

background-image: repeat
background-image: repeat-x
background-image: repeat-y
background-image: no-repeat