Problem #1: (50%)  
Write a Matlab function that takes a color image as input and generates the color histogram as output.

```matlab
function hist = colorhist (img, n1, n2, n3)
    % hist is a one-dimensional vector. Assume each color channel is uniformly divided into a number of bins, with the numbers of bins specified by n1, n2, and n3 for the R, G, and B color channel respectively. The 3-D color index is sequentially converted to the 1-D index used in hist. The conversion process scans the R channel first, then the G channel, and finally the B channel.
```

The following example shows the image of a Van Gogh painting and its color histogram.

Use the image ‘lena.bmp’ provided with the homework to test your program. Plot histograms under two different conditions (1) n1=n2=n3=4 and (2) n1=n2=n3=5.

Problem #2: (50%)  
The following are several primary colors in the CIE RGB color system

<table>
<thead>
<tr>
<th>Red</th>
<th>Yellow</th>
<th>Green</th>
<th>Cyan</th>
<th>Blue</th>
<th>Magenta</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>1.0</td>
<td>1.0</td>
<td>0</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>G</td>
<td>0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

(a) Use the conversion equations in Sec. 6.2 to convert these colors to the HSI space. Namely, compute the Hue, Saturation, and Intensity values of each color.

(b) If you are asked to compute the distance between any two colors, which color space will you use? What distance metrics will you use? Provide reasons for your answers.

Note there are no ‘best’ answers for this part of the question. Provide answers that you think are reasonable. Provide justification.