

- Reading: Digital Image Processing, Gonzalez and Woods, Ed. 4; Sections 2.1 to 2.4, and parts of 2.6. Sections 3.1, 3.2, 3.3.
- Show your work to get credits and state any assumptions you make. You can use/state results derived in class.

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1. [1 mark] You are preparing a report and have to insert an image of size 1024×1024 . Assume that the printer has no constraints, what would the resolution in dpi of the printer be if the image is to fit in 2×2 inches ?
 2. Consider point-wise operation between two images.
 - (a) [1 mark] Is summation operation between two images a linear or non-linear operation ? Justify.
 - (b) [1 mark] Is multiplication operation between two images a linear or non-linear operation ? Justify.You have to consider additivity and homogeneity properties to check linearity.
 3. Consider the geometrical transformation functions discussed in class. Provide a composite transformation function to perform the following operations:
 - (a) [1 mark] Scaling and translation
 - (b) [1 mark] Does order of multiplication in obtaining the composition makes a difference ? Justify by giving an example.
 4. [1 mark] Give a single intensity transformation function for spreading the intensities of an image so the lowest intensity is 0 and the highest is $L - 1$.
 5. This is related to bit-plane slicing.
 - (a) [2 marks] Propose a method for extracting the bit planes of an image based on converting the value of its pixels to binary. Consider a 4-bit image and provide a set of transformation functions ($T(r)$) to achieve individual bit-planes.
 - (b) [2 marks] Using the approach in (a) find all the bit planes of the following 4-bit image:

$$\begin{bmatrix} 0 & 1 & 8 & 6 \\ 2 & 2 & 1 & 1 \\ 1 & 15 & 14 & 12 \\ 3 & 6 & 9 & 10 \end{bmatrix}$$

6. In general:
 - (a) [1 mark] What effect would setting to zero the lower-order bit planes have on the histogram of an image ?
 - (b) [1 mark] What would be the effect on the histogram if we set to zero the higher-order bit planes instead ?