

CEG4311 Problem Set 2 Fall 2007 Solution

1. The solution is presented as MATLAB statements and output:

```
QRGBprime = [252 99 71]'/255 %given, tomato
QRGBprime = [0.9882 0.3882 0.2784]'
```

%part (a)

```
QRGB = ((QRGBprime+0.099)/1.099).^(20/9) % since all normalized values > 0.018
QRGB = [0.9764 0.1641 0.0930]'
```

% part (b)

```
RGBL = [.2127 .7152 .0722]; %pg 3-27
QL = RGBL * QRGB % luminance of Q
QL = 0.3317
```

qRGB = QRGB/([1 1 1]*QRGB) % RGB chromaticities of Q

```
qRGB = [0.7916 0.1330 0.0754]'
```

% part (c)

```
A1 = [.4125 .3576 .1804; .2127 .7152 .0722; .0193 .1192 .9502]; %pg. 3-27
QXYZ = A1*QRGB %XYZ tristimulus values
QXYZ = [0.4782 0.3317 0.1268]'
```

qXYZ = QXYZ/([1 1 1]*QXYZ) %XYZ chromaticities

```
qXYZ = [0.5105 0.3541 0.1353]'
```

% part (d)

```
A2 = [4/9 0 0; 0 1 0; -1/3 2/3 1/3]; %pg. 3-30
QUVW = A2*QXYZ %U'V'W' tristimulus values
QUVW = [0.2125 0.3317 0.1040]'
```

qUVW = QUVW/([1 1 1]*QUVW) %U'V'W' chromaticities

```
qUVW = [0.3279 0.5117 0.1604]'
```

% part (e) CIELAB

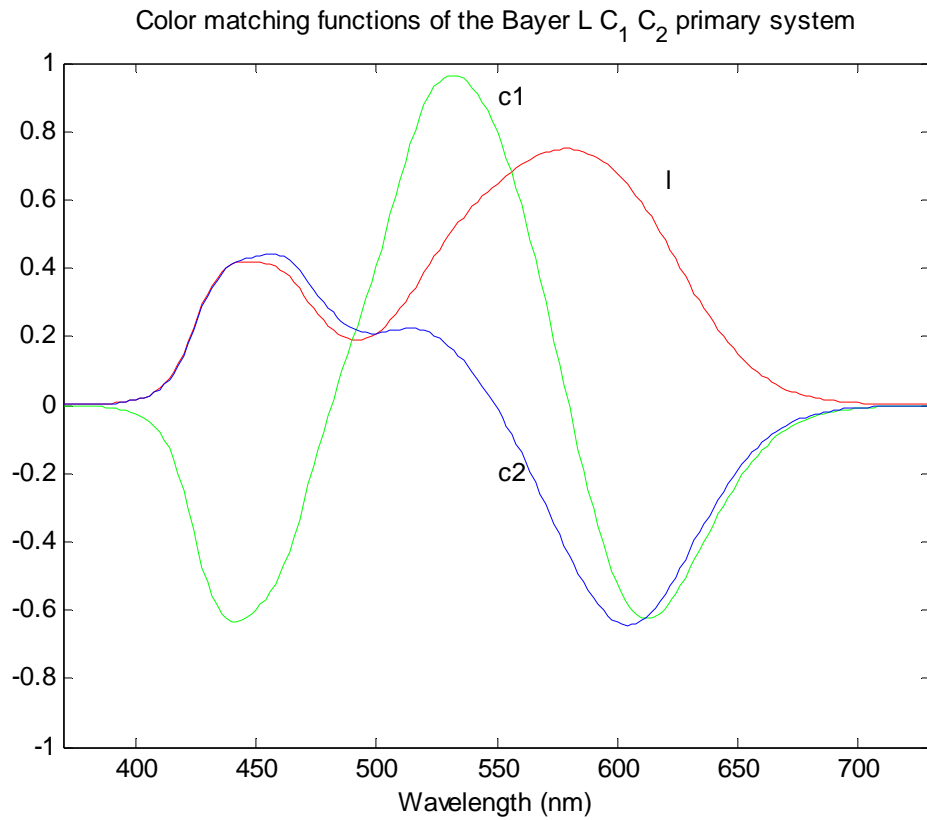
```
DXYZ = [.9505 1 1.0888]'; %reference white D65
QLstar = 116*(QXYZ(2))^(1/3) - 16
Qastar = 500*((QXYZ(1)/DXYZ(1))^(1/3) - QXYZ(2)^(1/3))
Qbstar = 200*(QXYZ(2)^(1/3) - (QXYZ(3)/DXYZ(3))^(1/3))
QLstar = 64.2998
Qastar = 51.5486
Qbstar = 40.7853
```

% part (f)

```
A3 = [.299 .587 .114; -.169 -.331 .5; .5 -.419 -.081]; %pg. 3-35
QYPBPR = A3 * QRGBprime
QYPBPR = [0.5551 -0.1563 0.3089]'
```



2.
(a)



(b)

$$\begin{aligned}
 \begin{bmatrix} [L] \\ [C1] \\ [C2] \end{bmatrix} &= \begin{bmatrix} 1.0 & 1.0 & 1.0 \\ -1.0 & 1.0 & -1.0 \\ -2.0 & 0.0 & 2.0 \end{bmatrix} \begin{bmatrix} [R] \\ [G] \\ [B] \end{bmatrix} \\
 &= \begin{bmatrix} 1.0 & 1.0 & 1.0 \\ -1.0 & 1.0 & -1.0 \\ -2.0 & 0.0 & 2.0 \end{bmatrix} \begin{bmatrix} 0.4125 & 0.2127 & 0.0193 \\ 0.3576 & 0.7152 & 0.1192 \\ 0.1804 & 0.0722 & 0.9502 \end{bmatrix} \begin{bmatrix} [X] \\ [Y] \\ [Z] \end{bmatrix} \\
 &= \begin{bmatrix} 0.9504 & 1.0000 & 1.0888 \\ -0.2353 & 0.4303 & -0.8504 \\ -0.4641 & -0.2811 & 1.8618 \end{bmatrix} \begin{bmatrix} [X] \\ [Y] \\ [Z] \end{bmatrix}
 \end{aligned}$$

(c) tomato: 0.3494 -0.1853 -0.2208
D65: 1.0 0 0