# Lab 1. Preparation tasks Template for answers

*Student names and LiU-IDs: (Max 2 students per group):*

*1. Magnus Kling LiU-ID: magkl572*

*2. Max Wiklundh LiU-id: maxwi824*

*Submission date:*

*Version (in case you need to re-submit):*

## Basic image operations and data types

1 A) What is the highest pixel value in the image?

The highest pixel value is 253

1 B) What is the maximum value for Image2?

The maximum value for Image2 is 16

1 C) What do you see if you display Image2?

We can see a really dark version of image 1 since every pixel value has been divided by 16

1 D) Image3:

A book cover with text and images

Description automatically generated

1 E) How many gray levels does Image3 have?

Image3 has 17 different gray levels. Every pixel value is rounded to the nearest multiple of 16, which gives us 16 + 1 different values between 0 and 255.

1 F) Explain what has happened to the image after these operations!

Every pixel value is first divided and rounded into values between 0 and 16. The values are then scaled back to 0 to 255, which results in every pixel value being a multiple of 16.

1 G) Explain the difference between using uint8 images and double images in this task.

The difference between uint8 and double is how doubles can store decimal values. This removes the needed rounding which occurs with uint8, since uint8 is only able to store integer values. This makes sure operations such as division and then multiplication result in almost (rounding is still possible) the same values while using doubles.

1 H) Which class (data type) should you make sure to use when applying such operations to images?

Since we want each operation to keep as much information about the original image as possible. Therefor we want to use double or some similar data type.

## Contrast stretching and image histogram

2 A) What is the max- and min- values for the image?

The max value is 0.6980 and the min value is 0.2902

2 B) Histogram:

A graph with a line

Description automatically generated

2 C) Resulting image after contrast stretching:

A person sitting at a desk writing on a piece of paper

Description automatically generated

2 D) What will the max- and min- values be for the stretched image?

The max and min values will be 1 and 0 respectively, since the formula stretches each value to the min and max value.

2 E) Histogram for the stretched image:

A graph with blue lines

Description automatically generated

## Image subtraction

3 A) Enhanced difference image:

A close-up of a brain

Description automatically generated

## Histogram equalization

4 A) Equalized image:

4 B) Histogram for the equalized image:

## Image division and shading correction

5 A) Histogram image:

5 B) Is it possible to find a global threshold to segment this image (look at the histogram)?

5 C) Recovered image:

5 D) Histogram of recovered image:

5 E) Segmented image:

5 F) What is the data type (class) for the segmented image?

5 G) How many bits (per pixel) is required to store this type of image?

## RGB-images and indexing

6 A) Image of Swedish flag:

*Save the document as .pdf before submitting!*