Digital Signal and Image Processing MCQs

Module 1 : DISCRETE-TIME SIGNAL AND DISCRETE-TIME SYSTEM

1. If x(n) is a discrete-time signal, then the value of x(n) at non-integer value of 'n' is?

a) Zero

b) Positive

e) Negative

d) Not defined

Answer: d

Explanation: For a discrete time signal, the value of x(n) exists only at integral values of n. So, for a non- integer value of 'n' the value of x(n) does not exist.

2. The discrete time function defined as u(n)=n for n≥O;u(n)=0 for n<0 is an ___________

a) Unit sample signal

b) Unit step signal

c) Unit ramp signal

d) None of the mentioned

Answer: c

Explanation: When we plot the graph for the given function, we get a straight line passing through origin with a unit positive slope. So, the function is called a unit ramp signal.

3. The phase function of a discrete time signal x(n}= a_{n} where a= $r.J9$ is?

a) tan(n8)

b) ne

c) ta n-1 (n8)

d) none of the mentioned

Answer: b

Explanation: Given x(n)=an=(r.ej8}n = rn.ejn8

=>x(n}=rn.(cosn8+jsinn8)

Phase function is tan-1(cosn8/sinn8}=tan-1(tan n8}=n8.

4. The signal given by the equation $\sum_{n=-\infty}^{\infty} |x(n)|^2$ is known as ________

a) Energy signal

b) Power signal

c) Work done signal

d) None of the mentioned

Answer: a

Explanation: We have used the magnitude-squared values of x(n), so that our definition applies to complex-valued as well as real-valued signals. If the energy of the signal is finite i.e., $0<E<\infty$ then the given signal is known as Energy signal.

5. $x(n)*\delta(n-k)=?$

a) x(n)

b) x(k)

c) $x(k)*\delta(n-k)$

d) $x(k)*\delta(k)$

Answer: c

Explanation: The given signal is defined only when n=k by the definition of delta function. So, $x(n)*\delta(n-k)= x(k)*\delta(n-k)$.

6. A real valued signal x(n) is called as anti-symmetric if _________

a) x(n)=x(-n)

b) x(n)=-x(-n)

c) x(n)=-x(n)

d) none of the mentioned

Answer: b

Explanation: According to the definition of anti-symmetric signal, the signal x(n) should be symmetric over origin. So, for the signal x(n) to be symmetric, it should satisfy the condition x(n)=-x(-n).

7. Time scaling operation is also known as _________

a) Down-sampling

b) Up-sampling

c) Sampling

d) None of the mentioned

Answer: a

Explanation: If the signal x(n) was originally obtained by sampling a signal $x_a(t)$, then $x(n)=x_a(nT)$. Now, $y(n)=x(2n)(\text{say})=x_a(2nT)$. Hence the time scaling operation is equivalent to changing the sampling rate from 1/T to 1/2T, that is to decrease the rate by a factor of 2. So, time scaling is also called as down-sampling.

8. What is the condition for a signal $x(n)=Br^n$ where $r=e^{aT}$ to be called as a decaying exponential signal?

a) 0<r<00

b) 0<r<1

e) r>1

d)r<O

Answer: b

Explanation: When the value of 'r' lies between 0 and 1 then the value of x(n) goes on decreasing exponentially with increase in value of 'n'. So, the signal is called a decaying exponential signal.

9. The function given by the equation x(n)=1, for n=O; x(n)=O, for n:tO is a __________

a) Step function

b) Ramp function

c) Triangular function

d) Impulse function

Answer: d

Explanation: According to the definition of the impulse function, it is defined only at n=0 and is not defined elsewhere which is as per the signal given.

10. The output signal when a signal x(n)=(0, 1,2,3) is processed through an 'Identical' system is?

a) (3,2, 1,0)

b) (1,2,3,0)

c) {O, 1,2,3)

d) None of the mentioned

Answer: c

Explanation: An identical system is a system whose output is the same as the input, that is it does not perform any operation on the input and transmits it.

11. If a signal x(n) is passed through a system to get an output signal of y(n)=x(n+ 1), then the signal is said to be _________

a) Delayed

b) Advanced

c) No operation

d) None of the mentioned

Answer: d

Explanation: For example, the value of the output at the time n=O is y(O)=x(1), that is the system is advanced by one unit.

12. if the output of the system is $y(n)= \sum_{=-00} x(y)$ with an input of x(n) then the system will work as ____________

a) Accumulator

b) Adder

c) Subtractor

d) Multiplier

Answer: a

Explanation: From the equation given, y(n)=x{n)+x(n-1)+x(n-2)+..... This system calculates the running sum of all the past input values till the present time. So, it acts as an accumulator.

13. What is the output y(n) when a signal x(n)=n*u(n)is passed through a accumulator system under the conditions that it is initially relaxed?

a) $\frac{n^2+n+1}{2}$
b) $\frac{n(n+1)}{2}$
e) ,,2+;+2

d) None of the mentioned

Answer: b

ExpJa.nation; Given that the system is initially relaxed, that is y(-1)...=0

According to the equation of the accu mutator,

y(n)=L:=-00 x(n)

=,t,,,¡k---oo X(n) + ,¿_,iç_Q .xi(n)

=y(=1) + r:,0 n * u(n)

=0 + L;-0 11(since u(n)=1 i11 0 ton)

$= \frac{n(rJ+1)}{2}$

14. The block denoted as follows is known as ----

z'

a) Delay block
b) Advance block
c) Multiplier block
d) Adder block

Answer: a

Explanation: If the function to this block is x(n) then the output from the block will be x(n-1). So, the block is called a delay block or delay element.

15. The output signal when a signal x(n)=(0, 1,2,3) is processed through an 'Delay' system is?

a) (3,2, 1,0)

b) (1,2,3,0)

e) (0, 1,2,3)

d) None of the mentioned

Answer: b

Explanation: An delay system is a system whose output is same as the input, but after a delay.

16. The system described by the input-output equation y(n)=nx(n)+b x'' (n) is a ________

a) Static system

b) Dynamic system

c) Identical system

d) None of the mentioned

Answer: a

Explanation: Since the output of the system y(n) depends only on the present value of the input x(n) but not on the past or the future values of the in put, the system is called as static or memory-less system.

17. Whether the system described by the input-output equations y(n)=x(n)-x(n-1) a Time-variant system.

a) True

b) False

Answer: b

Explanation: If the input is delayed by k units then the output will be y(n,k)=x(n-k)-x(n-k-1)

If the output is delayed by k units then y(n-k)=x(n-k)-x((n-k)-1)

=>y(n,k)=y(n-k). Hence the system is time-invariant.

18. The system described by the input-output equations y(n)= x'' (n) is a Non-linear system.

a) True

b) False

Answer: a

Explanation: Given equation is y(n)=x2{n}

Let Y1(n)=x12(n) and Y1(n)::x22(n)

y3i(n)=y,(n)+y2(n)= x12(n)+ x22(n):;(x1,(n)t-x2r(n))2

S0 the system is non-linear.

19. If the output of the system of the system at any 'n' depends only the present or the past values of the inputs then the system is said to be ________

a) Linear

b) Non-Linear

e) Causal

d) Non-causal

Answer: c

Explanation: A system is said to be causal if the output of the system is defined as the function shown below

y(n)=F[x(n),x(n-1),x(n-2),....] So, according to the conditions given in the question, the system is a causal system.

20. The system described by the input-output equations y(n)=x(-n) is a causal system.

a) True

b) False

Answer: b

Explanation: For n=-1, y(-1)=x(1)

That is, the output of the system at n=-1 is depending on the future value of the input at n=1. So the system is a non-causal system.

21. If a system do not have a bounded output for bounded input, then the system is said to be ________

a) Causal

b) Non-causal

c) Stable

d) Non-stable

Answer: d

Explanation: An arbitrary relaxed system is said to be BIBO stable if it has a bounded output for every value in the bounded input. So, the system given in the question is a Non-stable system.

22. Which of the following parameters are required to calculate the correlation between the signals x(n) and y(n)?

a) Time delay

b) Attenuation factor

c) Noise signal

d) All of the mentioned

Answer: d

Explanation: Let us consider x(n) be the input reference signal and y(n) be the reflected signal.

Now, the relation between the two signals is given as y(n)=ax(n-D)+w(n)

Where a-attenuation factor representing the signal loss in the round-trip transmission of the signal x(n)

D-time delay between the time of projection of signal and the reflected back signal

w(n)-noise signal generated in the electronic parts in the front end of the receiver.

23. What is the cross correlation sequence of the following sequences?

x(n)={....0,0,2,-1,3,7,1,2,-3,0,0....}

y(n)={....0,0,1,-1,2,-2,4,1,-2,5,0,0....}

a) {10,9,19,36,-14,33,0,7,13,-18,16,7,5,-3}

b) {10,-9,19,36,-14,33,0,7,13,-18,16,-7,5,-3}

c) {10,9,19,36,14,33,0,-7,13,-18,16,-7,5,-3}

d) {10,-9,19,36,-14,33,0,-7,13,18,16,7,5,-3}

24. Auto correlation sequence is an even function.

a) True

b) False

Answer: a

Explanation: Let us consider a signal x(n) whose auto correlation is defined as $r_{xx}(l)$.

We know that, for auto correlation sequence $r_{xx}(l)=r_{xx}(-l)$.

So, auto correlation sequence is an even sequence.

25 Which of the following should be done in order to convert a continuous-time signal to a discrete-time signal?

a) Sampling

b) Differentiating

c) Integrating

d) None of the mentioned

Answer: a

Explanation: The process of converting a continuous-time signal into a discrete-time signal by taking samples of continuous time signal at discrete time instants is known as 'sampling'.

26. The process of converting discrete-time continuous valued signal into discrete-time discrete valued (digital) signal is known as __________

u1::,Lr ele VdlUeu \UlbIldlJ ::,lbr ldi t::, K.I IUVVI ld::,----

a) Sampling

b) Quantization

e) Coding

d) None of the mentioned

Answer: b

Explanation: In this process, the value of each signal sample is represented by a value selected from a finite set of possible values. Hence this process is known as 'quantization'

27. What is output signal when a signal x(t)=cos(2*pi*40*t) is sampled with a sampling frequency of 20Hz?

a) cos(pi*n)

b) cos(2*pi*n)

e) cos(4*pi*n)

d) cos(8*pi*n)

Answer: c

Explanation: From the question F=40Hz, Fs=20Hz

=>f=F/Fs

=>f=40/20

=>f=2Hz

=>x(n)=cos(4*pi*n).

28. What is the nyquist rate of the signal x(t)=3cos(SO*pi*t)+1 Osin(300*pi*t)-cos(1 OO*pi*t)?

a) S0Hz

b)100Hz

c) 200Hz

d) 300Hz

Answer: d

Explanation: The frequencies present in the given signal are F1 =25Hz, F2=150Hz, F3=50Hz

Thus Fmax=150Hz and from the sampling theorem,

nyquist rate=2*Fmax

Therefore, Fs=2*150=300Hz.

29.What is the discrete-time signal obtained after sampling the analog signal x(t)=cos(2000*pi*t)+sin(SOOO*pi*t) at a sampling rate of 5000 samples/sec?

a) cos(2.5*pi*n)+sin(pi*n)

b) cos(0.4*pi*n)+sin(pi*n)

e) cos(2000*pi*n)+sin(SOOO*pi*n)

d) none of the mentioned

Answer: b

Explanation: From the given analog signal, F1 =1 OOOHz F2=2500Hz and Fs=SOOOHz

=>f1 =F1 /Fs and f2=F2/Fs

=>f1 =0.2 and f2=0.5

=>x(n)=cos(0.4*pi*n)+sin(pi*n).

30. Let $x_1(t)$ and $x_2(t)$ be periodic signals with fundamental periods T1 and T2 respectively. Which of the following must be a rational number for $x(t)=x_1(t)+x_2(t)$ to be periodic?

a) T1+T2

b) T1-T2

c) T1/T2

d) T1*T2

Answer: c

Explanation: Let T be the period of the signal x(t)

=>x(t+T)=x1(t+mT1)+x2(t+nT2)

Thus, we must have

mT1=nT2=T

=>(T1/T2)=(k/m)= a rational number.

31. Let x1(t) and x2(t) be periodic signals with fundamental periods T1 and T2 respectively. Then the fundamental period of x(t)=x1(t)+x2(t) is?

a) LCM of T1 and T2

b) HCF of Trand T2

c) Product of T1 and T2

d) Ratio of T1 to T2

Answer: a

Explanation: For the sum of x1(t) and x2(t) to be periodic the ratio of their periods should be a rational number, then the fundamental period is the LCM of T1 and T2.

32. All energy signals will have an average power of ________

a) Infinite

b)Zero

c) Positive

d) Cannot be calculated

Answer: b

Explanation: For any energy signal, the average power should be equal to 0 i.e., P=0.

33. x(t) or x(n) is defined to be an energy signal, if and only if the total energy content of the signal is a ________

a) Finite quantity

b) Infinite

e) Zero

d) None of the mentioned

Answer: a

Explanation: The energy signal should have a total energy value that lies between 0 and infinity.

34. What is the period of cos2t+sin3t?

a) pi

b) 2*pi

e) 3*pi

d) 4*pi

Answer: b

Explanation: Period of cos2t=(2*pi)/2=pi

Period of sin3t=(2*pi)/3

LCM of pi and (2*pi)/3 is 2*pi.

35. If x(n)=(O,1,2,3,3,0,0,0) then x(2n) is?

a) (0,2,4,6,6,0,0,0)

b) (0,1,2,3,3,0,0,0)

e) (0,2,3,0,0,0,0,0)

d) None of the mentioned

Answer: e

Explanation: Substitute n=0,1,2 ... in x(2n) and obtain the values from the given x(n).

36. If x(n)=(0,0, 1,2,3,4,0,0) then x(n-2) is?

a) (0,0,2,4,6,8,0,0)

b) (0,0,1,2,3,4,0,0)

e) (1,2,3,4,0,0,0,0)

d) (0,0,0,0,1,2,3,4)

Answer: d

Explanation: The signal x(n) is shifted right by 2.

37. If x(n)=(0,0, 1, 1, 1, 1, 1,0) then x(3n+1) is?

a) (0,1,0,0,0,0,0,0)

b) (0,0,1, 1, 1, 1,0,0)

e) (1,1,0,0,0,0,0,0)

d) None of the mentioned

Answer: a

Explanation: First shift the given signal left by 1 and then time scale the obtained signal by 3.

Discrete Fourier Transform

1. If x{n) is a finite duration sequence of length L, then the discrete Fourier transform X(k) of x(n) is given as __________

a) L l:.-=0 x(n)e-JWnJV {L<N)(k=O, 1,2 ...N-1)

b) L;,:=0 x(n)~2rrknJ N {L<N)(k=O, 1,2...N-1)

e) L.,=01 x(n)e' 1lfkn1J\'(L>N)(k=0,1,2, ...N-1)

d) L.=01 x(n)e-12rrk11 v{L>N)(k=0,1,2 ...N-1)

Answer: a

Explanation: If x{n) is *a* finite duration sequence of length L, then the Fourier transform of x(n} is given as X(w)= L L-1 11:--0 x(n)e-,wll

If we sample X(w} at equally spaced frequencies w=2nk/N, k=0,1,2 ... N-1 where N>L, the resultant samples are X{k)= L.0 x(n)e-j2.'JCkll/N

2. If X(k) discrete Fourier transform of x(n), then the inverse discrete Fourier transform ofX(k) is?

a) J/N ~N-l .LIk=0 X(k)e-j2nknJN

b) L~~J X(k)e-Î2nkn/N

e) r:-0 X(k)e.i2rr.kn11v

d) J/N ~N-J Lik--0 X(k) ei2rtk.nlN

Answer: d

Explanation: If X(k) discrete Fourier transform of x(n), then the inverse discrete Fourier transform of X(k) is given as x(n}=-'/N ~N-1 k.Ik=<J X(k)ei2xlcn!N

3. DFT stands for __________

a) Digital Fast Transform

b) Discrete Fourier Transform

c) Digital Fourier Transform

d) Discrete Fast Transform

Answer : b (Discrete Fourier Transform)

4. Irhe Nth rot of unity WN is given as __________

a) ~2:TtN

b) e-j2TlN

e) e-j,2rrJN

d) eiln!N

Answer: *e*

Explanation: We know that the Discrete Fourier transform of *a* signal x(n) is given as X(k)~

$\sum_{n=0}^{N-1} x(n) e^{-j2\pi kn/N} = \sum_{n=0}^{N-1} x(n) W_N^{kn}$

Thus we get Nth rot of unity $W_N = e^{fln/N}$

5. Which of the following is true regarding the number of computations requires to compute an N-point DFT?

a) N^2 complex multiplications and N(N-1) complex additions
b) N^2 complex additions and N(N-1) complex multiplications
c) N^2 complex multiplications and N(N+1) complex additions
d) N^2 complex additions and N(N+1) complex multiplications

Answer: B

6. Which of the following is true?
a) $W_N^{*} = \frac{1}{N} W_N^{-1}$
b) $W_N^{-1} = \frac{1}{N} W_N^{*}$
c) $W_N^{-1} = W_N^{*}$
d) None of the mentioned

Answer: b
Explanation: If X_N represents the N point DFT of the sequence x_N in the matrix form, then we know that
$X_N = W_N . x_N$
By pre-multiplying both sides by W_N^{-1}, we get
$x_N = W_N^{-1} . X_N$
But we know that the inverse DFT of X_N is defined as
$x_N = \frac{1}{N} W_N^{*} X_N$
Thus by comparing the above two equations we get
$W_N^{-1} = \frac{1}{N} W_N^{*}$

7. What is the DFT of the four point sequence x(n)={0,1,2,3}?
a) {6,-2+2j-2,-2-2j}
b) {6,-2-2j,2,-2+2j}
c) {6,-2+2j,-2,-2-2j}
d) {6,-2-2j,-2,-2+2j}

Answer: c
Explanation: The first step is to determine the matrix W4. By exploiting the periodicity property of W4 and the symmetry property
$W_N^{k+N/2} = -W_N^{k}$
The matrix W_4 may be expressed as

$$W_4=\begin{bmatrix} W_4^0 & W_4^0 & W_4^0 & W_4^0 \\ W_4^0 & W_4^1 & W_4^2 & W_4^3 \\ W_4^0 & W_4^2 & W_4^4 & W_4^6 \\ W_4^0 & W_4^3 & W_4^6 & W_4^9 \end{bmatrix} = \begin{bmatrix} W_4^0 & W_4^0 & W_4^0 & W_4^0 \\ W_4^0 & W_4^1 & W_4^2 & W_4^3 \\ W_4^0 & W_4^2 & W_4^0 & W_4^2 \\ W_4^0 & W_4^3 & W_4^2 & W_4^1 \end{bmatrix}$$

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

Then $X_4 = W_4 . x_4 = \begin{bmatrix} 6 \\ -2+2j \\ -2 \\ -2-2j \end{bmatrix}$

8. If X(k) is the N point DFT of a sequence whose Fourier series coefficients is given by ck, then which of the following is true?
a) X(k)=Nck ✓
b) X(k)=ck/N
c) X(k)=N/ck
d) None of the mentioned

Answer: a

Explanation: The Fourier series coefficients are given by the expression
$c_k = \frac{1}{N}\sum_{n=0}^{N-1} x(n)e^{-j2\pi kn/N} = \frac{1}{N}X(k) \Rightarrow X(k) = Nc_k$

9. What is the DFT of the four point sequence x(n)={0,1,2,3}?
a) {6,-2+2j-2,-2-2j}
b) {6,-2-2j,2,-2+2j}
c) {6,-2-2j,-2,-2+2j}
d) {6,-2+2j,-2,-2-2j}

Answer: d
Explanation: Given x(n)={O,1,2,3}
We know that the 4-point DFT of the above given sequence is given by the expression
$X(k)=\sum_{n=0}^{N-1} x(n)e^{-j2\pi kn/N}$
In this case N=4
=>X(0)=6,X(1)=-2+ 2j,X(2)=-2,X(3)=-2-2j.

10. If $W_4^{100}=W_x^{200}$, then what ls the value of x?
a) 2
b) 4
e) 8
d) 16

Answer: e
Explanation: We know that according to the periodicity and synunetry property,
100/4=200/x=>x=8.

11. If x(n) and X(k) are an N-point DFT pair, then x(n+N)=x(n).
a) True
b) False

Answer: a
Explanation: We know that the expression for an OFT is given as
$X(k)=\sum_{n=0}^{N-1} x(n)e^{-j2\pi kn/N}$
Now take x(n)=x(n+N)=>$X_1(k)=\sum_{n=0}^{N-1} x(n+N)e^{-j2\pi kn/N}$
Let n+N=l=>$X_1(k)=\sum_{l=N}^{2N-1} x(l)e^{-j2\pi kl/N}$ =X(k)
Therefore, we got x(n)=x(n+N)

12. If x(n) and X(k) are an N-point DFT pair, then X(k+N)=?
a) X(-k)
b) -X(k)
c) X(k)
d) None of the mentioned

Answer: e
Explanation: We know that
$x(n)=\frac{1}{N}\sum_{k=0}^{N-1} X(k)e^{j2\pi kn/N}$
Let X(k)=X(k+N)
=>$x_1(n)=\frac{1}{N}\sum_{k=0}^{N-1} X(k+N)e^{j2\pi kn/N}$ =x(n)
Therefore, we have X(k)=X(k+N)

13. If $X_1(k)$ and $X_2(k)$ are the N-point DFTs of $X_1(n)$ and $x_2(n)$ respectively, then what is the N-point DFT of $x(n)=ax_1(n)+bx_2(n)$?
a) $X_1(ak)+X_2(bk)$
b) $aX_1(k)+bX_2(k)$
e) $e^{ak}X_1(k)+e^{bk}X_2(k)$
d) None of the mentioned

Answer: b

Explanation: We know that, the DFT of a signal x(n) is given by the expression

$X(k)=\sum_{n=0}^{N-1} x(n)e^{-j2\pi kn/N}$

Given $x(n)=ax_1(n)+bx_2(n)$

$\Rightarrow X(k)=\sum_{n=0}^{N-1}(ax_1(n)+bx_2(n))e^{-j2\pi kn/N}$

$=a\sum_{n=0}^{N-1}x_1(n)e^{-j2\pi kn/N}+b\sum_{n=0}^{N-1}x_2(n)e^{-j2\pi kn/N}$

$\Rightarrow X(k)=aX_1(k)+bX_2(k)$.

14. If x(n) is a complex valued sequence given by $x(n)=x_R(n)+jx_I(n)$, then what is the DFT of $x_R(n)$?

a) $\sum_{n=0}^{N} x_R(n)\cos\frac{2\pi kn}{N}+x_I(n)\sin\frac{2\pi kn}{N}$

b) $\sum_{n=0}^{N} x_R(n)\cos\frac{2\pi kn}{N}-x_I(n)\sin\frac{2\pi kn}{N}$

c) $\sum_{n=0}^{N-1} x_R(n)\cos\frac{2\pi kn}{N}-x_I(n)\sin\frac{2\pi kn}{N}$

d) $\sum_{n=0}^{N-1} x_R(n)\cos\frac{2\pi kn}{N}+x_I(n)\sin\frac{2\pi kn}{N}$

Answer: d

Explanation: Given $x(n)=x_R(n)+jx_I(n)\Rightarrow x_R(n)=1/2(x(n)+x^*(n))$

Substitute the above equation in the DFT expression

Thus we get, $X_R(k)=\sum_{n=0}^{N-1} x_R(n)\cos\frac{2\pi kn}{N}+x_I(n)\sin\frac{2\pi kn}{N}$

15. If x(n) is a real sequence and X(k) is its N-point DFT, then which of the following is true?

a) X(N-k)=X(-k)

b) X(N-k)=X*(k)

c) X(-k)=X*(k)

d) All of the mentioned

Answer: d

Explanation: We know that

$X(k)=\sum_{n=0}^{N-1} x(n)e^{-j2\pi kn/N}$

Now $X(N-k)=\sum_{n=0}^{N-1} x(n)e^{-j2\pi(N-k)n/N}=X^*(k)=X(-k)$

Therefore,

X(N-k)=X*(k)=X(-k)

16. If x(n) is real and even, then what is the DFT of x(n)?

a) $\sum_{n=0}^{N-1} x(n)\sin\frac{2\pi kn}{N}$

b) $\sum_{n=0}^{N-1} x(n)\cos\frac{2\pi kn}{N}$

c) $-j\sum_{n=0}^{N-1} x(n)\sin\frac{2\pi kn}{N}$

d) None of the mentioned

Answer: b

Explanation: Given x(n) is real and even, that is x(n)=x(N-n)

We know that $X_I(k)=0$. Hence the DFT reduces to

$X(k)=\sum_{n=0}^{N-1} x(n)\cos\frac{2\pi kn}{N};\ 0\le k\le N-1$

17. If x(n) is real and odd, then what is the IDFT of the given sequence?

a) $j\frac{1}{N}\sum_{k=0}^{N-1} X(k)\sin\frac{2\pi kn}{N}$

b) $\frac{1}{N}\sum_{k=0}^{N-1} X(k)\cos\frac{2\pi kn}{N}$

c) $-j\frac{1}{N}\sum_{k=0}^{N-1} X(k)\sin\frac{2\pi kn}{N}$

d) None of the mentioned

Answer: a

Expblnation: If x(n) is real and odd, that is x(n)=-x(N-n), then XR(k)=0. Hence X(k) is purely Imsglnary and odd. SInce XR(k) reduces to zero, the IDFT reduces to

x(ri) = j $\frac{1}{N}$ ~$_{k-0}$ x(k)sin'hkn/N

18. If X1(n), x2(n) and x3(m) are three sequences each of length N whose DFîs an} given as X1(k), X2(k) and X3(k) respectively and X3(k)~X1 (k).X2(k), then what is the expression for x3(m)?

a) L^{Nt}ll-0 X1 (ll)x2(m + n)

b) ~N n x1 (n)x2(m - n)

e) 1:..0 x1 (n)x2(m - n)N

d) L!ol Xl (n)x2(m + n)N

Answer: c

Explanation: If X1(n), x2(n) and x3(m) are three sequences each of length N whose DFTs are given as X1(k), x2(k) and X3(k) respectively and X3(k)=X1(k).X2(k), then according to the multiplication property of OFT we have x3(m) is the circular convolution of X1 (n) and x2(n).

That is x3(m) = L~_0 X1 (n)x2(m - n)N,

19. What is the circular convolution of the sequences Xl(n)={2,1,2,1} and x2(n)={1,2,3,4}?

a) {14,14,16,16}

b) {16,16,14,14}

e) {2,3,6,4}

d) {14,16,14,16}

Answer: d

Explanation: We know that the circular convolution of two sequences is given by the expression

X(m)= L:~ Xl (n)x2(m - n)N

For m=0, x2((-n))4={1,4,3,2}

For m=1, x2((1-n))4={2, 1,4,3}

For m=2, x2((2-n))4={3,2, 1,4}

For m=3, x2((3-n))4={4,3,2, 1}

Now we get x(m)={14, 16, 14, 16}.

20. What is the circular convolution of the sequences Xl(n)={2,1,2,1} and x2(n)={1,2,3,4}, find using the DFT and IDFT concepts?

a) {16,16,14,14}

b) {14,16,14,16}

e) {14,14,16,16}

d) None of the mentioned

Answer: b

Explanation; Given X1(n)={2, 1,2, 1}=>X1 (k)=[6,0,2,0]

Given x2(n)~{1,2,3,4}=>X2(k)=[10,-2+j2,-2,-2-j2]

when we multiply both DFTs we obtain the product

X(k)=X1(k).X2(k}=[60,0,-4,0]

By applying the IDFT to the above sequence, we get

x(n):=~{14116, 14,16}.

21. If X(k) is the N-point DFT of a sequence x(n), then circular time shift property is that N-point DFT of x((n-l))N is X(k)e-j1πJdlN.

a) True

b) False

Answer: a

Explanation: According to the circular time shift property of a sequence, If X(k) is the N-point OFT of a sequence x(n), then the N-pint OFT of x((n-l))N is X(k)e-J2nkl/N.

22. If X(k) is the N-point DFT of a sequence x(n), then what is the DFT of x*(n)?

a) XrN-k)

a) X(N-k)
b) X*(k)
e) X*(N-k)
d) None of the mentioned
Answer: e
Explanation: According to the complex conjugate property of DFT, we have if X(k) is the N-point DFT of a sequence x(n), then what is the DFT of x*(n) is X*(N-k).

Fast Fourier Transform

1. FFT algorithm is designed to perform complex operations.
a) True
b) False
Answer: a
Explanation: The FFT algorithm is designed to perform complex multiplications and additions, even though the input data may be real valued. The basic reason for this is that the phase factors are complex and hence, after the first stage of the algorithm, all variables are basically complex valued.

2. If $x_1(n)$ and $x_2(n)$ are two real valued sequences of length N, and let x(n) be a complex valued sequence defined as $x(n)=x_1(n)+jx_2(n)$, $0\le n\le N-1$, then what is the value of $x_1(n)$?
a) $\frac{x(n)-x^*(n)}{2}$
b) $\frac{x(n)+x^*(n)}{2}$
e) $\frac{x(n)-x^*(n)}{2j}$
d) $\frac{x(n)-x^*(n)}{j}$

Answer: b
Explanation: Given $x(n)=x_1(n)+jx_2(n)$
$\Rightarrow x^*(n)= x_1(n)-jx_2(n)$
Upon adding the above two equations, we get $x_1(n)=\frac{x(n)-x^*(n)}{2}$.

3. If $x_1(n)$ and $x_2(n)$ are two real valued sequences of length N, and let x(n) be a complex valued sequence defined as $x(n)=x_1(n)+jx_2(n)$, $0\le n\le N-1$, then what is the value of $x_2(n)$?
a) $\frac{x(n)-x^*(n)}{2}$
b) $\frac{x(n)-x^*(n)}{}$
e) $\frac{x(n)+x^*(n)}{2j}$
d) $\frac{x(n)-x^*(n)}{-1}$

Answer: d
Explanation: Given $x(n)=x_1(n)+jx_2(n)$
$\Rightarrow x^*(n) = x_1(n)-jx_2(n)$
Upon subtracting the above two equations, we get $x_2(n)=\frac{x(n)-x^*(n)}{2j}$.

4. If X(k) is the DFT of x(n) which is defined as $x(n)=x_1(n)+jx_2(n)$, $0 \le n \le N-1$, then what is the DFT of $x_1(n)$?

a) ~ $[X^*(k) + X^*(N-k)]$

b) ~ $[X^*(k) - X^*(N-k)]$

e) f;- $[X^*(k) - X^*(N-k)]$

d) ij $[X^*(k) + X^*(N-k)]$

Answer: a

Explanation: We know that if $x(n)=x_1(n)+jx_2(n)$ then $x_1(n)=$ ~~x(n)+;..*(n)~~

On applying DFT on both sides of the above equation, we get

$X_1(k)=$ ~ $DFT[x(n)] + DFT[x^*(n)]$

We know that if X(k) is the DFT of x(n), the $DFT[x^*(n)]=X^*(N-k)$

$\Rightarrow X_1(k)=$ ~ $[X^*(k) + X^*(N-k)]$.

5. If X(k) is the DFT of x(n) which is defined as $x(n)=x_1(n)+jx_2(n)$, $0 \le n \le N-1$, then what is the DFT of $x_1(n)$?

a) ! $[X^*(k) + X^*(N-k)]$

b) ~ $[X^*(k) - X^*(N-k)]$

c) dj $[X^*(k) - X^*(N-k)]$

d) ij $[X^*(k) + X^*(N-k)]$

Answer: e

Explanation: We know that if $x(n)=x_1(n)+jx_2(n)$ then $x_2(n)=$ ~~x(n);;*(n)~~

On applying OFT on both sides of the above equation, we get

$X_2(k)=\frac{1}{-1}DFT[x(n)] - DFT[x^*(n)]$

We know that if X(k) is the DFT of x(n), the $DFT[x^*(n)]=X^*(N-k)$

$\Rightarrow X_2(k)=\frac{1}{-1}[X^*(k) - X^*(N-k)]$.

6. If g(n) is a real valued sequence of 2N points and $x_1(n)=g(2n)$ and $x_2(n)=g(2n+1)$, then what is the value of G(k), k=0,1,2 ... N-1?

a) $X_1(k)-W_{2N}^kX_2(k)$

b) $X_1(k)+W_{2N}^kX_2(k)$

e) $X_1(k)+W_2^kX_2(k)$

d) $X_1(k)-W_2^kX_2(k)$

Answer: b

Explanation: Given g(n) is a real valued 2N point sequence. The 2N point sequence is divided into two N point sequences $x_1(n)$ and $x_2(n)$

Let $x(n)=x_1(n)+jx_2(n)$

$\Rightarrow X_1(k)=$! $[X^*(k) + X^*(N-k)]$ and $X_2(k)=$ ij $[X^*(k) - X^*(N-k)]$

We know that $g(n)=x_1(n)+x_2(n)$

$\Rightarrow G(k)=X_1(k)+W_{2N}^kX_2(k)$, k=0,1,2 ...,N-1.

7. If g(n) is a real valued sequence of 2N points and $x_1(n)=g(2n)$ and $x_2(n)=g(2n+1)$, then what is the value of G(k), k=N,N-1, ...2N-1?

a) $X_1(k)-W_2^kX_2(k)$

b) $X_1(k)+W_{2N}^kX_2(k)$

c) $X_1(k)+W_2^kX_2(k)$

d) $X_1(k)-W_{2N}^kX_2(k)$

Answer: d

Explanation: Given g(n) is a real valued 2N point sequence. The 2N point sequence is divided into two N point sequences $x_1(n)$ and $x_2(n)$

Let $x(n)=x_1(n)+jx_2(n)$

$\Rightarrow X_1(k)=$; $[X^*(k) + X^*(N-k)]$ and $X_2(k)=\frac{}{2}[X^*(k) - X^*(N-k)]$

We know that $g(n)=x_1(n)+x_2(n)$

$\Rightarrow G(k)=X_1(k)-W_{2N}^kX_2(k)$, k=N, N-1, ...2N-1.

8. Decimation-in frequency FFT algorithm is used to compute H(k).

a) True

b) False

Answer: a

Explanation: The N-point DFT of h(n), which is padded by L-1 zeros, is denoted as H(k). This computation is performed once via the FFT and resulting N complex numbers are stored. To be specific we assume that the decimation-in frequency FFT algorithm is used to compute H(k). This yields I-I(k) in the bit-reversed order, which is the way it is stored in the memory.

9. How many complex multiplications are need to be performed for each FFT algorithm?

a) {N/2)1ogN

b) Nlog2N

e) {N/2)1og2N

d) None of the mentioned

Answer: e

Explanation: The decimation of the data sequence should be repeated again and agaln until the resulting sequences are reduced to one point sequences. For N=2v, this decimation can be performed v=log2N times. Thus the total number of complex multiplications is reduced to (N/2}1og2N.

10. How many complex additions are required to be performed in linear filtering of a sequence using FFT algorithm?

a} (N/2)1ogN

b) 2Nlog2N

c) (N/2)1og2N

d) Nlog2N

Answer: b

Explanation: The number of additions to be performed in FFT are Nlog2N. But in linear filtering of a sequence, we calculate OFT which requires Nlog2N complex additions and IDFT requires Nlog2N complex additions. So, the total number of complex additions to be performed in linear filtering of a sequence using FFT algorithm is 2Nlog2N.

11. How many complex rnultiplkatlon are required per output data point?

a} [(NJ/2),logNJ/L

b) [Nlog22NJ/L

e) [(N/.2)'og2N]/L

d) None of the mentioned

Answer. b

Explanation: In the overlap add method, the N-point data block consists of L new data points and additional M-1 zeros and the number of complex multiplications required in FFT algorithm are (N/2)1og2N. So, the number of complex multiplications per output data point is [Nlog22N]/L.

Module 04

1. The spatial coordinates of a digital image (x,y) are proportional to:

a) Position

b) Brightness

c) Contrast

d) Noise

Answer: b

Explanation: The Brightness levels are distributed over the spatial area. Hence, the spatial coordinates are proportional to brightness levels.

2. Among the following image processing techniques which is fast, precise and flexible.

a) Optical

b) Digital

c) Electronic

d) Photographic

Answer: b

Explanation: Digital image processing is more flexible and agile techniques as it is fast, accurate and reliable.

3. 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

Answer: c

Explanation: The image is a collection of dots with a definite intensity or amplitude.

4. What is pixel?

a) Pixel is the elements of a digital image

b) Pixel is the elements of an analog image

c) Pixel is the cluster of a digital image

d) Pixel is the cluster of an analog image

Answer: a

Explanation: An Image is a collection of individual points referred as pixel, thus a Pixel is the element of a digital image.

5. The range of values spanned by the gray scale is called:

a) Dynamic range

b) Band range

c) Peak range

d) Resolution range

Answer: a

Explanation: The valued spanned in gray scale image are depicted using dynamic range values.

6. Which is a colour attribute that describes a pure colour?

a) Saturation

b)Hue

c) Brightness

d) Intensity

Answer: b

Explanation: The color attribute of an image refers to the contrast of colors, which can be controlled using the Hue values.

7. Which gives a measure of the degree to which a pure colour is diluted by white light?

a) Saturation

b)Hue

c) Intensity

d) Brightness

Answer: a

Explanation: Saturation is color recognizing capability of the human eye. Hence a degree of dilution is measured using saturation.

8. Which means the assigning meaning to a recognized object.

a) Interpretation

b) Recognition

c) Acquisition

d) Segmentation

Answer: a

Explanation: The interpretation is called the assigning meaning to recognized object.

9. A typical size comparable in quality to monochromatic TV image is of size.

a) 256 X 256

b) 512 X 512

c) 1920 X 1080

d) 1080 X 1080

Answer: b

Explanation: A normal T.V have 512 x 512 resolution.

10. The number of grey values are integer powers of:

a) 4

b) 2

c) 8

d) 1

Answer: b

Explanation: The gray values are interpreted as the power of number of colors. In monochromatic image the number of colors are 2.

11. What is the first and foremost step in Image Processing?

a) Image restoration

b) Image enhancement

c) Image acquisition

d) Segmentation

Answer: c

Explanation: Image acquisition is the first process in image processing. Note that acquisition could be as simple as being given an image that is already in digital form. Generally, the image acquisition stage involves preprocessing, such as scaling.

12. In which step of processing, the images are subdivided successively into smaller regions?

a) Image enhancement

b) Image acquisition

c) Segmentation

d) Wavelets

Answer: d

Explanation: Wavelets are the foundation for representing images in various degrees of resolution. Wavelets are particularly used for image data compression and for pyramidal representation, in which images are subdivided successively into smaller regions.

13. What is the next step in image processing after compression?

a) Wavelets

b) Segmentation

c) Representation and description

d) Morphological processing

Answer: d

Explanation: Steps in image processing:

Image acquisition-> Image enhancement-> Image restoration-> Color image processing-> Wavelets and multi resolution processing-> Compression-> Morphological processing-> Segmentation-> Representation & description-> Object recognition.

14. What is the step that is performed before color image processing in image processing?

a) Wavelets and multi resolution processing

b) Image enhancement

c) Image restoration

d) Image acquisition

Answer: c

Explanation: Steps in image processing:

Image acquisition-> Image enhancement-> Image restoration-> Color image processing-> Wavelets and multi resolution processing-> Compression-> Morphological processing-> Segmentation-> Representation & description-> Object recognition.

15. How many number of steps are involved in image processing?

a) 10

b) 9

c) 11

d) 12

Answer: a

Explanation: Steps in image processing:

Image acquisition-> Image enhancement-> Image restoration-> Color image processing-> Wavelets and multi resolution processing-> Compression-> Morphological processing-> Segmentation-> Representation & description-> Object recognition.

16. What is the expanded form of JPEG?

a) Joint Photographic Expansion Group

b) Joint Photographic Experts Group

c) Joint Photographs Expansion Group

d) Joint Photographic Expanded Group

Answer: b

Explanation: Image compression is familiar (perhaps inadvertently) to most users of computers in the form of image file extensions, such as the jpg file extension used in the JPEG (Joint Photographic Experts Group) image compression standard.

17. Which of the following step deals with tools for extracting image components those are useful in the representation and description of shape?

a) Segmentation

b) Representation & description

c) Compression

d) Morphological processing

Answer: d

Explanation: Morphological processing deals with tools for extracting image components that are useful in the representation and description of shape. The material in this chapter begins a transition from processes that output images to processes that output image attributes.

18. In which step of the processing, assigning a label (e.g., "vehicle") to an object based on its descriptors is done?

a) Object recognition

b) Morphological processing

c) Segmentation

d) Representation & description

Answer: a

Explanation: Recognition is the process that assigns a label (e.g., "vehicle") to an object based on its descriptors. We conclude our coverage of digital image processing with the development of methods for recognition of individual objects.

19. What role does the segmentation play in image processing?

a) Deals with extracting attributes that result in some quantitative information of interest

b) Deals with techniques for reducing the storage required saving an image, or the bandwidth required transmitting it

c) Deals with partitioning an image into its constituent parts or objects

d) Deals with property in which images are subdivided successively into smaller regions

Answer: c

Explanation: Segmentation procedures partition an image into its constituent parts or objects. In general, autonomous segmentation is one of the most difficult tasks in digital image processing. A rugged segmentation procedure brings the process a long way toward successful solution of imaging problems that require objects to be identified individually.

20. What is the correct sequence of steps in image processing?

a) Image acquisition->Image enhancement->Image restoration->Color image processing->Compression->Wavelets and multi resolution processing->Morphological processing->Segmentation->Representation & description->Object recognition

b) Image acquisition->Image enhancement->Image restoration->Color image processing->Wavelets and multi resolution processing->Compression->Morphological processing->Segmentation->Representation & description->Object recognition

c) Image acquisition->Image enhancement->Color image processing->Image restoration->Wavelets and multi resolution processing->Compression->Morphological processing->Segmentation->Representation & description->Object recognition

d) Image acquisition->Image enhancement->Image restoration->Color image processing->Wavelets and multi resolution processing->Compression->Morphological processing->Representation & description->Segmentation->Object recognition

Answer: b

Explanation: Steps in image processing:

Image acquisition-> Image enhancement->Image restoration->Color image processing->Wavelets and multi resolution processing->Compression->Morphological processing->Segmentation->Representation & description->Object recognition

21. To convert a continuous sensed data into Digital form, which of the following is required?

a) Sampling

b) Quantization

c) Both Sampling and Quantization

d) Neither Sampling nor Quantization

Answer: c

Explanation: The output of the most sensor is a continuous waveform and the amplitude and spatial

behavior of such waveform are related to the physical phenomenon being sensed.

22. To convert a continuous image f(x, y) to digital form, we have to sample the function in ______

a) Coordinates

b) Amplitude'

c) All of the mentioned

d) None of the mentioned

Answer: c

Explanation: An image may be continuous in the x- and y-coordinates or in amplitude, or in both.

23. For a continuous image f(x, y), how could be Sampling defined?

a) Digitizing the coordinate values

b) Digitizing the amplitude values

c) All of the mentioned

d) None of the mentioned

Answer: a

Explanation: Sampling is the method of digitizing the coordinate values of the image.

24. For a continuous image f(x, y), Quantization is defined as

a) Digitizing the coordinate values

b) Digitizing the amplitude values

c) All of the mentioned

d) None of the mentioned

Answer: b

Explanation: Sampling is the method of digitizing the amplitude values of the image.

25. Validate the statement:

"For a given image in one-dimension given by function f(x, y), to sample the function we take equally spaced samples, superimposed on the function, along a horizontal line. However, the sample values still span (vertically) a continuous range of gray-level values. So, to convert the given function into a digital function, the gray-level values must be divided into various discrete levels."

a) True

b) False

Answer: a

Explanation: Digital function requires both sampling and quantization of the one-dimensional image function.

26. How is sampling been done when an image is generated by a single sensing element combined With mechanical motion?

a) The number of sensors in the strip defines the sampling limitations in one direction and Mechanical motion in the other direction.

b) The number of sensors in the sensing array establishes the limits of sampling in both directions.

c) The number of mechanical increments when the sensor is activated to collect data.

d) None of the mentioned.

Answer: c

Explanation: When an image is generated by a single sensing element along with mechanical motion, the output data is quantized by dividing the gray-level scale into many discrete levels. However, sampling is done by selecting the number of individual mechanical increments recorded at which we activate the sensor to collect data.

27. How does sampling gets accomplished with a sensing strip being used for image acquisition?

a) The number of sensors in the strip establishes the sampling limitations in one image direction and Mechanical motion in the other direction

b) The number of sensors in the sensing array establishes the limits of sampling in both directions

c) The number of mechanical increments when the sensor is activated to collect data

d) None of the mentioned

Answer: a

Explanation: When a sensing strip is used the number of sensors in the strip defines the sampling limitations in one direction and mechanical motion in the other direction.

28. How is sampling accomplished when a sensing array is used for image acquisition?

a) The number of sensors in the strip establishes the sampling limitations in one image direction and Mechanical motion in the other direction

b) The number of sensors in the sensing array defines the limits of sampling in both directions

c) The number of mechanical increments at which we activate the sensor to collect data

d) None of the mentioned

Answer: b

Explanation: When we use sensing array for image acquisition, there is no motion and so, only the number of sensors in the array defines the limits of sampling in both directions and the output of the sensor is quantized by dividing the gray-level scale into many discrete levels.

29. The quality of a digital image is well determined by _______

a) The number of samples

b) The discrete gray levels

c) All of the mentioned

d) None of the mentioned

Answer: c

Explanation: The quality of a digital image is determined mostly by the number of samples and discrete gray levels used in sampling and quantization.

30. A continuous image is digitized at _______ points.

a) random

b) vertex

c) contour

d) sampling

Answer: d

Explanation: The sampling points are ordered in the plane and their relation is called a Grid.

31. The transition between continuous values of the image function and its digital equivalent is called __________

a) Quantization

b) Sampling

c) Rasterization

d) None of the Mentioned

Answer: a

Explanation: The transition between continuous values of the image function and its digital equivalent is called Quantization.

32. Images quantised with insufficient brightness levels will lead to the occurrence of _______

a) Pixillation

b) Blurring

c) False Contours

d) None of the Mentioned

Answer: c

Explanation: This effect arises when the number brightness levels is lower that which the human eye can distinguish.

33. The smallest discernible change in intensity level is called ________

a) Intensity Resolution

b) Contour

c) Saturation

d) Contrast

Answer: a

Explanation: Number of bits used to quantise intensity of an image is called intensity resolution.

34. What is the tool used in tasks such as zooming, shrinking, rotating, etc.?

a) Sampling

b) Interpolation

c) Filters

d) None of the Mentioned

Answer: b

Explanation: Interpolation is the basic tool used for zooming, shrinking, rotating, etc.

35. The type of Interpolation where for each new location the intensity of the immediate pixel is Assigned is ________

a) bicubic interpolation

b) cubic interpolation

c) bilinear interpolation

d) nearest neighbour interpolation

Answer: d

Explanation: Its called as Nearest Neighbour Interpolation since for each new location the intensity of the next neighbouring pixel is assigned.

36. The type of Interpolation where the intensity of the FOUR neighbouring pixels is used to obtain intensity a new location is called ________

a) cubic interpolation

b) nearest neighbour interpolation

c) bilinear interpolation

d) bicubic interpolation

Answer: b

Explanation: Bilinear interpolation is where the FOUR neighbouring pixels is used to estimate intensity for a new location.

37. Dynamic range of imaging system is a ratio where the upper limit is determined by

a) Saturation

b) Noise

c) Brightness

d) Contrast

Answer: a

Explanation: Saturation is taken as the Numerator.

38. For Dynamic range ratio the lower limit is determined by

a) Saturation

b) Brightness

c) Noise

d) Contrast

Answer: c

Explanation: Noise is taken as the Denominator.

39. Quantitatively, spatial resolution cannot be represented in which of the following ways

a) line pairs

b) pixels

c) dots

d) none of the Mentioned

Answer: d

Explanation: All the options can be used to represent spatial resolution.

40. Assume that an image f(x, y) is sampled so that the result has M rows and N columns. If the values Of the coordinates at the origin are (x, y) = (0, 0), then the notation (0, 1) is used to signify:

a) Second sample along first row ✓

b) First sample along second row

c) First sample along first row

d) Second sample along second row

Answer: c

Explanation: The values of the coordinates at the origin are (x, y)= (0, 0). Then, the next coordinate values (second sample) along the first row of the image are represented as (x, y)= (0, 1).

41. The resulting image of sampling and quantization is considered a matrix of real numbers. By what name(s) the element of this matrix array is called ______

a) Image element or Picture element

b) Pixel or Pel

c) All of the mentioned

d) None of the mentioned

Answer: c

Explanation: Sampling and Quantization of an image f(x, y) forms a matrix of real numbers and each element of this matrix array is commonly known as Image element or Picture element or Pixel or Pel.

42. Let Z be the set of real integers and R the set of real numbers. The sampling process may be viewed as partitioning the x-y plane into a grid, with the central coordinates of each grid being from the Cartesian product Z2, that is a set of all ordered pairs (zi, zj), with zi and zj being integers from Z. Then, f(x, y) is said a digital image if:

a.(x, y) are integers from Z2 and fis a function that assigns a gray-level value (from Z) to each distinct pair of coordinates (x, y)

b. (x, y) are integers from R2 and fis a function that assigns a gray-level value (from R) to each distinct pair of coordinates (x, y)

c. (x, y) are integers from R2 and fis a function that assigns a gray-level value (from Z) to each distinct pair of coordinates (x, y)

d. (x, y) are integers from Z2 and fis a function that assigns a gray-level value (from R) to each distinct pair of coordinates (x, y)

Answer: d

Explanation: In the given condition, f(x, y) is a digital image if (x, y) are integers from Z2 and fa function that assigns a gray-level value (that is, a real number from the set R) to each distinct coordinate pair (x.y).

43. Let Z be the set of real integers and R the set of real numbers. The sampling process may be viewed as partitioning the x-y plane into a grid, with the central coordinates of each grid being from the Cartesian product Z2, that is a set of all ordered pairs (zi, zj), with zi and zj being integers from Z. Then, f(x, y) is a digital image if (x, y) are integers from Z2 and fis a function that assigns a gray-level value (that is, a real number from the set R) to each distinct coordinate pair (x, y). What happens to the digital image if the gray levels also are integers?

a) The Digital image then becomes a 2-D function whose coordinates and amplitude values are integers

b) The Digital image then becomes a 1-D function whose coordinates and amplitude values are integers

c) The gray level can never be integer

d) None of the mentioned

Answer: a

Explanation: In Quantization Process if the gray levels also are integers the Digital image then becomes a 2-D function whose coordinates and amplitude values are integers.

44. The digitization process i.e. the digital image has M rows and N columns, requires decisions about values for M, N, and for the number, L, of gray levels allowed for each pixel. The value Mand N have to be:

a) Mand N have to be positive integer

b) Mand N have to be negative integer

c) M have to be negative and N have to be positive integer

d) M have to be positive and N have to be negative integer

Answer: a

Explanation: The digitization process i.e. the digital image has M rows and N columns, requires decisions about values for M, N, and for the number, L, of max gray level. There are no requirements on Mand N, other than that M and N have to be positive integer.

45. The digitization process i.e. the digital image has M rows and N columns, requires decisions about values for M, N, and for the number, L, of max gray levels. There are no requirements on M and N, other than that M and N have to be positive integer. However, the number of gray levels typically is

a) An integer power of 2 i.e. L = 2k

b) A Real power of 2 i.e. L = 2k

c) Two times the integer value i.e. L = 2k

d) None of the mentioned

Answer: a

Explanation: Due to processing, storage, and considering the sampling hardware, the number of gray levels typically is an integer power of 2 i.e. L = 2k.

46. The digitization process i.e. the digital image has M rows and N columns, requires decisions about values for M, N, and for the number, L, of max gray levels is an integer power of 2 i.e. L = 2k, allowed for each pixel. If we assume that the discrete levels are equally spaced and that they are integers then they are in the interval ________ and Sometimes the range of values spanned by the gray scale is called the ______ of an image.

a) [0, L - 1] and static range respectively

b) [0, LI 2] and dynamic range respectively

c) [0, LI 2] and static range respectively

d) [0, L - 1] and dybnamic range respectively.

Answer: d

Explanation: In digitization process M rows and N columns have to be positive and for the number, L, of discrete gray levels typically an integer power of 2 for each pixel. If we assume that the discrete levels are equally spaced and that they are integers then they lie in the interval [0, L-1] and Sometimes the range of values spanned by the gray scale is called the dynamic range of an image.

47. After digitization process a digital image with M rows and N columns have to be positive and for The number, L, max gray levels i.e. an integer power of 2 for each pixel. Then, the number b, of bits required to store a digitized image is:

a) b=M*N*k

b) b=M*N*L

c) b=M*L *k

d) b=L*N*k

Answer: a

Explanation: In digital image of M rows and N columns and L max gray levels an integer power of 2 for each pixel. The number, b, of bits required to store a digitized image is: b=M*N*k.

48. An image whose gray-levels span a significant portion of gray scale have ________ dynamic Range while an image with dull, washed out gray look have ________ dynamic range.

a) Low and High respectively

b) High and Low respectively

c) Both have High dynamic range, irrespective of gray levels span significance on gray scale

d) Both have Low dynamic range, irrespective of gray levels span significance on gray scale

Answer: b

Explanation: An image whose gray-levels signifies a large portion of gray scale have High dynamic range, while that with dull, washed out gray look have Low dynamic range.

49. Validate the statement "When in an Image an appreciable number of pixels exhibit high dynamic range, the image will have high contrast."

a) True

b) False

Answer: a

Explanation: In an Image if an appreciable number of pixels exhibit high dynamic range property, the image will have high contrast.

50. In digital image of M rows and N columns and L discrete gray levels, calculate the bits required to

store a digitized image for M=N=32 and L=16.

a) 16384

b)4096

c) 8192

d)512

Answer: b

Explanation: In digital image of M rows and N columns and L max gray levels i.e. an integer power of 2

for each pixel. The number, b, of bits required to store a digitized image is: b=M*N*k.

For L=16, k=4.

i.e. b=4096.

Discrete-Time Signal ... | Discrete Fourier Tran ... | Fast Fourier Transform | Digital Image Fundam ... | Image Enhancement i... | Image Segmentation

Module 05

1. Using gray-level transformation, the basic function linearity deals with which of the following transformation?

a) log and inverse-log transformations

b) negative and identity transformations

c) nth and nth root transformations

d) All of the mentioned

Answer: b

Explanation: For Image Enhancement gray-level transformation shows three basic function that are:

Linearity for negative and identity transformation

Logarithmic for log and inverse-log transformation, and

Power-law for nth and nth root transformations.

2. Using gray-level transformation, the basic function Logarithmic deals with which of the following transformation?

a) Log and inverse-log transformations

b) Negative and identity transformations

c) nth and nth root transformations

d) All of the mentioned

Answer: a

Explanation: For Image Enhancement gray-level transformation shows three basic function that are:

Linearity for negative and identity transformation

Logarithmic for log and inverse-log transformation, and

Power-law for nth and nth root transformations.

3. Using gray-level transformation, the basic function power-law deals with which of the following transformation?

a) log and inverse-log transformations

b) negative and identity transformations

e) nth and nth root transformations

d) all of the mentioned

Answer: b

Explanation: For Image Enhancement gray-level transformation shows three basic function that are:

Linearity for negative and identity transformation

Logarithmic for log and inverse-log transformation, and

Power-law for nth and nth root transformations.

4. If r be the gray-level of image before processing and s after processing then which expression defines the negative transformation, for the gray-level in the range [0, L-1]?

a) s = L - 1 - r

b) s = err, e and γ are positive constants

e) s = e log (1 + r), e is a constant and r ≥ 0

d) none of the mentioned

Answer: a

Explanation: The expression for negative transformation is given as: s = L - 1 - r.

5. If r be the gray-level of image before processing and s after processing then which expression helps to obtain the negative of an image for the gray-level in the range [0, L-1]?

a) s = L - 1 - r

b) s = err, e and γ are positive constants

e) s = e log (1 + r), e is a constant and r ≥ 0

d) none of the mentioned

Answer: e

Explanation: The expression for log transformation is given as: s = e log (1 + r), e is a constant and r ≥ 0.

6. If r be the gray-level of image before processing and s after processing then which expression defines the power-law transformation, for the gray-level in the range [0, L-1]?

a) s = L - 1 - r

b) s = err, e and γ are positive constants

e) s = e log (1 + r), e is a constant and r ≥ 0

d) none of the mentioned

Answer: b

Explanation: The expression for power-law transformation is given as: s = err, e and γ are positive constants.

7. Which of the following transformations is particularly well suited for enhancing an image with white and gray detail embedded in dark regions of the image, especially when there is more black area in the image.

a) Log transformations

b) Power-law transformations

c) Negative transformations

d) None of the mentioned

Answer: c

Explanation: Negative transformation reverses the intensity levels in the image and produces an equivalent photographic negative. So, well suited for the above given condition.

8. Which of the following transformations expands the value of dark pixels while the higher-level values are being compressed?

a) Log transformations

b) Inverse-log transformations

c) Negative transformations

d) None of the mentioned

Answer: a

Explanation: Log transformation derives a narrow range of gray-level values in input image to wider range of gray-levels in the output image, and does performs the above given transformation.The inverse-log is applied for the opposite.

9. Although power-law transformations are considered more versatile than log transformations for compressing of gray-levels in an image, then, how is log transformations advantageous over power-law transformations?

a) The log transformation compresses the dynamic range of images

b) The log transformations reverses the intensity levels in the images

c) All of the mentioned

d) None of the mentioned

Answer: a

Explanation: For compressing gray-levels in an image, power-law transformation is more versatile than log transformation, but log transformation has an important characteristics of compressing dynamic ranges of pixels having a large variation of values.

10. A typical Fourier Spectrum with spectrum value ranging from 0 to 106, which of the following transformation is better to apply.

a) Log transformations

b) Power-law transformations

c) Negative transformations

d) None of the mentioned

Answer: a

Explanation: The log transformation compresses the dynamic range of images and so the given range turns to 0 to approx. 7, which is easily displayable with 8-bit display.

11. The power-law transformation is given as: s = err, e and rare positive constants, and ris the gray-level of image before processing ands after processing. Then, for what value of c and-: does power-law transformation becomes identity transformation?

a) c = 1 and $\gamma < 1$

b)c=1 and+>t

e) e = -1 and γ = 0

d) c= r= 1

Answer: d

Explanation: For e =γ= 1 the power-law transformations s = *en* becomes= r that is an identity transformations.

12. What is gamma correction?

a) A process to remove power-law transformation response phenomena

b) A process to remove log transformation response phenomena

e) A process to correct log transformation response phenomena

d) A process to correct power-law transformation response phenomena

Answer: d

Explanation: The exponent used in power-law transformation is called gamma. So, using the γ value, either γ< 1 or γ> 1, various responses are obtained.

13. Which of the following transformation is used cathode ray tube (CRT) devices?

a) Log transformations

b) Power-law transformations

e) Negative transformations

d) None of the mentioned

Answer: b

Explanation: The CRT devices has a power function relation between intensity and volt response.

In such devices output appears darker than input. So, gamma correction is a must in this case.

14. Log transformation is generally used in which of the following device(s)?

a) Cathode ray tube

b) Scanners and printers

e) All of the mentioned

d) None of the mentioned

Answer: d

Explanation: All the mentioned devices uses gamma correction and so power-law transformation is generally of use in such case.

15. The power-law transformation is given as: s = cr,, c and rare positive constants, and ris the gray-level of image before processing ands after processing. What happens if we increase the gamma value from 0.3 to 0.7?

a) The contrast increases and the detail increases

b) The contrast decreases and the detail decreases

e) The contrast increases and the detail decreases

d) The contrast decreases and the detail increases

Answer: e

Explanation: In power-law transformation as gamma decreases is increase in image details however, the contrast reduces.

16. If h(rk) = nk, rk the kth gray level and nk total pixels with gray level rk, is a histogram in gray level range [0, L – 1]. Then how can we normalize a histogram?

a) If each value of histogram is added by total number of pixels in image, say n, p(rk)=nk+n

b) If each value of histogram is subtracted by total number of pixels in image, say n, p(rk)=nk-n

c) If each value of histogram is multiplied by total number of pixels in image, say n, p(rk)=nk * n

d) If each value of histogram is divided by total number of pixels in image, say n, p(rk)=nk / n

Answer: d

Explanation: To normalize a histogram each of its value is divided by total number of pixels in image, say n. p(rk) = nk /n.

17. What is the sum of all components of a normalized histogram?

a) 1

b) -1

c) 0

d) None of the mentioned

Answer: a

Explanation: A normalized histogram. p(rk) = nk /n

Where, n is total number of pixels in image, rk the kth gray level and nk total pixels with gray level rk.

Here, p(rk) gives the probability of occurrence of rk.

18. A low contrast image will have what kind of histogram when, the histogram, h(rk) = nk, rk the kth gray level and nk total pixels with gray level rk, is plotted nk versus rk?

a) The histogram that are concentrated on the dark side of gray scale

b) The histogram whose component are biased toward high side of gray scale

c) The histogram that is narrow and centered toward the middle of gray scale

d) The histogram that covers wide range of gray scale and the distribution of pixel is approximately uniform

Answer: c

Explanation: The histogram plot is nk versus rk. So, the histogram of a low contrast image will be narrow and centered toward the middle of gray scale.

A dark image will have the histogram that are concentrated on the dark side of gray scale.

A bright image will have the histogram whose component are biased toward high side of gray scale.

A high contrast image will have the histogram that covers wide range of gray scale and the distribution of pixel is approximately uniform.

19. A bright image will have what kind of histogram, when the histogram, h(rk) = nk, rk the kth gray level and nk total pixels with gray level rk, is plotted nk versus rk?

a) The histogram that are concentrated on the dark side of gray scale

b) The histogram whose component are biased toward high side of gray scale

c) The histogram that is narrow and centered toward the middle of gray scale

d) The histogram that covers wide range of gray scale and the distribution of pixel is approximately uniform

Answer: b

Explanation: The histogram plot is nk versus rk. So, the histogram of a low contrast image will be narrow and centered toward the middle of gray scale.

A dark image will have the histogram that are concentrated on the dark side of gray scale.

A bright image will have the histogram whose component are biased toward high side of gray scale.

A high contrast image will have the histogram that covers wide range of gray scale and the distribution of pixel is approximately uniform.

20. A high contrast image and a dark image will have what kind of histogram respectively, when the histogram, $h(r_k) = n_k$, r_k the kth gray level and n_k total pixels with gray level r_k, is plotted n_k versus r_k?

I. The histogram that are concentrated on the dark side of gray scale.

Ii. The histogram whose component are biased toward high side of gray scale.

Iii. The histogram that is narrow and centered toward the middle of gray scale.

IV. The histogram that covers wide range of gray scale and the distribution of pixel is approximately uniform.

a) I) And Ii) respectively

b) Iii) And Ii) respectively

c) Ii) And IV) respectively

d) IV) And I) respectively

Answer: d

Explanation: The histogram plot is n_k versus r_k. So, the histogram of a low contrast image will be narrow and centered toward the middle of gray scale.

A dark image will have the histogram that are concentrated on the dark side of gray scale.

A bright image will have the histogram whose component are biased toward high side of gray scale.

A high contrast image will have the histogram that covers wide range of gray scale and the distribution of pixel is approximately uniform.

21. The transformation $s = T(r)$ producing a gray level s for each pixel value r of input image. Then, if the $T(r)$ is single valued in interval $0 \le r \le 1$, what does it signifies?

a) It guarantees the existence of inverse transformation

b) It is needed to restrict producing of some inverted gray levels in output

c) It guarantees that the output gray level and the input gray level will be in same range

d) All of the mentioned

Answer: a

Explanation: The $T(r)$ is single valued in interval $0 \le r \le 1$, guarantees the existence of inverse transformation.

22. The transformation $s = T(r)$ producing a gray level s for each pixel value r of input image. Then, if the $T(r)$ is monotonically increasing in interval $0 \le r \le 1$, what does it signifies?

a) It guarantees the existence of inverse transformation

b) It is needed to restrict producing of some inverted gray levels in output

c) It guarantees that the output gray level and the input gray level will be in same range

d) All of the mentioned

Answer: b

Explanation: A $T(r)$ which is not monotonically increasing, could result in an output containing at least a section of inverted intensity range. The $T(r)$ is monotonically increasing in interval $0 \le r \le 1$, is needed to restrict producing of some inverted gray levels in output.

23) The transformation s = T(r) producing a gray level s for each pixel value of imput image. Then, if T(r) is satisfying 0<= T(r) <= 1 in interval 0<=r<=1, what does it signifies?

a) It guarantees the existence of inverse transformation

b) It is needed to restrict producing of some inverted gray levels in output

c) It guarantees that the output gray level and the input gray level will be in same range

d) All of the mentioned

Answer: c

Explanation: If, $0 \le T(r) \le 1$ in interval $0 \le r \le 1$, then the output gray level and the input gray level will be in same range.

24. What is the full form for PDF, a fundamental descriptor of random variables i.e. gray values in an image?

a) Pixel distribution function

b) Portable document format

c) Pel deriving function

d) Probability density function

Answer: d

Explanation: For a random variable, a PDF, probability density function, is one of the most fundamental descriptor.

25. What is the full form of CDF?

a) Cumulative density function

b) Contour derived function

c) Cumulative distribution function

d) None of the mentioned

Answer: c

Explanation: CDF of random variable r, gray value of input image, is cumulative distribution function.

26. In Histogram Matching r and z are gray level of input and output image and p stands for PDF, then, what does $p_z(z)$ stands for?

a) Specific probability density function
b) Specified pixel distribution function
c) Specific pixel density function
d) Specified probability density function

Answer: d

Explanation: In Histogram Matching, $p_r(r)$ is estimated from input image while $p_z(z)$ is Specified probability density function that output image is supposed to have.

27. Which of the following histogram processing techniques is global?

a) Histogram Linearization
b) Histogram Specification
c) Histogram Matching
d) All of the mentioned

Answer: d

Explanation: All of the mentioned methods modifies the pixel value by transformations that are based on the gray-level of the whole image.

28. If the histogram of same images, with different contrast, are different, then what is the relation between the histogram equalized images?

a) They look visually very different from one another

b) They look visually very similar to one another

c) They look visually different from one another just like the input images

d) None of the mentioned

Answer: b

Explanation: This is because the contents of all images is same. The difference is just the contrast.

The histogram equalization increases the contrast and make the gray-level difference of output image visually indistinguishable.

29. In neighborhood operations working is being done with the value of image pixel in the neighborhood and the corresponding value of a subimage that has same dimension as neighborhood. The subi mage is referred as ______

a) Filter

b) Mask

c) Template

d) All of the mentioned

Answer: d

Explanation: Working in neighborhood operations is done with the value of a subimage having same dimension as neighborhood corresponding to the value in the image pixel. The subi mage is called as filter, mask, template, kernel or window.

30. The response for linear spatial filtering is given by the relationship ______

a) Sum of filter coefficient's product and corresponding image pixel under filter mask

b) Difference of filter coefficient's product and corresponding image pixel under filter mask

c) Product of filter coefficient's product and corresponding image pixel under filter mask

d) None of the mentioned

Answer: a

Explanation: In spatial filtering the mask is moved from point to point and at each point the response is calculated using a predefined relationship. The relationship in linear spatial filtering is given by: the Sum of filter coefficient's product and corresponding image pixel in area under filter mask.

31. In linear spatial filtering, what is the pixel of the image under mask corresponding to the mask coefficient w (1, -1), assuming a 3*3 mask?

a) f (X, -y)

b) f (X+ 1, y)

C) f (X, y - 1)

d) f (X + 1, y - 1)

Answer: d

Explanation: The pixel corresponding to mask coefficient (a 3*3 mask) w (0, 0) is f (x, y), and so for w (1, -1) is f (x + 1, y - 1).

32. Which of the following is/are a nonlinear operation?

a) Computation of variance

b) Computation of median

c) All of the mentioned

d) None of the mentioned

Answer: c

Explanation: Computation of variance as well as median comes under nonlinear operation.

33. Which of the following is/are used as basic function in nonlinear filter for noise reduction?

a) Computation of variance

b) Computation of median

c) All of the mentioned

d) None of the mentioned

Answer: b

Explanation: Computation of median gray-level value in the neighborhood is the basic function of nonlinear filter for noise reduction.

34. In neighborhood operation for spatial filtering if a square mask of size n*n is used it is restricted that the center of mask must be at a distance>_ (n - 1)/2 pixels from border of image, what happens to the resultant image?

a) The resultant image will be of same size as original image

b) The resultant image will be a little larger size than original image

c) The resultant image will be a little smaller size than original image

d) None of the mentioned

Answer: c

Explanation: If the center of mask must be at a distance>_ (n - 1)/2 pixels from border of image, the border pixels won't get processed under mask and so the resultant image would be of smaller size.

35. Which of the following method is/are used for padding the image?

a) Adding rows and column of 0 or other constant gray level

b) Simply replicating the rows or columns

c) All of the mentioned

d) None of the mentioned

Answer: c

Explanation: In neighborhood operation for spatial filtering using square mask, padding of original image is done to obtain filtered image of same size as of original image done, by adding rows and column of 0 or other constant gray level or by replicating the rows or columns of the original image.

36. In neighborhood operation for spatial filtering using square mask of n*n, which of the following approach is/are used to obtain a perfectly filtered result irrespective of the size?

a) By padding the image

b) By filtering all the pixels only with the mask section that is fully contained in the image

c) By ensuring that center of mask must be at a distance>_ (n - 1)/2 pixels from border of image

d) None of the mentioned

Answer: c

Explanation: By ensuring that center of mask must be at a distance>_ (n - 1)/2 pixels from border of image, the resultant image would be of smaller size but all the pixels would be the result of the filter processing and so is a fully filtered result.

In the other approach like padding affect the values near the edges that gets more prevalent with mask size increase, while the another approach results in the band of pixels near border that gets processed with partial filter mask. So, not a fully filtered case.

37. Noise reduction is obtained by blurring the image using smoothing filter.

a) True

b) False

Answer: a

Explanation: Noise reduction is obtained by blurring the image using smoothing filter. Blurring is used in pre-processing steps, such as removal of small details from an image prior to object extraction and, bridging of small gaps in lines or curves.

38. What is the output of a smoothing, linear spatial filter?

a) Median of pixels

b) Maximum of pixels

c) Minimum of pixels

d) Average of pixels

Answer: d

Explanation: The output or response of a smoothing, linear spatial filter is simply the average of the pixels contained in the neighbourhood of the filter mask.

39. Smoothing linear filter is also known as median filter.

a) True

b) False

Answer: b

Explanation: Since the smoothing spatial filter performs the average of the pixels, it is also called as averaging filter.

40. Which of the following in an image can be removed by using smoothing filter?

a) Smooth transitions of gray levels

b) Smooth transitions of brightness levels

c) Sharp transitions of gray levels

d) Sharp transitions of brightness levels

Answer: c

Explanation: Smoothing filter replaces the value of every pixel in an image by the average value of the gray levels. So, this helps in removing the sharp transitions in the gray levels between the pixels. This is done because, random noise typically consists of sharp transitions in gray levels.

41. Which of the following is the disadvantage of using smoothing filter?

a) Blur edges

b) Blur inner pixels

c) Remove sharp transitions

d) Sharp edges

Answer: a

Explanation: Edges, which almost always are desirable features of an image, also are characterized by sharp transitions in gray level. So, averaging filters have an undesirable side effect that they blur these edges.

42. Smoothing spatial filters doesn't smooth the false contours.

a) True

b) False

Answer: b

Explanation: One of the application of smoothing spatial filters is that, they help in smoothing the false contours that result from using an insufficient number of gray levels.

43. Which of the following shows three basic types of functions used frequently for image enhancement?
a) Linear, logarithmic and inverse law
b) Power law, logarithmic and inverse law
c) Linear, logarithmic and power law
d) Linear, exponential and inverse law

44. Which expression is obtained by performing the negative transformation on the negative of an image with gray levels in the range[O,L-1]?
a) s=L+1-r
b)s=L+1+r
c) s=L-1-r
d) s=L-1 +r

Answer: c
Explanation: The negative of an image with gray levels in the range[O,L-1] is obtained by using the negative transformation, which is given by the expression: s=L-1-r.

45. Box filter is a type of smoothing filter.

a) True

b) False

Answer: a

Explanation: A spatial averaging filter or spatial smoothening filter in which all the coefficients are equal is also called as box filter.

46. In which type of slicing, highlighting a specific range of gray levels in an image often is desired?
a) Gray-level slicing
b) Bit-plane slicing
c) Contrast stretching
d) Byte-level slicing

Answer: a
Explanation: Highlighting a specific range of gray levels in an image often is desired in gray-level slicing. Applications include enhancing features such as masses of water in satellite imagery and enhancing flaws in X-ray images.

47. Which of the following comes under the application of image blurring?

a) Object detection

b) Gross representation

e) Object motion

d) Image segmentation

Answer: b

Explanation: An important application of spatial averaging is to blur an image for the purpose of getting a gross representation of interested objects, such that the intensity of the small objects blends with the background and large objects become easy to detect.e

48. Which of the following filters response is based on ranking of pixels?

a) Nonlinear smoothing filters

b) Linear smoothing filters

e) Sharpening filters

d) Geometric mean filter

Answer: a

Explanation: Order static filters are nonlinear smoothing spatial filters whose response is based on the ordering or ranking the pixels contained in the image area encompassed by the filter, and then replacing the value of the central pixel with the value determined by the ranking result.

49. Median filter belongs to which category of filters?

a) Linear spatial filter

b) Frequency domain filter

e) Order static filter

d) Sharpening filter

Answer: e

Explanation: The median filter belongs to order static filters, which, as the name implies, replaces the value of the pixel by the median of the gray levels that are present in the neighbourhood of the pixels.

50. Median filters are effective in the presence of impulse noise.

a) True

b) False

Answer: a

Explanation: Median filters are used to remove impulse noises, also called as salt-and-pepper noise because of its appearance as white and black dots in the image.

51. What is the maximum area of the cluster that can be eliminated by using an nxn median filter?

a) n2

b) n2/2

e) 2*n2

d) n

Answer: b

Explanation: Isolated clusters of pixels that are light or dark with respect to their neighbours, and whose area is less than n2/2, i.e., half the area of the filter, can be eliminated by using an nxn median filter.

52. Which of the following is the primary objective of sharpening of an image?

a) Blurring the image

b) Highlight fine details in the image

c) Increase the brightness of the image

d) Decrease the brightness of the image

Answer: b

Explanation: The sharpening of image helps in highlighting the fine details that are present in the image or to enhance the details that are blurred due to some reason like adding noise.

53. Image sharpening process is used in electronic printing.

a) True

b) False

Answer: a

Explanation: The applications of image sharpening is present in various fields like electronic printing, autonomous guidance in military systems, medical imaging and industrial inspection.

54. In spatial domain, which of the following operation is done on the pixels in sharpening the image?

a) Integration

b) Average

c) Median

d) Differentiation

Answer: d

Explanation: We know that, in blurring the image, we perform the average of pixels which can be considered as integration. As sharpening is the opposite process of blurring, logically we can tell that we perform differentiation on the pixels to sharpen the image.

55. Image differentiation enhances the edges, discontinuities and deemphasizes the pixels with slow varying gray levels.

a) True

b) False

Answer: a

Explanation: Fundamentally, the strength of the response of the derivative operative is proportional to the degree of discontinuity in the image. So, we can state that image differentiation enhances the edges, discontinuities and deemphasizes the pixels with slow varying gray levels.

56. In which of the following cases, we wouldn't worry about the behaviour of sharpening filter?

a) Flat segments

b) Step discontinuities

c) Ramp discontinuities

d) Slow varying gray values

Answer: d

Explanation: We are interested in the behaviour of derivatives used in sharpening in the constant gray level areas i.e., flat segments, and at the onset and end of discontinuities, i.e., step and ramp discontinuities.

57. Which of the following is the valid response when we apply a first derivative?

a) Non-zero at flat segments

b) Zero at the onset of gray level step

c) Zero in flat segments

d) Zero along ramps

Answer: c

Explanation: The derivations of digital functions are defined in terms of differences. The definition we use for first derivative should be zero in flat segments, nonzero at the onset of a gray level step or ramp and nonzero along the ramps.

58. Which of the following is not a valid response when we apply a second derivative?

a) Zero response at onset of gray level step

b) Nonzero response at onset of gray level step

c) Zero response at flat segments

d) Nonzero response along the ramps

Answer: b

Explanation: The derivations of digital functions are defined in terms of differences. The definition we use for second derivative should be zero in flat segments, zero at the onset of a gray level step or ramp and nonzero along the ramps.

59. If f(x,y) is an image function of two variables, then the first order derivative of a one dimensional function, f(x) is:

a) f(x+1)-f(x)

b) f(x)-f(x+1)

c) f(x-1)-f(x+1)

d) f(x)+f(x-1)

Answer: a

Explanation: The first order derivative of a single dimensional function f(x) is the difference between f(x) and f(x+1).

That is, òf/àX=f(x+1)-f(x).

60. Isolated point is also called as noise point.

a) True

b) False

Answer: a

Explanation: The point which has very high or very low gray level value compared to its neighbours, then that point is called as isolated point or noise point. The noise ooint of is of one oixel size.

61. What is the thickness of the edges produced by first order derivatives when compared to that of second order derivatives?

a) Finer

b) Equal

c) Thicker

d) Independent

Answer: c

Explanation: We know that, the first order derivative is nonzero along the entire ramp while the second order is zero along the ramp. So, we can conclude that the first order derivatives produce thicker edges and the second order derivatives produce much finer edges.

62. First order derivative can enhance the fine detail in the image compared to that of second order derivative.

a) True

b) False

Answer: b

Explanation: The response at and around the noise point is much stronger for the second order derivative than for the first order derivative. So, we can state that the second order derivative is better to enhance the fine details in the image including noise when compared to that of first order derivative.

63. Which of the following derivatives produce a double response at step changes in gray level?

a) First order derivative

b) Third order derivative

c) Second order derivative

d) First and second order derivatives

Answer: c

Explanation: Second order derivatives produce a double line response for the step changes in the gray level. We also note of second-order derivatives that, for similar changes in gray-level values in an image, their response is stronger to a line than to a step, and to a point than to a line.

Module 06

1.Digital functions' derivatives are defined as

a. differences

b. multiplication

c. addition

d. division

Answer: a

2.For line detection we use mask that is

a. Gaussian

b. laplacian

c. ideal

d. butterworth

Answer: b

3.Gradient computation equation is

a. |Gx|+|GY|

b. |Gx|-|Gy|

c. |Gx|/|Gy|

d. |Gx|x|GY|

Answer: a

4.For finding horizontal lines we use mask of values

a.[-1 -1-1;22 2; -1 -1 -1]

b.[2 -1 -1; -1 2 -1; -1 -1 2]

c.[-12-1;-12-1;-12-1]

d.[-1 -1 2; -1 2 -1;2 -1 -1]

Answer: a

5.If the inner region of the object is textured then approach we use is

a.discontinuity

b.similarity

e.extraction

ci.recognition

Answer: b

6.The horizontal gradient pixels are denoted by

a.Gx

b.Gy

e.Gt

d.Gs

Answer: a

7.To avoid the negative values taking absolute values in lapacian image doubles

a.thickness of lines

b.thinness of lines

e.thickness of edges

ci.thinness of edges

Answer: a

8.First derivative approximation says that values of constant intensities must be

a. 1

b.0

c. positive

d. negative

Answer: b

9.For finding lines at angle 45 we use mask of values

a.[-1 -1 -1; 2 2 2; -1 -1 -1]

b.[2-1 -1;-1 2-1;-1 -1 2]

c.[-1 2-1; -1 2-1;-1 2-1]

d.[-1-12;-12-1;2-1-1]

10.Second derivative approximation says that values along the ramp must be

a. nonzero

b.zero

c. positive

d. negative

Answer: b

11.Ri is a connected set, where is

a. 1,2,3,4

b. 1,2,3...10

c. 1,2,3...50

d. 1,2,3...n

Answer: d

12.Gradient magnitude images are more useful in

a. point detection

b. line detection

c. area detection

d. edge detection

Answer: d

13.Image having gradient pixels is called

a.sharp image

b.blur image

e.gradient image

ci.binary image

Answer: c

14.In laplacian images light shades of gray level is represented by

a.O

b. 1

c. positive

d. negative

Answer: c.

15.For noise reduction we use

a. image smoothing

b. image contouring

c. image enhancement

d. image recognition

Answer: a

16.Diagonal lines are angles at

a.0

b.30

c. 45

d.90

Answer: c

17.Transition between objects and background shows

a. ramp edges

b. step edges

c. sharp edges

d. Both a and b

Answer: d.

18.Horizontal lines are angles at

a.0

b.30

c. 45

d.90

Answer: a

19. Standard deviation is referred to as noiseless if having the value

a. 0.1

b. 0.2

c. 0.3

d. 0.4

Answer: a

20. For edge detection we use

a. first derivative

a) First derivative

b. second derivative

c. third derivative

d. Both a and b

Answer: a

21.Step edge transition is between pixels over the distance of

a. 1 pixel

b. 2 pixels

c. 3 pixels

d. 4 pixels

Answer: a

22. Sobel gradient is not that good for detection of

a. horizontal lines

b. vertical lines

c. Diagonal lines

ci.edges

Answer: c

23. Smoothness reduced the bricks of

a. pixels

b. constant intensities

c. point pixels

ci.edges

Answer: d

24. Second derivative approximation says that it is nonzero only at

a. ramp

b. step

c. onset

ci.edges

Answer: c

25. Method in which images are input and attributes are output is called

a. low level processes

b. high level processes

c. mid level processes

d.edgelevel processes

Answer: c

26. Computation of derivatives in segmentation is also called

a. spatial filtering

b. frequency filtering

c. low pass filtering

d. high pass filtering

Answer: a

27. Model of lines through region is called

a. ramp edges

b. step edge

c. roof edges

d. thinness of edges

Answer: c

28. Transition of intensity takes place between

a. adjacent pixels

b. near pixels

c. edge pixels

d. line pixels

Answer: a

29. Averaging is analogous to

a. differentiation

b. derivation

c. addition

d. integration

Answer: d

30. Response of derivative mask is zero at

a. sharp intensities

b. constant intensities

c. low intensities

d. high intensities

Answer: b

31. Subdivision of the image depends upon the

a. problem

b. objects

c. image

d. partition

Answer: a

32. One that is not a method of image segmentation is

a. area

b. line

c. point

d.edge

Answer: a

33. Discontinuity approach of segmentation depends upon

a. low frequencies

b. smooth changes

c. abrupt changes

d. contrast

Answer: c

34. On ramp and step second derivatives produce

a. single edge effect

b. single effect

c. double edge effect

d. double line effect

Answer: c

35. Point detection is done using filter that is

a. Gaussian

b. laplacian

c. ideal

d. butterworth

Answer: b

36. Second derivatives are zero at points on

a. ramp

b. step

c. constant intensity

ci.edge

Answer: a

37. Two regions are said to be adjacent if their union forms

a. connected set

b. boundaries

c. region

d. image

Answer: a

38. 8bit image has intensity levels of

a. 0

b. 128

c. 255

d.256

Answer: d

39. Sobel operators were introduced in

a. 1970

b. 1971

c. 1972

d. 1973

Answer: a

40. Blurring attenuate the

a. pixels

b. points

c. cross gradient

d. intensity

Answer: d

Scheme	R2016
Semester	VII
Course Code	CSC701
Course Name	Digital Signal and Image Processing

Question No.	Question	a	b	c	d	Answer Key
1	Which of the following condition should hold true for a signal x[n] to be odd?	x[-n] = x[n] • x[n]	x[n] = -x[-n]	x[n] = [x[n]]3	x[n] = x[n]	x[n] = -x[-n]
2	If the impulse response the system is of infinite duration then it is called	FIR system	IIR system	IFR system	IIF system	IIR system
3	The overlap save method is used to calculate	The discrete convolution between a sampled signal and a finite impulse response (FIR) filter	The discrete convolution between a sampled signal and an infinite impulse response (IIR) filter	The discrete convolution between a very long signal and a finite impulse response (FIR) filter	The discrete convolution between a very long signal and a infinite impulse response (IIR) filter	The discrete convolution between a very long signal and a finite impulse
4	Which of the following property makes it possible to calculate 2D DFT using 1D DFT?	conjugate symmetry	Separability	Time shift	Periodicity	Separability
5	The 4-point DFT of {1,1,0,0} is	{ 2, 1-j, 0, 1+j }	{ -2, 1-j, 0, 1+j }	{ 4, 1-j, 0, 1+j }	{ -2, 1-j, 0, 1-j }	{ 2, 1-j, 0, 1+j }
6	The number of complex addition in direct DFT are	N(N-1)	N^2	Nlog2 N	(N/2)log2 N	N(N-1)
7	Calculate the minimum sampling rate to avoid aliasing when a continuous time signal is given by x(t) = 5 cos 200πt	100 Hz	200 Hz	250 Hz	400 Hz	200 Hz
8	A random signal is the one	which is discrete in time	which is discrete in value	which varies with respect to only single variable	which can not be represented using an equation or a set of rules	which can not be represented using an equation or a set of rules
9	The total energy of a discrete time signal is	zero	negative	infinite	finite	finite

10	If a discrete time signal x(n) of length l is convolved with a discrete time signal y(n) of length n then the length of output signal is	l+n-1	l-n+1	l*n	l*n-1	l+n-1
11	If sampling frequency is below Nyquist frequency , distortion in the present sprectra due to other spectra in the frequency domain is called as ____	Discrete Fourier Transform	Nyquist – Shannon sampling theory	Aliasing	Up sampling	Aliasing
12	Auto correlation of x(n) = [4, 3, 2, 1] and its value at lag=0 are	[4, 11, 12, 30, 20, 12,4] and 30	[4, 11, 20, 30, 20, 12,4] and 30	[3, 11, 20, 30, 20, 12,3] and 20	[4, 11, 20, -30, 20, 12,4] and 11	[4, 11, 20, 30, 20, 12,4] and 30
13	DFT of a signal is a lossy process.	No	Yes	May be	No way to decide	No
14	DFT of a discrete signal is ___ in nature	Continuous	Analog	Discrete	Aperiodic	Discrete
15	Under which conditions does an initially relaxed system become stable	only if bounded input generates unbounded output	only if bounded input generates bounded output	only if unbounded input generates unbounded output	only if unbounded input generates bounded output	only if bounded input generates bounded output
16	The N-point DFT of a L-point sequence will have a periodicity of ____ samples	N	L	N(N-1)	N * N	N
17	Computation of linear filtering of a sequence using FFT algorithm requires no. of complex additions are	(N/2)logN	2NlogN [Base=2]	(N/2)logN [Base=2]	NlogN [Base=2]	NlogN [Base=2]
18	Which filter is best to remove salt and pepper noise?	Low pass	Sobel	Median	Laplacian	Median
19	In which case power law of transformation is used	purification	industry	radar	MRI	MRI
20	While performing negative of a 3 bpp image the pixel value '5' will transform to	2	5	8	0	2
21	Which is true about bit plane slicing?	Highest order plane contains most of the information of an image	Lowest order plane contains most of the information of an image	Mid order plane contains most of the information of an image	All plane contains equal information of an image	Highest order plane contains most of the information of an image
22	In neighborhood processing methods	All the pixels in the neighborhood are processed at a time	A pixel in the neighborhood is processed using the current pixel	A pixel is processed using all the pixels within the neighborhood	A pixel is processed using its own current value	A pixel is processed using all the pixels within the neighborhood

23	Histogram processing looses _____ of the pixels of an image.	information	intensity	position	content	position
24	Laplacian operator is rotation invariant because	it is two dmensional in nature	it is one Dimentional in nature	it rotates very fast with respect to the centre pixel	Rotating the image and then applying the operator or roatating the operator and then applying on the image	Rotating the image and then applying the operator or roatating the operator and then
25	Point, line, edge detectors are based on ____ of an image	Similarity	equality	discontinuities	nature	discontinuities