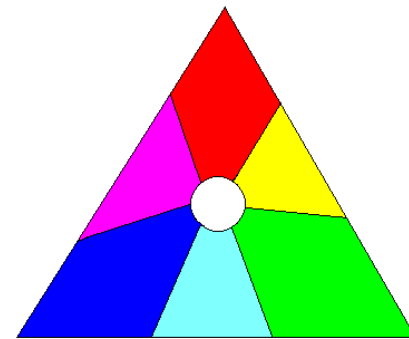


REPRESENTING COLORS IN WEB PAGES BY RGB and HEXADECIMAL NOTATION

The appearance of colors in imaging devices such as TV screens, computer monitors and digital cameras is caused by adding colored light to an initially black background (black is the absence of color). This **additive color system** is different from the subtractive system associated with the absorption, transmission and reflection of white light by objects in our everyday life and in spectroscopy. When white light (all colors combined) is passed through a prism, the prism refracts the light into its constituent colors, producing the familiar color spectrum of ROYGBIV (red, orange, yellow, green, blue, indigo and violet). Of these seven (arbitrary) colors, three are predominant, or **primary**: red, green and blue (RGB). If these three colors of light are mixed, white light results. If any two of them are mixed, a **secondary** color is produced. $R+G \rightarrow \text{yellow}$, $G+B \rightarrow \text{cyan}$, $B+R \rightarrow \text{magenta}$. When Y, C and M are combined, they too produce white light, which is all colors combined. Mixing the colors in different combinations, proportions and intensities produces a seemingly infinite variety of colors.



RGB is the default mode to specify colors in many drawing programs such as Paint or Photoshop. Each component RGB color is specified by a decimal (base 10) number ranging from 0 to 255, with 0 being the least intense, black, and 255 the most intense, white. So black, the absence of color is (0,0,0); white, all colors, is (255, 255, 255); pure red is (255, 0, 0). Add green (0, 255, 0) to red to get yellow (255, 255, 0). You can see the effect of changing the values by opening Paint and choosing **Colors | Edit Colors... | Define Custom Colors**. The result is $(255)^3$, or 16.7 million different colors.

HTML uses the hexadecimal notation (base 16) to specify web page colors. The first 18

hex characters are:

Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11
Dec	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

The three RGB numbers in decimal notation are converted to hexadecimal notation. The result is a set of hex triplets in the format #RRGGBB, where the # symbol denotes hexadecimal representation. The smallest decimal number is 0 (black), which becomes 00 in hexadecimal. So #000000 is black in hexadecimal notation. The largest decimal number is 255 which in hexadecimal is FF. In hexadecimal notation, #FFFFFF is white. Pure red is #FF0000, pure blue is #0000FF, yellow is #FFFF00, and so on. The same 16.7 million colors can be represented in hexadecimal as well as decimal notation. For reasons of computing efficiency, the hexadecimal is preferred. Monitors used to be limited to 256 RGB colors, of which 216 are now called “web-safe” colors. All the hex triplets are either 00, 33, 66, 99, CC, or FF in this palette. Furthermore, sixteen colors can be specified by name including the primary and secondary RGB colors and black and white: red, lime (really #00FF00 or green), blue, aqua (really #00FFFF or cyan), yellow and fuchsia (really #FF00FF or magenta). The characters between FF and 00 for any color go from lighter (FF) to darker (00). The first two digits represent the level of red, the second two the level of green, and the third two are the level of blue. For example, #003366 is a greenish blue color.

When you insert a color attribute in a web page, you can use either hexadecimal or rgb. For example, color="#FF00CC" or rgb(255,0,0) (only in CSS).