## UNIT:1 Introduction to Image Processing
### Short answer questions
1. What do you mean by intensity?
2. Represent below figure into spatial coordinates x and y.

![Figure](image.png)

3. Write one example where human being is more powerful than computer in image processing.
4. Why do we need digital image processing?
5. X-ray imaging is example of which type of imaging?
6. Write the name of field which study how images are transmitted.
7. Define the term: Bit depth.
8. List out any four sources of images.
10. Differentiate raster and bitmap data.
11. What is the basic difference between Digital Signal Processing and Digital Image Processing?
12. How much memory required for storing 500x500 binary image?
13. Spatial resolution is depend on which parameters?
14. What do you mean by pseudo color image?
15. Which are the components involved in image processing?
16. Captured image is never best resolution and best quality image. Why?
17. Write a situation where PNG file format is more preferable than JPEG.
18. Define pixel or picture element.
19. What do you mean by Gray level?
20. Define Resolutions.
21. How one can differentiate between image processing and image analysis and computer vision?
22. What are the steps involved in DIP?
23. What do you mean by image enhancement?
24. What do you mean by suitable image for an application in image enhancement?
25. What do you mean by morphological processing?
26. What is recognition and interpretation?
27. Specify the elements of DIP system.

### Long answer questions
1. Explain by drawing diagram fundamental steps in image processing.
2. Describe the functions of elements of digital image processing system with a diagram.
3. Explain the basic relationships between pixels.
4. Distinguish between digital image, and binary image. Give suitable example to each type of images.
5. State and explain various applications of digital image processing.

6. Explain application of imaging which uses:
   a. Gamma-Rays
   b. X-Ray
   c. Ultraviolet
   d. Visible and Infrared band
   e. Microwave band
   f. Radio band

7. Write a note on image enhancement.

8. Write a note on representation and description in image processing.

9. Write a note on computer vision. Does it require image processing?

10. Summarize the application of digital image processing in society.

Multiple choice questions

1. Computer vision defined as a discipline in which ---------
   a) both the input and output of a process are images.
   b) the input of a process is an image description and the output is an image.
   c) both the input and output of a process are descriptions.
   d) the input of a process is an image and the output is an image description.

2. MRI Technology used -------- band.
   a) Gamma Rays  b) CT Scan  c) Visible  d) Radio waves

3. Imaging Radar Technology is an application of
   a) Radio waves  b) Gamma Rays  c) Ultra Violet  d) Micro Waves

4. The process of extracting information from the image is called as
   a) Image enhancement  b) Image restoration  c) Image Analysis  d) Image compression

5. An image is considered to be a function of a(x, y) where a represents
   a) height of image  b) width of image  c) amplitude of image  d) resolution of image

6. Which is the image processing technique used to improve the quality of image for human viewing?
   a) compression  b) enhancement  c) restoration  d) analysis

7. Image compression is
   a) making image look better
   b) sharpening the intensity-transition regions
   c) minimizing degradation over image
   d) reducing the redundancy of the image data

8. Select one of the most appropriate application of Computer vision?
   a) medical computer imaging  b) remote sensing  c) geographical map  d) medical diagnosis

9. The initial step in any image processing technique is
   a) segmentation  b) masking  c) image acquisition  d) normalization

10. The output quality of a printer is measured by
    a) Dot per inch  b) Dot per sq. inch  c) Dots printed per unit time  d) All of these

Applied answer questions

1. Consider a color image of 1024x1024. If this image is transmitted across a channel of 2 Mbps, what will be the transmission time?

2. What is the storage requirement of 1024 X 1024, 8 level gray level image?
### UNIT: 2 Digital Image Fundamentals and Operations

#### Short answer questions

1. For image acquiring method, Magnetic Resonance Imaging (MRI) is example of which kind of imaging?
2. How continuous image is converted to digital image?
3. Write the equation of entropy.
4. What do you mean by sampling?
5. What do you mean by quantization?
6. How do you represent image in M X N numerical array form?
7. Which technique is used to produce the gray shades for bi-level devices such as printers?
8. How image can be defined as vector?
9. What is spatial resolution?
10. What do you mean by intensity level resolution?
11. What is the relationship between sample size and image quality?
12. What is the storage requirement for a 1024x512 8-bit color image?
13. What is the relationship between intensity level and image quality?
14. What do you mean by dynamic range of an imaging system?
15. Give the error dispersion chart for Stucki.
16. What do you mean by noise?
17. An image is 2400 pixels wide and 1200 pixels high. The image was scanned at 300 dpi. What is the physical size of the image?
18. What do you mean by contrast?
19. What is dpi? What is the effect on image quality if dpi is increase or decreased?
20. What is the effect on image size if dpi is increase or decreased?
21. What is meant by sampling and quantization?
22. What is false contouring?
23. What is interpolation?
24. List application of interpolation in image processing.
25. What do you mean by 4-neighbors of pixel? How it can be represented?
26. What do you mean by 8-neighbors of pixel? How it can be represented?
27. What do you mean by Diagonal-neighbors of pixel? How it can be represented?
28. Define connectivity. Also define 4-connectivity, 8-connectivity and m-connectivity.
29. Define adjacency. What are 4-adjacency, 8-adjacency and m-adjacency?
30. Define path. Also define 4-path, 8-path and m-path.
31. Define distance, \( D_4 \)-distance & \( D_8 \)-distance.
32. What is the difference between adjacency and connectivity?
33. How to compute Euclidean distance between two pixels?

#### Long answer questions

1. What do you mean sampling and quantization? Explain in detail.
2. What is the requirement of image sampling and quantization? Explain significant of spatial resolution.
3. How to measure distance between two pixels in an image? Explain with the help of example.
4. Explain with example a) Neighbors of pixel b) Connectivity.
5. What is m-connectivity among pixels? Give an example.
6. Explain any four metrics used to quantify the image quality.
7. Discuss any four low-level image-processing operations.
8. Explain relationship between image size, intensity resolution and image quality with example.
9. Explain false contouring with example.
10. Explain nearest neighbor interpolation method. Also give its disadvantage.
11. Explain bilinear and bicubic interpolation.
12. Explain neighbors of pixel and notations.
13. Explain relationship amongst the pixel.
14. Write a note on image interpolation.
15. Explain type of connectivity in pixels using example.
16. Explain types of path and distance with examples.
17. Distinguish between array operation and matrix operation.
18. Explain linear and non-linear operation. Also prove operation Max is non-linear operation.
19. Consider image segment shown here:

   | 3 | 1 | 2 |
   ---|---|---|
   | 2 | 2 | 0 |
   | 1 | 2 | 1 |

   Let V = {0, 1} and compute the lengths of shortest 4, 8 and m-path between p and q. If a particular path does not exist between p and q, explain why?
20. Give the condition(s) in which the D4 distance between two pixel p and q is equal to the shortest 4-path between these points. Is this path unique?
21. Explain image arithmetic with example.
22. Explain logical operation on images. Give its application.
23. Explain set operation on images.

**Applied answer questions**
1. For figure 1, apply the ordered dithering technique. Choose appropriate threshold matrix.
2. List out any two practical application of image subtraction. Carry out the subtraction of unit metric with figure 1.
3. Obtain the digital negative of figure 1.
4. Using any one application, explain the steps involved in image processing.

![Figure 1](image.png)

**Multiple choice questions**
1. To convert continuous image \( f \) to digital form, we have to sample function in coordinates is called:
   a. sampling    b. quantization    c. Signaling    d. digitizing
2. To convert continuous image \( f \) to digital form, we have to sample function in amplitude is called:
   a. sampling    b. quantization    c. Signaling    d. amplifying
3. Sampling of an image is required for:
   a. Quantization    b. Sharpening    c. Digitization    d. Smoothing
4. The effect cause by the use of an insufficient number of gray levels in smooth area of a digital image is called
   a. Gray level    b. Bit plane    c. Thinning    d. False contouring
5. Intensity range of 8-bit pixel image is:
   a. 0 to 15    b. 0 to 127    c. 0 to 255    d. 0 to 256
6. Consider an image of size M X N with 64 gray levels. The total number of bytes required to store this digitize image is
7. A pixel \( p \) at coordinate \( (x, y) \) has four horizontal and vertical neighbors whose coordinates are given by:
   a. \( (x-1, y-1), (x+1, y+1), (x+1, y), (x, y+1) \)    b. \( (x+1, y), (x, y+1), (x-1, y), (x, y-1) \)
8. The $D_8$ distance between $p$ and $q$ with coordinates $(x, y), (s, t)$ is defined as
   
   a. $|x-s| + |y-t|$
   b. $\text{Max}(|x-s|, |y-t|)$
   c. $((x-s)^2 + (y-t)^2)^{\frac{1}{2}}$
   d. $\text{Min}(|x-s|, |y-t|)$

9. The $D_e$ distance between $p$ and $q$ with coordinates $(x, y), (s, t)$ is defined as
    
   a. $|x-s| + |y-t|$
   b. $\text{Max}(|x-s|, |y-t|)$
   c. $((x-s)^2 + (y-t)^2)^{\frac{1}{2}}$
   d. $\text{Min}(|x-s|, |y-t|)$

10. The $D_4$ distance between $p$ and $q$ with coordinates $(x, y), (s, t)$ is defined as
    
   a. $|x-s| + |y-t|$
   b. $\text{Max}(|x-s|, |y-t|)$
   c. $((x-s)^2 + (y-t)^2)^{\frac{1}{2}}$
   d. $\text{Min}(|x-s|, |y-t|)$
### UNIT :3 Image Enhancement in Spatial Domain

#### Short answer questions

1. What is spatial domain and transform domain?
2. Write expression to represent processes on image in spatial domain.
3. Write intensity transform function.
4. What do you mean by thresholding?
5. What do you mean by point processing techniques?
6. What do you mean by neighborhood processing techniques?
7. What do you mean by spatial filter?
8. What do you mean by filter/kernel/mask?
9. What do you mean by image enhancement?
10. Specify the objective of image enhancement technique.
11. What is contrast stretching?
12. What is gray level slicing?
14. What is the purpose of image averaging?
15. What is meant by masking?
16. Give formula for negative and log transformation.
17. What is meant by bit plane slicing?
18. What is meant by laplacian filter?
19. What is meant by histogram equalization?
21. Give the mask used for high boost filtering.
22. Define histogram.
23. How to compute histogram of an image?
24. Write the steps involved in frequency domain filtering.
25. What is Image Negatives?
27. Explain spatial filtering.
28. What is a Median filter?
29. What is maximum filter and minimum filter?
30. Write the application of sharpening filters.
31. Name the different types of derivative filters.
32. What are the advantages of Median filter?

#### Long answer questions

1. Write note on following, also give its application:
   a. Image Negatives
   b. Log Transformations
   c. Power-Law Transformations
   d. Contrast stretching
   e. Intensity-level slicing
   f. Bit-plane slicing
   g. Histogram processing
2. Compare spatial and frequency domain methods.
3. Give a single intensity transformation function for spreading the intensities of an image so that lowest intensity is 0 and the highest is L-1.
4. What effect would set to zero the lower-order bit planes have on the histogram of an image in general?
5. Explain why the discrete histogram equalization technique does not, in general, yield a flat histogram.
6. Two image f(x,y) and g(x,y) have histogram h<sub>f</sub> and h<sub>g</sub>. Give the condition under which you can determine the histogram of
7. Explain the types of gray level transformation used for image enhancement.
8. What is histogram? Explain histogram equalization.
9. Explain histogram matching.
10. Discuss the image smoothing filter with its model in the spatial domain.
11. What are image sharpening filters? Explain the various types of it.
12. Explain spatial filtering in image enhancement.
13. Explain correlation and convolution.

Applied answer questions
1. Perform intensity slicing with background for figure 1.
2. Apply median filter on figure 1.
3. What is image up sampling? Explain three techniques for doing up sampling using example.
4. What would be the impact of the removal of the last bit in the histogram for figure 1?
5. What do you mean by contrast stretching? Explain using one example.

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Figure 1

Multiple choice questions
1. -------- Filter cannot be implemented using convolution mechanism.
   a) Average b) Gaussian c) Median d) Disk
2. To remove "salt-and-pepper" noise without blurring we use
   a) Max Filter b) Median Filter c) Min Filter d) Smoothing Filter
3. Edge detection in images is commonly accomplished by performing a spatial ------ of the image field.
   a) Smoothing Filter b) Integration c) Differentiation d) Min Filter
4. Both the ------ and ------ filters are used to enhance horizontal edges (or vertical if transposed).
   a) Prewitt and Sobel b) Sobel and Gaussian c) Prewitt and Laplacian d) Sobel and Laplacian
5. Transforming the pixel values of an image using the log ( ) transformation is an example of contrast compression of the dark pixels
   a) True b) False
6. To map a narrow range of low gray-level input image into a wider range of output levels, we use
   a) Log Intensity Transformation Function b) Power-law Intensity Transformation Function
   c) Inverse Log Intensity Transformation Function d) Identity Intensity Transformation Function
7. The sum of all elements in the mask of the smoothing averaging spatial filtering must be equal to
   a) m rows b) n columns c) m * n d) 1
8. Sharpening the images is commonly accomplished by performing a spatial ------ of the image field.
   a) Min Filter b) Smoothing Filter c) Integration d) Differentiation
9. One of the following filters is nonlinear
   a) Gaussian Filter b) Averaging Filter c) Laplacian Filter d) Median
10. Which type of enhancement operations are used to modify pixel values according to the value of the pixel’s neighbors?
     a) point operations b) local operations c) global operations d) mask operations
11. In which type of progressive coding technique, grey color is encoded first and then other colors are encoded?
   a) quality progressive   b) resolution progressive   c) component progressive   d) region progressive

12. If the pixels of an image are shuffled then the parameter that may change is
   a) Histogram   b) Mean   c) Entropy   d) Covariance