Problem Set 01

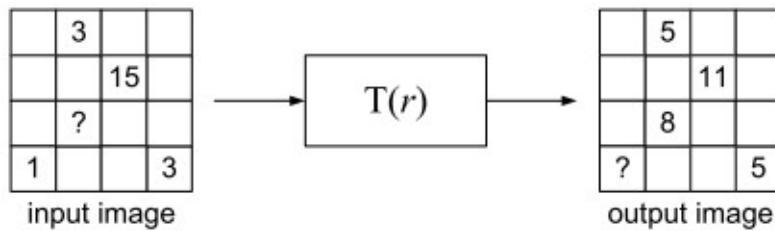**Solve all questions**

Question 01

A 4×4, 4bits/pixel image passes through a point-wise intensity transformation given by

$$s = T(r) = \alpha \log_2(1 + r) + \beta$$

where α and β are unknown parameters. Only a few pixels are available in the input and the output images, as shown below.

input image   output image

    a. Find α and β.
    b. What's the value of the pixel with the "?" mark in the output image?
    c. What's the value of the pixel with the "?" mark in the input image?

Question 2
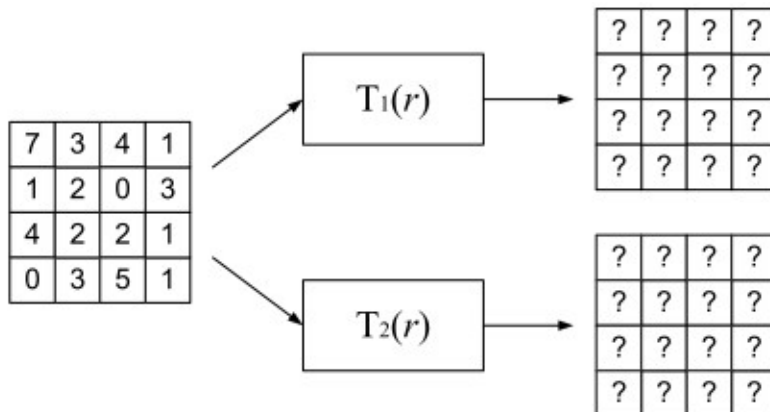
A 4×4, 4bits/pixel image (shown below) passes through two point-wise intensity transformations given by

$$s = T_1(r) = round(5\sqrt{r})$$

And

$$s = T_2(r) = 15 - 2r$$

respectively.

Find the two output images.

Question 3

Assume that the prediction rule for the perceptron is that "Prediction (y`) = 1 if **Wx**+b > 0 and 0 if **Wx**+b ≤ 0", and the steps for learning are very similar to how Neural Networks learn, which is as follows;

- Initialize weight values and bias
- Forward Propagate
- Check the error
- Backpropagate and Adjust weights and bias
- Repeat for all training examples

a. what are the weights and bias for the AND perceptron? Assuming that the initializations of w1, w2, as 1 and b as –1.
b. Repeat with the same initialization for OR perceptron and NOR perceptron.
c. It is impossible to implement the EXCLUSIVE-OR function $Y = X_1 \oplus X_2$ in a single unit. However, you can do it using a multiple unit neural network. Please do. Use the smallest number of units you can. Draw your network, and show all weights of each unit.

- Last submission date: ***Saturday, March 4, 2023.***