Lab 3. Färg

Del 3- Laboration
Svarsdokument

Spara detta dokument som .pdf dokument innan ni lämnar in det på Lisam.

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Inlämningsdatum:
Version (ifall ni behöver lämna retur)
V1

1) Working with Spectral Power Distribution

Uppgift 1.1)
XYZ values for CIED65:
X= 95.04
Y= 100
Z= 108.88

Uppgift 1.2)

XYZ values for R1, under CIED65: X= 40.0489 , Y= 49.7395 , Z= 26.6104

XYZ values for R2, under CIED65: X= 40.0489 , Y= 49.7395 , Z= 26.6104

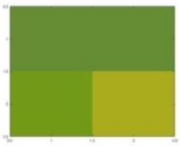
Uppgift 1.3)

XYZ values for R1, under f11: X= 41.6587, Y= 53.3569 , Z= 16.3345

XYZ values for R2, under f11: X= 53.9818 , Y= 63.4675, Z=20.7173

Uppgift 1.4)
Firstly the colors where the same under one light condition when we changed the illumination factor the colors changed. This is called metamerism.

Uppgift 1.5)
Insert the figure here: (You can save this figure using File in the window, and then save as..., *yourfilename.png*. It is ok to scale down the image after inserting it in words)



What has happened to the white point in the xy chromaticity diagram when changing the light source? The color becomes lighter for each increment, though the two first are the same for the reasons stated in 1.4.
Does that show in the colors?

Yes it does.

Uppgift 1.6)

Explain briefly what color matching functions ($\bar{x}(\lambda)$, $\bar{y}(\lambda)$ and $\bar{z}(\lambda)$) are and what they represent.
They represent different color spaces for the eyes. For an example $\bar{y}(\lambda)$ is used to match the eye's spectral luminous efficiency curve for high light level.

Uppgift 1.7)

Explain why the CIEY-value of a light source is always equal to 100 by referring to Equation 1.4 in the theory document.
y(λ) is chosen to coincide with the luminous efficiency function, meaning that the tristimulus value Y represents the perceived luminance. So the CIEY-value is 100 for the light source. If it is not the light source does not excist?

2) Dot-on-Dot and Dot-off-Dot Halftoning

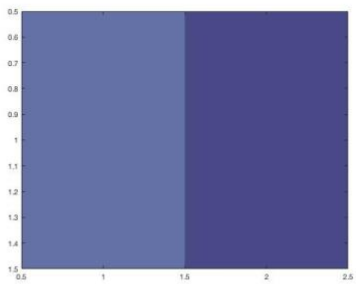
Uppgift 2.1)

Write the XYZ-values for dot-on-dot and dot-off-dot in the below table:

	X	Y	Z
Dot-on-dot	43.915	44.87	68.43
Dot-off-dot	31,6	30,48	54,2

Uppgift 2.2)

Insert the figure here: (You can save this figure using File in the window, and then save as..., *yourfilename.png*. It is ok to scale down the image after inserting it in words)



Is there a noticeable difference between dot-on-dot and dot-off-dot? For example, which one is darker? Why?
Dot on dot is lighter than dot off dot. This is because the blue from dot on dot is mixed with the white paper. Or the white nothingness.

Uppgift 2.3)

Could you use this function in all applications? Is this function device independent?
"This function converts the CIEXYZ values to RGB assuming a monitor with a white point close to CIED65" – from the help of `myxyz2rgb`. This means it cannot be used when the white points is not close to CIED65. It is therefore semi device independent because it can be used on all devices if the white point is close to CIED65.

3) Color Halftoning According to Demichel

Uppgift 3.1)

Notice, Column 1 in the below table should be filled by your calculations in **uppgift 4** in the preparation part of this lab.
Fill column 2, Test 1, by your results using C1, M1, Y1 and K1.
Fill column 3, Test 2, by your results after simulating misregistration.
Describe also which channels and how many pixels and in each direction, you chose to simulate misregistration.

Ink	Demichel	Test 1	Test 2
None	0.189	0.1628	0.1662
Only C	0.081	0.0765	0.0753
Only M	0.14	0.1351	0.1327
Only Y	0.189	0.2090	0.2031
Only K	0.021	0.0191	0.0183
Only C & M (Blue)	0.054	0.0648	0.0584
Only C & Y (Green)	0.081	0.0858	0.0895
Only C & K	0.009	0.0096	0.0101
Only M & Y (Red)	0.126	0.1126	0.1172
Only M & K	0.014	0.0185	0.0198
Only Y & K	0.021	0.0120	0.0100
C & M & Y	0.054	0.0509	0.0514
C & M & K	0.006	0.0021	0.0018
C & Y & K	0.009	0.0206	0.0225
M & Y & K	0.014	0.0201	0.0233
C & M & Y & K	0.006	6.5*10^-4	0.0002

Uppgift 3.2)

Now, compare column 1, 2 and 3 in this table. Are Demichel's equations a good model of the reality? Does it work reasonably well even when misregistration occurs?
We consider Demichels equation a good one. It represents fractional coverage well and the values on each row are similar so yes, it is a good model of reality and it also works well when misregistration occurs.

Uppgift 3.3)

What would have happened in case of misregistration if all the four printing colors had had the same screen angle? Would Demichel's equation be applicable? Why not?
If all the four printing colors had the same screen angle
The result of all the four printing colors having the same screen angle is that the halftone dots in the different halftone channels would be on top of each other, and this would lead to the structure of the color halftone to be very periodic. Demichel's equation would not work seeing as they are all on the same screen angle.

4) Color Adjustment in CIELAB

Uppgift 4.1)
Why do the images seem to be inverted?

Uppgift 4.2)
Insert the image corresponding to L+20 here: (ok to scale down the image)

Insert the image corresponding to L-20 here: (ok to scale down the image)

What attribute (among lightness, contrast, hue, and saturation) has been changed.
If you compare L+20 and L-20 the lightness hue and saturation is lower. At least to what our eyes can see. The light is the main thing changed as it is changed by adding 20 or removing 20. The contrast is similar and not that changed between L+20 and L-20 although it is a bit lower to the eye in L-20 because of the lowered lightness which makes it more difficult to see the differences in shapes.

Uppgift 4.3)
Insert the image when you change the sign of **a*** here: (ok to scale down the image)

Insert the image when you set **a*=0** here: (ok to scale down the image)

Did you expect the results? (answer by looking at Fig. 1.5 in the theory document to see what the a-axis represents).

Yes it makes sense if you look at the figure. The different axis represent different colors so when you change the a value from positive to negative it is reflected in the image reproduction.
What attribute (among lightness, contrast, hue, and saturation) of the color do we change when switching sign of **a*** or **b***? The CIELAB space in figure 1.5 shows us that changing a and b does not affect the lightness, giving us the understanding that it changes the constrast hue and saturation. This also shows is the images in which we get when we change the a and b values.

Uppgift 4.4)

Insert the image when you multiply **a*** and **b*** by 0.5 here: (ok to scale down the image)

Insert the image when you multiply **a*** and **b*** by 3 here: (ok to scale down the image)

What attribute (among lightness, contrast, hue, and saturation) of the color do we change when scaling **a*** and **b***?

Here contrast and hue are changed. You can see it in the colors. Much more vibrant when u take a and b * 3.

5) Light sources, CIEXYZ and CIELAB

Uppgift 5.1)

XYZ values for CIED65:
X= 95.0437
Y= 100
Z= 108.8818

XYZ values for Tungsten60W:
X= 112.9853
Y= 100
Z= 28.5810

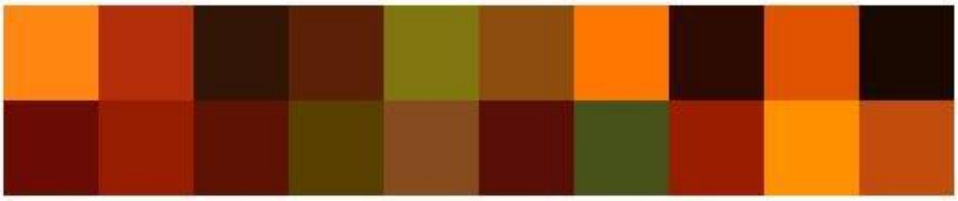
XYZ values for plank90k:
X= 97.0578
Y= 100
Z= 141.1759

Insert the figure showing the color of these three light sources here: (ok to scale down the image)

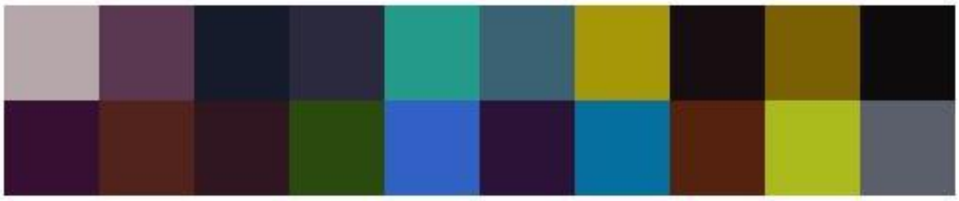
Are the colors of these three light sources what you expected?
I did not really know what to expect. But I guess so looking at the figure for light and colors and fig 1.8.

Uppgift 5.2)

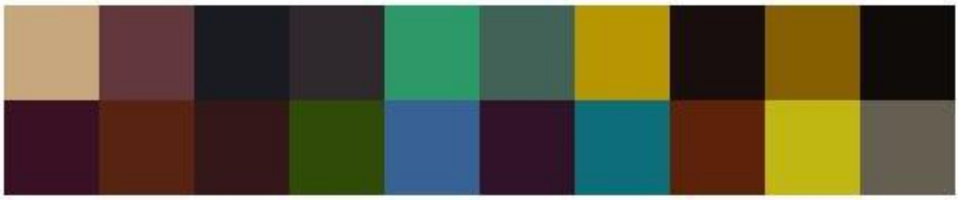
Insert Figure 1 here: (ok to scale down the image)



What light source it seems to have been used in the above figure?
By looking at fig 1.8, Tungsten
Insert Figure 2 here and specify: (ok to scale down the image)



What light source it seems to have been used in the above figure?
Plank90k
Insert Figure 3 here: (ok to scale down the image)



What light source it seems to have been used in the above figure?
Cied65

Uppgift 5.3)

Why are the color differences between the color of the objects under **Tungsten** and **plank90k** larger than those under the other two pairs of light sources?
When looking at figure 1.8 you can clearly see that the Tungsten light source increases at the wavelengths increase and the opposite is clear in plank90k. The cied65 curve moves in a different way,

it increases and then decreases. Higher wavelengths correspond to more red colors. Because of how the **Tungsten** and **plank90k** curves look it changes how objects look under the light.

Uppgift 5.4)

You can see in the plot that all light sources have the same Y-value. What is this value?

This value is the brightness.

Uppgift 5.5)

How do the positions of the color (XYZ) of the objects move when the illumination is changed? Do you agree that, when the illumination is changed, we get completely different positions in the XYZ space?

Yes we agree. For an example when the illumination is changed for the lower, the red stars are more concentrated. The pluses and X are more dispersed at all illumination levels.

Uppgift 5.6)

What is the CIELab values of light sources and why?

Looking at equation 1.13 and figure 1.5 and the information we've gathered previously we understand that the CIElab values of lightsources is constant when changing from XYZ to CIELab. When looking at the plot_Lab graph it looks as if the white point is [0,0,100].

Uppgift 5.7)

How do the positions of the color (Lab) of the objects move when the illumination is changed? Do you agree that the position of each object is almost constant independent of the illumination?

As previously stated it barely changes, it is almost constant.

Uppgift 5.8)

Discuss at least two differences between CIEXYZ and CIELAB.

One difference between the two-color spaces is that the CIEXYZ color space does not correspond to the perceived color difference, and this leads to having a hard time trying to compare different colors. The CIELAB color-space was originally made to help the textile industry to get more accurate colors, however it is not the case today. It is today the most popular method for device independent color spaces regarding all different types of implementations.

Another difference is that the CIELAB values for all different light sources are always constant and always has the values [100,0,0], while the corresponding values for CIEXYZ are different.

Glöm inte att spara dokumentet som *.pdf* innan ni lämnar in det på Lisam.