

NOORUL ISLAM COLLEGE OF ENGG

KUMARACOIL

DEPARTMENT OF EIE

2 MARKS, QUESTIONS & ANSWERS

EC 1034 - Digital Image Processing

Class: S8 EIE

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1. Define Image?

An Image may be defined as a two dimensional function $f(x,y)$ where x & y are spatial (plane) coordinates, and the amplitude of f at any pair of coordinates (x,y) is called intensity or gray level of the image at that point. When x,y and the amplitude values of f are all finite, discrete quantities we call the image as Digital Image.

2. Define Image Sampling?

Digitization of spatial coordinates (x,y) is called Image Sampling. To be suitable for computer processing, an image function $f(x,y)$ must be digitized both spatially and in magnitude.

3. Define Quantization ?

Digitizing the amplitude values is called Quantization. Quality of digital image is determined to a large degree by the number of samples and discrete gray levels used in sampling and quantization.

4. What is Dynamic Range?

The range of values spanned by the gray scale is called dynamic range of an image. Image will have high contrast, if the dynamic range is high and image will have dull washed out gray look if the dynamic range is low.

5. Define Mach band effect?

The spatial interaction of Luminance from an object and its surround creates a Phenomenon called the mach band effect.

6. Define Brightness?

Brightness of an object is the perceived luminance of the surround. Two objects with different surroundings would have identical luminance but different brightness.

7. Define Tapered Quantization?

If gray levels in a certain range occur frequently while others occurs rarely, the quantization levels are finely spaced in this range and coarsely spaced outside of it. This method is sometimes called Tapered Quantization.

8. What do you meant by Gray level?

Gray level refers to a scalar measure of intensity that ranges from black to grays

and finally to white.

9. What do you meant by Color model?

A Color model is a specification of 3D-coordinates system and a subspace with in that system where each color is represented by a single point.

10. List the hardware oriented color models?

- 1. RGB model
- 2. CMY model
- 3. YIQ model
- 4. HSI model

11. What is Hue of saturation?

Hue is a color attribute that describes a pure color where saturation gives a measure of the degree to which a pure color is diluted by white light.

12. List the applications of color models?

- 1. RGB model--- used for color monitor & color video camera
- 2. CMY model---used for color printing
- 3. HIS model----used for color image processing
- 4. YIQ model---used for color picture transmission

13. What is Chromatic Adoption?

‘ The hue of a perceived color depends on the adoption of the viewer. For example, the American Flag will not immediately appear red, white, and blue of the viewer has been subjected to high intensity red light before viewing the flag. The color of the flag will appear to shift in hue toward the red component cyan.

14. Define Resolutions?

Resolution is defined as the smallest number of discernible detail in an image. Spatial resolution is the smallest discernible detail in an image and gray level resolution refers to the smallest discernible change is gray level.

15. Write the M X N digital image in compact matrix form?

$f(x,y) = f(0,0) f(0,1) \dots \dots \dots f(0,N-1)$
 $f(1,0) f(1,1) \dots \dots \dots f(1,N-1)$

.
. .
.

$f(M-1) f(M-1,1) \dots \dots \dots f(M-1,N-1)$

16. Write the expression to find the number of bits to store a digital image?

The number of bits required to store a digital image is

$$b = M \times N \times k$$

When $M=N$, this equation becomes

$$b = N^2 k$$

17. What do you meant by Zooming of digital images?

Zooming may be viewed as over sampling. It involves the creation of new pixel locations and the assignment of gray levels to those new locations.

18. What do you meant by shrinking of digital images?

Shrinking may be viewed as under sampling. To shrink an image by one half, we delete every row and column. To reduce possible aliasing effect, it is a good idea to blur an image slightly before shrinking it.

19. Define the term Radiance?

Radiance is the total amount of energy that flows from the light source, and it is usually measured in watts (w).

20. Define the term Luminance?

Luminance measured in lumens (lm), gives a measure of the amount of energy an observer perceives from a light source.

21. What is Image Transform?

An image can be expanded in terms of a discrete set of basis arrays called basis images. Unitary matrices can generate these basis images. Alternatively, a given NXN image can be viewed as an N^2X1 vectors. An image transform provides a set of coordinates or basis vectors for vector space.

22. What are the applications of transform?

- 1) To reduce band width
- 2) To reduce redundancy
- 3) To extract feature.

23. Give the Conditions for perfect transform?

Transpose of matrix = Inverse of a matrix. Orthogonality.

24. What are the properties of unitary transform?

- 1) Determinant and the Eigen values of a unitary matrix have unity magnitude
- 2) The entropy of a random vector is preserved under a unitary Transformation
- 3) Since the entropy is a measure of average information, this means information is preserved under a unitary transformation.

25. Write the expression of one-dimensional discrete Fourier transforms?

Forward transform

The sequence of $x(n)$ is given by $x(n) = \{x_0, x_1, x_2, \dots, x_{N-1}\}$.

$X(k) = \sum_{n=0}^{N-1} x(n) \exp(-j 2\pi nk/N)$; $k= 0, 1, 2, \dots, N-1$

Reverse transforms

$X(n) = (1/N) \sum_{k=0}^{N-1} x(k) \exp(-j 2\pi nk/N)$; $n= 0, 1, 2, \dots, N-1$

26. Properties of twiddle factor?

1. Periodicity

$$W_N^{K+N} = W_N^K$$

2. Symmetry

$$W_N^{K+N/2} = -W_N^K$$

27. Give the Properties of one-dimensional DFT

1. The DFT and unitary DFT matrices are symmetric.
2. The extensions of the DFT and unitary DFT of a sequence and their inverse transforms are periodic with period N.
3. The DFT or unitary DFT of a real sequence is conjugate symmetric about $N/2$.

28. Give the Properties of two-dimensional DFT

1. Symmetric
2. Periodic extensions

3. Sampled Fourier transform
4. Conjugate symmetry.

29. What is cosine transform?

The NXN cosine transform $c(k)$ is called the discrete cosine transform and is defined as

$$C(k) = 1/\sqrt{N}, k=0, 0 \leq n \leq N-1$$

$$= \sqrt{2/N} \cos(\pi(2n+1)/2N - k\pi/N), 0 \leq n \leq N-1$$

30. What is sine transform?

The NXN sine transform matrix $S(k,n)$ also called the discrete sine transform is defined as $S(k,n) = \sqrt{2/(N+1)} \sin[\pi(k+1)(n+1)/(N+1)], 0 \leq k, n \leq N-1$

31. Write the properties of cosine transform?

- 1) Real & orthogonal.
- 2) Fast transform.
- 3) Has excellent energy compaction for highly correlated data

32. Write the properties of sine transform?

- 1) Real, symmetric and orthogonal.
- 2) Not the imaginary part of the unitary DFT.
- 3) Fast transform.

33. Write the properties of Hadamard transform?

- 1) Hadamard transform contains any one value.
- 2) No multiplications are required in the transform calculations.
- 3) The no: of additions or subtractions required can be reduced from N^2 to $N \log_2 N$
- 4) Very good energy compaction for highly correlated images.

34. Define Haar transform?

The Haar functions are defined on a continuous interval $X \in [0,1]$ and for $K=0,1,\dots, N-1$. Where $N=2^n$. The integer k can be uniquely decomposed as $K=2^p+q-1$.

35. Write the expression for Hadamard transforms

Hadamard transform matrices H_n are NXN matrices where $N=2^n, n=1,2,3,\dots$ is defined as $H_n = H_{n-1} * H_1 = H_1 * H_{n-1}$

$$= 1/\sqrt{2} H_{n-1} H_{n-1}$$

$$H_2 = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

36. What are the properties of Haar transform.

1. Haar transform is real and orthogonal.
2. Haar transform is a very fast transform
3. Haar transform has very poor energy compaction for images
4. The basic vectors of Haar matrix are sequentially ordered.

37. What are the Properties of Slant transform?

1. Slant transform is real and orthogonal.
2. Slant transform is a fast transform
3. Slant transform has very good energy compaction for images
4. The basic vectors of Slant matrix are not sequentially ordered.

38. Define of KL Transform?

KL Transform is an optimal in the sense that it minimizes the mean square error between the vectors X and their approximations X^{\wedge} . Due to this idea of using the Eigenvectors corresponding to largest Eigen values. It is also known as principal component transform.

39. Justify that KLT is an optimal transform.

Since mean square error of reconstructed image and original image is minimum and the mean value of transformed image is zero so that uncorrelated.

40. What is Image Enhancement?

Image enhancement is to process an image so that the output is more suitable for specific application.

41. Name the categories of Image Enhancement and explain?

The categories of Image Enhancement are

1. Spatial domain
2. Frequency domain

Spatial domain: It refers to the image plane, itself and it is based on direct manipulation of pixels of an image.

Frequency domain techniques are based on modifying the Fourier transform of an image.

42. What do you mean by Point processing?

Image enhancement at any Point in an image depends only on the gray level at that point is often referred to as Point processing.

43. Explain Mask or Kernels?

A Mask is a small two-dimensional array, in which the value of the mask coefficient determines the nature of the process, such as image sharpening.

44. What is Image Negatives?

The negative of an image with gray levels in the range $[0, L-1]$ is obtained by using the negative transformation, which is given by the expression.

$$s = L-1-r$$

Where s is output pixel.

r is input pixel.

45. Define Histogram?

The histogram of a digital image with gray levels in the range $[0, L-1]$ is a discrete function $h(r_k) = n_k$, where r_k is the k th gray level and n_k is the number of pixels in the image having gray level r_k .

46. Define Derivative filter?

For a function $f(x, y)$, the gradient f at co-ordinate (x, y) is defined as the vector $\nabla f = \nabla f / \nabla x$

$$\nabla f / \nabla y$$

$$|\nabla f| = \text{mag}(\nabla f) = \{[(\nabla f / \nabla x)^2 + (\nabla f / \nabla y)^2]\}^{1/2}$$

47. Explain spatial filtering?

Spatial filtering is the process of moving the filter mask from point to point in an image. For linear spatial filter, the response is given by a sum of products of the filter coefficients, and the corresponding image pixels in the area spanned by the filter mask.

48. Define averaging filters?

The output of a smoothing, linear spatial filter is the average of the pixels contain in the neighborhood of the filter mask. These filters are called averaging filters.

49. What is a Median filter?

The median filter replaces the value of a pixel by the median of the gray levels in the neighborhood of that pixel.

50. What is maximum filter and minimum filter?

The 100th percentile is maximum filter is used in finding brightest points in an image. The 0th percentile filter is minimum filter used for finding darkest points in an image.

51. Define high boost filter?

High boost filtered image is defined as

$$\begin{aligned} \text{HBF} &= A \text{ (original image) - LPF} \\ &= (A-1) \text{ original image} + \text{original image - LPF} \\ \text{HBF} &= (A-1) \text{ original image} + \text{HPF} \end{aligned}$$

52. State the condition of transformation function $s=T(r)$

1. $T(r)$ is single-valued and monotonically increasing in the interval $0 \leq r \leq 1$
- $0 \leq T(r) \leq 1$ for $0 \leq r \leq 1$.

53. Write the application of sharpening filters?

1. Electronic printing and medical imaging to industrial application
2. Autonomous target detection in smart weapons.

54. Name the different types of derivative filters?

1. Perwitt operators
2. Roberts cross gradient operators
3. Sobel operators.

55. Define Restoration?

Restoration is a process of reconstructing or recovering an image that has been degraded by using a priori knowledge of the degradation phenomenon. Thus restoration techniques are oriented towards modeling the degradation and applying the inverse process in order to recover the original image.

56. How a degradation process is modeled?

A system operator H , which together with an additive white noise term $w(x,y)$ operates on an input image $f(x,y)$ to produce a degraded image $g(x,y)$.

57. What is homogeneity property and what is the significance of this property?

$$H [k_1 f_1(x,y)] = k_1 H[f_1(x,y)]$$

Where H =operator

K_1 =constant

$f(x,y)$ =input image.

It says that the response to a constant multiple of any input is equal to the response to that input multiplied by the same constant.

58. What is Fred Holm integral of first kind?

$$g(x,y) = \int \int f(x',y') h(x,x',y,y') dx' dy'$$

which is called the superposition or convolution or Fred Holm integral of first kind. It states that if the response of H to an impulse is known, the response to any input $f(x,y)$ can be calculated by means of Fred Holm integral.

$$g(x,y) = \int \int H(x-x',y-y') f(x',y') dx' dy'$$

59. Define circulant matrix?

A square matrix, in which each row is a circular shift of the preceding row and the first row is a circular shift of the last row, is called circulant matrix.

Example:

$$\begin{bmatrix} h_e(0) & h_e(M-1) & h_e(M-2) & \dots & h_e(1) \\ h_e(1) & h_e(0) & h_e(M-1) & \dots & h_e(2) \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ h_e(M-1) & h_e(M-2) & h_e(M-3) & \dots & h_e(0) \end{bmatrix}$$

60. What is the concept behind algebraic approach to restoration?

Algebraic approach is the concept of seeking an estimate of f , denoted f^{\wedge} , that minimizes a predefined criterion of performance where f is the image.

61. Why the image is subjected to wiener filtering?

This method of filtering consider images and noise as random process and the objective is to find an estimate f^{\wedge} of the uncorrupted image f such that the mean square error between them is minimized. So that image is subjected to wiener filtering to minimize the error.

62. Define spatial transformation?

Spatial transformation is defined as the rearrangement of pixels on an image plane.

63. Define Gray-level interpolation?

Gray-level interpolation deals with the assignment of gray levels to pixels in the spatially transformed image.

64. Give one example for the principal source of noise?

The principal source of noise in digital images arise image acquisition (digitization) and/or transmission. The performance of imaging sensors is affected by a variety of factors, such as environmental conditions during image acquisition and by the quality of the sensing elements. The factors are light levels and sensor temperature.

65. When does the degradation model satisfy position invariant property?

An operator having input-output relationship $g(x,y)=H[f(x,y)]$ is said to position invariant if $H[f(x-x',y-y')] = g(x-x',y-y')$ for any $f(x,y)$ and (x',y') . This definition indicates that the response at any point in the image depends only on the value of the input at that point not on its position.

66. Why the restoration is called as unconstrained restoration?

In the absence of any knowledge about the noise 'n', a meaningful criterion

function is to seek an f^{\wedge} such that $H f^{\wedge}$ approximates g in a least square sense by assuming the noise term is as small as possible.

Where H = system operator.

f^{\wedge} = estimated input image.

g = degraded image.

67. Which is the most frequent method to overcome the difficulty to formulate the spatial relocation of pixels?

The point is the most frequent method, which are subsets of pixels whose location in the input (distorted) and output (corrected) image is known precisely.

68. What are the three methods of estimating the degradation function?

1. Observation
2. Experimentation
3. Mathematical modeling.

69. How the blur is removed caused by uniform linear motion?

An image $f(x,y)$ undergoes planar motion in the x and y -direction and $x_0(t)$ and $y_0(t)$ are the time varying components of motion. The total exposure at any point of the recording medium (digital memory) is obtained by integrating the instantaneous exposure over the time interval during which the imaging system shutter is open.

70. What is inverse filtering?

The simplest approach to restoration is direct inverse filtering, an estimate $F^{\wedge}(u,v)$ of the transform of the original image simply by dividing the transform of the degraded image, $G^{\wedge}(u,v)$ by the degradation function.

$$F^{\wedge}(u,v) = G^{\wedge}(u,v)/H(u,v)$$

71. Give the difference between Enhancement and Restoration?

Enhancement technique is based primarily on the pleasing aspects it might present to the viewer. For example: Contrast Stretching. Whereas Removal of image blur by applying a deblurring function is considered a restoration technique.

72. What is segmentation?

The first step in image analysis is to segment the image. Segmentation subdivides an image into its constituent parts or objects.

73. Write the applications of segmentation.

- (i) Detection of isolated points.
- (ii) Detection of lines and edges in an image.

74. What are the three types of discontinuity in digital image?

Points, lines and edges.

75. How the discontinuity is detected in an image using segmentation?

- (i) Compute the sum of the products of the coefficient with the gray levels contained in the region encompassed by the mask.
- (ii) The response of the mask at any point in the image is

$$R = w_1z_1 + w_2z_2 + w_3z_3 + \dots + w_9z_9$$

Where z_i = gray level of pixels associated with mass coefficient w_i .

- (iii) The response of the mask is defined with respect to its center

location.

76. Why edge detection is most common approach for detecting discontinuities?

The isolated points and thin lines are not frequent occurrences in most practical applications, so edge detection is mostly preferred in detection of discontinuities.

77. How the derivatives are obtained in edge detection during formulation?

The first derivative at any point in an image is obtained by using the magnitude of the gradient at that point. Similarly the second derivatives are obtained by using the laplacian.

78. Write about linking edge points.

The approach for linking edge points is to analyse the characteristics of pixels in a small neighborhood (3x3 or 5x5) about every point (x,y) in an image that has undergone edge detection. All points that are similar are linked, forming a boundary of pixels that share some common properties.

79. What are the two properties used for establishing similarity of edge pixels?

- (1) The strength of the response of the gradient operator used to produce the edge pixel.
- (2) The direction of the gradient.

$W_1 W_2 W_3$

$W_4 W_5 W_6$

$W_7 W_8 W_9$

80. Explain about gradient operator.

The gradient of an image $f(x,y)$ at location (x,y) is the vector

$$\underline{f} = G_x = \frac{f}{x}$$

$$G_y \frac{f}{y}$$

-The gradient vector points are in the direction of maximum rate of change of f at (x,y)

- In edge detection an important quantity is the magnitude of this vector (gradient) and is denoted as $|\underline{f}|$

$$|\underline{f}| = \text{mag}(\underline{f}) = [G_x^2 + G_y^2]^{1/2}$$

The direction of gradient vector also is an important quantity.

$$\theta(x,y) = \tan^{-1}(G_y/G_x)$$

81. What is the advantage of using sobel operator?

Sobel operators have the advantage of providing both the differencing and a smoothing effect. Because derivatives enhance noise, the smoothing effect is particularly attractive feature of the sobel operators.

82. What is pattern?

Pattern is a quantitative or structural description of an object or some other entity of interest in an image. It is formed by one or more descriptors.

83. What is pattern class?

It is a family of patterns that share some common properties. Pattern classes are denoted as $w_1 w_2 w_3 \dots w_M$, where M is the number of classes.

84. What is pattern recognition?

It involves the techniques for arranging pattern to their respective classes by automatically and with a little human intervention.

85. What are the three principle pattern arrangements?

The three principal pattern arrangements are vectors, Strings and trees. Pattern vectors are represented by old lowercase letters such as x y z and In the form $x=[x_1, x_2, \dots, x_n]$ Each component x represents l th descriptor and n is the number of such descriptor.

86. What is Data Compression?

Data compression requires the identification and extraction of source redundancy. In other words, data compression seeks to reduce the number of bits used to store or transmit information.

87. What are two main types of Data compression?

Lossless compression can recover the exact original data after compression. It is used mainly for compressing database records, spreadsheets or word processing files, where exact replication of the original is essential.

□ **Lossy compression** will result in a certain loss of accuracy in exchange for a substantial increase in compression. Lossy compression is more effective when used to compress graphic images and digitised voice where losses outside visual or aural perception can be tolerated.

88. What is the Need For Compression?

In terms of storage, the capacity of a storage device can be effectively increased with methods that compress a body of data on its way to a storage device and decompresses it when it is retrieved. In terms of communications, the bandwidth of a digital communication link can be effectively increased by compressed data at the sending end and decompressing data at the receiving end. At any given time, the ability of the Internet to transfer data is fixed. Thus, if data can effectively be compressed wherever possible, significant improvements of data throughput can be achieved. Many files can be combined into one compressed document making sending easier.

89. What are different Compression Methods?

- (1) Run Length Encoding (RLE)
- (2) Arithmetic coding
- (3) Huffman coding
- (4) Transform coding

90. What is run length coding?

Run-length Encoding, (RLE) is a technique used to reduce the size of a repeating string of characters. This repeating string is called a *run*; typically RLE encodes a run of symbols into two bytes, a count and a symbol. RLE can

compress any type of data regardless of its information content, but the content of data to be compressed affects the compression ratio. Compression is normally measured with the compression ratio:

91. Define compression ratio.

Compression Ratio = original size / compressed size: 1

92. Give an example for Run length Encoding.

Consider a character run of 15 'A' characters, which normally would require 15 bytes to store:

AAAAAAAAAAAAAAAAA coded into 15A

With RLE, this would only require two bytes to store; the count (15) is stored as the first byte and the symbol (A) as the second byte.

93. What is Huffman Coding?

Huffman compression reduces the average code length used to represent the symbols of an alphabet. Symbols of the source alphabet, which occur frequently, are assigned with short length codes. The general strategy is to allow the code length to vary from character to character and to ensure that the frequently occurring characters have shorter codes.

94. What is Arithmetic Coding?

Arithmetic compression is an alternative to Huffman compression; it enables characters to be represented as fractional bit lengths. Arithmetic coding works by representing a number by an interval of real numbers greater or equal to zero, but less than one. As a message becomes longer, the interval needed to represent it becomes smaller and smaller, and the number of bits needed to specify it increases.

95. What is JPEG?

The acronym is expanded as "Joint Photographic Expert Group". It is an international standard in 1992. It perfectly Works with colour and greyscale images, Many applications e.g., satellite, medical, etc,

96. What are the basic steps in JPEG?

- The Major Steps in JPEG Coding involves
 - DCT (Discrete Cosine Transformation)
 - Quantization
 - Zigzag Scan
 - DPCM on DC component
 - RLE on AC Components
 - Entropy Coding

97. What is MPEG?

The acronym is expanded as "Moving Picture Expert Group". It is an international standard in 1992. It perfectly Works with video and also used in teleconferencing.

98. What is transform coding?

Transform coding is used to convert spatial image pixel values to transform coefficient values. Since this is a linear process and no information is lost, the number of coefficients produced is equal to the number of pixels transformed. The desired effect is that most of the energy in the image will be contained in a few large transform coefficients. If it is generally the same few coefficients that contain most of the energy in most pictures, then the coefficients may be further coded by lossless entropy coding. In addition, it is likely that the smaller coefficients can be coarsely quantized or deleted (lossy coding) without doing visible damage to the reproduced image.

99. What are the different transforms used in transform coding and how the differ?

Many types of transforms used for picture coding, are Fourier, Karhonen-Loeve, Walsh - Hadamard, lapped orthogonal, discrete cosine (DCT), and recently, wavelets. The various transforms differ among themselves in three basic ways that are of interest in picture coding:

- 1) The degree of concentration of energy in a few coefficients;
- 2) The region of influence of each coefficient in the reconstructed picture;
- 3) The appearance and visibility of coding noise due to coarse quantization of the coefficients.

100. Explain the term digital image.

The digital image is an array of real or complex numbers that is represented by a finite no of bits.

101. Write any four applications of DIP.

- (i). Remote sensing
- (ii). Image transmission and storage for business application
- (iii). Medical imaging
- (iv). Astronomy

102. What is the effect of Mach band pattern.

The intensity or the brightness pattern perceive a darker scribe in region D and brighter scribe in region B. This effect is called Mach band pattern or effect.

103. Find the number of bits to store a 128_128 image with 64 gray levels.

Given: $M = N = 128$

$$L = 64 = 2^k$$

$$\Rightarrow k = 6$$

No. of bits = $M \cdot N \cdot k$

$$= 128 \cdot 128 \cdot 6$$

$$= 98304 \text{ bits}$$

104. Name the types of connectivity and explain

- (a). 4-connectivity:

Two pixels p and q with values from V are 4-connected if q is in the set $N_4(p)$

(b). 8- connectivity:

Two pixels p and q with values from V are 8-connected if q is in the set $N_8(p)$

©. m - connectivity:

Two pixels p and q with values from V are m -connected if

(i). q is in $N_4(p)$ or

(ii). q is in $N_b(p)$ and the set $N_4(p) \cap N_4(q) = \emptyset$

105. Define the chessboard distance

It is also known as D_8 distance given by

$$D_8(p, q) = \max(|x-s|, |y-t|)$$

The pixels with D_8 distance from (x, y) less than or equal to some value r form a square centered at (x, y) .

106. Write down the properties of 2D fourier transform.

Separability

Translation

Periodicity and Conjugate property

Rotation

Distributivity and scaling

Average value

Convolution and Correlation

Laplacian

107. Obtain the Hadamard transformation for $N = 4$

$$N = 4 = 2^n$$

$$\Rightarrow n = 2$$

108. Write down the properties of Haar transform.

Real and orthogonal

Very fast transform

Basis vectors are sequentially ordered

Has fair energy compaction for image

Useful in feature extraction, image coding and image analysis

problem

109. What is enhancement.

Image enhancement is a technique to process an image so that the result is more suitable than the original image for specific applications;

110. What is point processing.

Enhancement at any point in an image depends only on the gray level at that point is referred to as point processing.

111. What is gray level slicing.

Highlighting a specific range of gray levels in an image is referred to as gray level

slicing. It is used in satellite imagery and x-ray images

112. What is histogram equalization?

It is a technique used to obtain linear histogram. It is also known as histogram linearization. Condition for uniform histogram is $P_s(s) = 1$.

113. Define the degradation phenomena?

Image restoration or degradation is a process that attempts to reconstruct or recover an image that has been degraded by using some clear knowledge of the degradation phenomena. Degradation may be in the form of

Sensor noise

Blur due to camera misfocus

Relative object camera motion

114. What is unconstrained restoration.

It is also known as least square error approach. $n = g - Hf$
To estimate the original image f^\wedge , noise n has to be minimized and $f^\wedge = g/H$.

115. What is blind image restoration

Degradation may be difficult to measure or may be time varying in an unpredictable manner. In such cases information about the degradation must be extracted from the observed image either explicitly or implicitly. This task is called blind image restoration.