Digital Data Format

- Bit
- Byte = 8 bits
- Word = 2 or 4 bytes
- Block = 512 or 1024 bytes
- 1 KByte = 1024 bytes

Binary and Decimal Numeral Systems

<table>
<thead>
<tr>
<th>Decimal</th>
<th>Binary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0001</td>
</tr>
<tr>
<td>2</td>
<td>0010</td>
</tr>
<tr>
<td>3</td>
<td>0011</td>
</tr>
<tr>
<td>4</td>
<td>0100</td>
</tr>
<tr>
<td>5</td>
<td>0101</td>
</tr>
<tr>
<td>6</td>
<td>0110</td>
</tr>
<tr>
<td>7</td>
<td>0111</td>
</tr>
<tr>
<td>8</td>
<td>1000</td>
</tr>
<tr>
<td>9</td>
<td>1001</td>
</tr>
<tr>
<td>10</td>
<td>1010</td>
</tr>
<tr>
<td>11</td>
<td>1011</td>
</tr>
<tr>
<td>12</td>
<td>1100</td>
</tr>
<tr>
<td>13</td>
<td>1101</td>
</tr>
<tr>
<td>14</td>
<td>1110</td>
</tr>
<tr>
<td>15</td>
<td>1111</td>
</tr>
</tbody>
</table>

$1111 = 1 \times 2^0 + 1 \times 2^1 + 1 \times 2^2 + 1 \times 2^3$
### ArcGIS Variables

- **Data types**

  - **Text:** ASCII (American Standard Code for Information Exchange)
  
  - **Binary**

<table>
<thead>
<tr>
<th>Name</th>
<th>Specific range, length, or format</th>
<th>Size (Bytes)</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short integer</td>
<td>-32,768 to 32,767</td>
<td>2</td>
<td>numbers without fractions within specific range; coded values</td>
</tr>
<tr>
<td>Long integer</td>
<td>-2,147,483,648 to 2,147,483,647</td>
<td>4</td>
<td>numbers without fractions within specific range</td>
</tr>
<tr>
<td>Single-precision floating point number (Float)</td>
<td>approx. -3.4E38 to 1.2E38</td>
<td>4</td>
<td>numbers with fractions within specific range</td>
</tr>
<tr>
<td>Double-precision floating point number (Double)</td>
<td>approx. -2.2E307 to 1.8E308</td>
<td>8</td>
<td>numbers with fractions within specific range</td>
</tr>
<tr>
<td>Text</td>
<td>up to 64,000 characters</td>
<td>varies</td>
<td>names or other textual qualities</td>
</tr>
<tr>
<td>Date</td>
<td>mm/dd/yyyy</td>
<td>8</td>
<td>date and/or time</td>
</tr>
<tr>
<td>BLOB</td>
<td>varies</td>
<td>varies</td>
<td>images or other multimedia</td>
</tr>
<tr>
<td>GUID</td>
<td>36 characters enclosed in early brackets</td>
<td>16 or 38</td>
<td>customized applications requiring global identifiers</td>
</tr>
</tbody>
</table>

### Raster Data Structure

- **Header**
  - Dimension and spatial resolution
  - Projection and coordinates
  - Thumbnails

- **Data**
  - Types: ascii, binary (1-bit), integer (8-bit), floating-point (4-byte)
  - Single- and multi-band structures (BSQ, BIL, BIP)

- **Trailer**
  - Color look-up table
  - Statistics
Raster Data Structure (cont.)

- Uncompressed/lossless compression
  - Cell-by-cell encoding
  - Run-length encoding (RLE)
  - Quad Tree
- Lossy compression
  - JPEG
  - MrSID (Multi-resolution Seamless Image Database)
Image Display

- Display size
- Radiometric resolution (range of brightness)
- Color rendition
  - D-to-A conversion (Analog CRT)
  - RGB-channels
  - Grey scale, pseudo color, and true-color
  - Color look-up table
    - 4-bit, 8-bit, 24-bit, 32-bit, …
Display Modes

- Binary (B&W 2 colors)
- Gray scale (B&W with various tones)
- True-color
  - Natural color
  - False color
- Pseudo-color (Color)
  - Natural color
  - False color
- Relief (Gray scale with relief shading functions.)

Natural- & False-Color Composite
Cathode-Ray Tube (CRT) & RGB Color

See Figure 3.4 in Mather.

Display Images on a Computer Screen

See Figure 3.4 in Mather.
Pseudo and True-color

True-color display

Pseudo-color display

![Image of true-color display](image1.png)

![Image of pseudo-color display](image2.png)
Color Mixing

Light:
Additive color system
(Primary colors: R, G, B)

- \( R + G = Y \)
- \( B + G = C \)
- \( R + B = M \)
- \( R + G + B = W \)

Pigments:
Subtractive color system
(Secondary colors: C, M, Y)

- Yellow filters blue
- Cyan filters red
- Magenta filters green