DIGITAL SIGNAL PROCESSING(EC 1361)

1. Define signal?
   Any physical quantity that carries information varies with other independent or dependent variables.
2. What are the main types of signals with respect to time as independent variable?
   Continous time (analog) signals &discrete time (discrete) signals
3. What is analog signal?

   The analog signal is a continous function of independent variabls.The analog signal is defined for every instant of independent variable and so magnitude of independent variable is continous in the specified range.here both the independent variable and magnitude are continous.
4. What is discrete signal?
   The discrete signal is a function of discreted independent variabls.The indindependent variable is divided into uniform interval and is represented by an integer,The discrete signal is is defined for every integer value of independent variable.here both the values of signal and independent variable are discrete.
5. What is digital signal?
   The digital signal is same as discrete signal except that the magnitude of signal is quantised.

6.What are the different types of signal representations?

   a. Graphical representation
   b. Functional representations
   c. Tabular representation
   d. Sequence representation

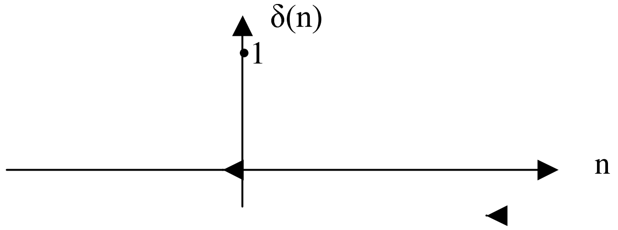
7. Define periodic and non periodic discrete timesignals?
   If the discrete time signal repeated after equal samples of time then it is called periodic signal.When the discrete time signal x[n] satis fies the condition x[n+N]=x(n), then it is called periodic signal with fundamental period N samples.if x(n) ≠x(n+N) then it is called nonperiodic signals.

0

8.Define unit sample sequence?the unit sample sequence δ(n) and is defined as

δ(n)= 1 for n=0

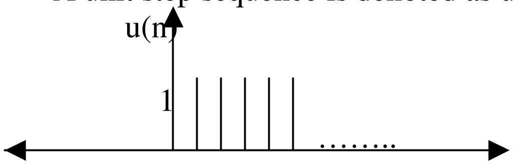
0 for n≠0



9. .Define unit step sequence

A unit step sequence is denoted as $u(n)=1$ for $n\geq0$

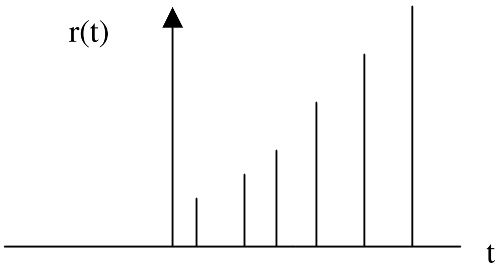
0 other wise



10.Define unit ramp sequence?

A unit ramp sequence is defined as $r(n)= n$ for $n\geq0$

0 other wise



11..Define a system?

A system is a physical device or algorithm that performs an operation on the signal

12.What is digital signal processing?

The dsp refers processing of signal by digital system.

13. What are the steps involved in digital signal processing?

a. Converting the analog signal to digital signal ,which is performed by A/D converter
b. Processing the digital signal by digital systems.
c. Converting the digital output signal from the digital system to analog signal by D/A converter.

14. What are the advantages of DSP?

a. The programme can be modified easily for better Performance.
b. Better accuracy can be achieved by using adaptive algorithm.
c. The digital signal can be easily stored and transported.
d. Digital systems are cheaper than analog equallent.

15. Give some applications of DSP?

a. Speech processing
b. Communications
c. Biomedical

16. Write the difference equation governing the Nth order LTI system.

$$Y(n)=\sum^{N} a_k\, y(n-k) +\sum^{M} b_k\, x(n-k)$$

k=1 k=0

a. N is the order of the system
b. a_k & b_k are constant coefficients
c. y(n)&x(n) are output and input to the system

17. List the various methods of classifying discrete time systems?
    a. Static and dynamic systems.
    b. Time invariant and time variant
    c. Linear and nonlinear
    d. Causal and noncausal
    e. Stable and unstable
    f. FIR and IIR systems
    g. Recursive and non recursive systems

18. What are static and dynamic systems? Give examples?

A discrete time system is called static(memory less)if it's output at any instant n dependent on the input sample at the same time (but does not depend on past or future samples).If the response depends on past or future samples, then the system is called dynamic system.

Eg.y(n)=ax(n) static system
Y(n)=ax(n)+bx(n-1)

19. Define time invariant system?

A system is said to be time invariant if it's input output characteristics does not change with time. Let H be a system and H{X(n)}=Y(n).now if H{X(n-k)}=Y(n-k) then the system H is called time invariant.

20. What is linear and nonlinear systems?

If a system satisfies superposition and homogeneity principles then the system is called linear otherwise it is called nonlinear

If H is a system,$X_1(n)$ and $X_2(n)$ are inputs a and b are constants then $H\{aX_1(n)+BX_2(n)\}=aH\{X_1(n)\}+bH\{X_2(n)\}$ then His linear.

21. What is a causal system give an example?

A system is said to be causal, if the output of the system at any time n depends on present and past inputs ,but does not depend on future inputs.
Eg.y(n)=x(n)+x(n-1)

22. Define a stable system?

Any relaxed system is said to be bounded input bounded output stable if and only if every bounded input yields a bounded output.

$$\sum_{n=-\propto}^{\propto} h(n)< \propto$$

where h(n)is impulse response of the system

23. What is LTI system?

A linear time invariant system is defined that a system obeys both linearity and time invariant properties.

If a system satisfies superposition and homogeneity principles then the system is called linear

A system is said to be time invariant if it,s input output characteristics does not change with time.

24. What are FIR and IIR systems?

FIR (finite impulse response):this type of system has an impulse response which is zero outside the finite time interval eg. $h(n)=0$ for $n<0$ and $n>N$

IIR (Infinite Impulse Response):An IIR system exhibits an impulse response of infinite duration.

25. State sampling theorem.

A band limited continous time signal ,with higher frequency f_c Hz can be uniquely recovered from it's samples provided that the sampling rate $F>2f_c$ samples per second.

26. Show whether the system is linear?

$Y(n)=n\ x(n)$

$H\{aX_1(n)+BX_2(n)\}=a\ H\{X_1(n)\}+b\ H\{X_2(n)\}$ then H is linear.

$a\ H\{X_1(n)\}+b\ H\{X_2(n)\}=anx_1(n)+bnx_2(n)$ ------------(1)

$H\{aX_1(n)+BX_2(n)\}= anx_1(n)+bnx_2(n)$ --------------(2)

(1)=(2) So the system is linear.

27. Show whether the system is linear?

$Y(n)=nx^2(n)$

Since $x^2(n)$ term is present in the system which implies non linearity in to the system. Therefore the system is nonlinear.

28. Determine if the following system is time invariant or time variant?

$Y(n)=x(n)+x(n-1)$

If the input is delayed by k units in time we have $y(n,k)=H\{x(n-k)\}=x(n-k)+x(n-k-1)$

If we delay the output by k units then $y(n-k)= x(n-k)+x(n-k-1)$

So the system is time invariant.

29. Determine if the system described by the following equation is causal or not?

$Y(n)=x(n^2)$

For n = -1

$Y(-1)=x(1)$

For n = 2 $Y(2) = x(4)$

Therefore the output of the system depends on future input and hence the system is non causal.

30. Define unit sample response of a system and what is it's significance?

The response of a system denoted as h(n),obtained from a discrete time system when the input signal is a unit sample sequence is known as unit sample response.

31. Define z transform?

The Z transform of a discrete time signal x(n) is defined as

$$X(z) = \sum_{n=-\infty}^{\infty} x(n)z^{-n}$$

where z is a complex variable. In polar form $z=re^{-jw}$

32. What is meant by ROC?

The region of convergence (ROC) is defined as the set of all values of z for which x(z) converges.

33. Explain about the roc of causal and anti-causal infinite sequences?

For causal system the roc is exterior to the circle of radius r.

For anti causal system it is interior to the circle of radius r.

34. Explain about the roc of causal and anti causal finite sequences

For causal system the roc is entire z plane except z=0.

For anti causal system it is entire z plane except $z=\infty$.

35. What are the properties of roc?
   a. The roc is a ring or disk in the z plane centered at the origin.
   b. The roc cannot contain any pole.
   c. The roc must be a connected region
   d. The roc of an LTI stable system contains the unit circle.

36. Explain the linearity property of the z transform

If $z\{x_1(n)\}=x_1(z)$ and $z\{x_2(n)\}=x_2(z)$ then $z\{ax_1(n)+bx_2(n)\}=ax_1(z)+bx_2(z)$ a&b are constants.

37. State the time shifting property of the z transform

If $z\{x(n)\}=x(z)$ then $z\{x(n-k)\}=z^{-k}x(z)$

38. State the scaling property of the z transform

If $z\{x(n)\}=x(z)$ then $z\{a^n x(n)\}=x(a^{-1}z)$

39. State the time reversal property of the z transform

If $z\{x(n)\}=x(z)$ then $z\{x(-n)\}=x(z^{-1})$

40. Explain convolution property of the z transform

If $z\{x(n)\}=x(z)$ & $z\{h(n)\}=h(z)$ then $z\{x(n)*h(n)\}=x(z)h(z)$

41. Explain the multiplication property of z transform

If $z\{x(n)\}=x(z)$ & $z\{h(n)\}=h(z)$ then

$z\{x(n)\,h(n)\}= 1/2\pi j \int_c x(\gamma)h(z/\gamma)\,\gamma^{-1}d\,\gamma$

42. State Parseval's relation in z transform

If x1(n) and x2(n) are complex valued sequences then

$$\sum_{n=-\infty}^{\infty} x_1(n)x_2^*(n)=1/2\,\pi j \int_c x_1(\gamma)x_2^*(1/\gamma^*)\,\gamma^{-1}d\,\gamma$$

43. State and proveinitial value theorem of z transform

If x(n) is causal then $x(0)= \lim_{z\to\infty} x(z)$

proof:

$$X(z)=\sum_{n=-\infty}^{\infty}x(n)z^{-n} \quad \text{----------------------(1)}$$

in(1) put n=0 $\rightarrow x(n)\rightarrow x(z)=\infty$

hence proved

44. State final value theorem of z tramsform

If x(n) is causal z{x(n)}=x(z), where the roc of x(z) includes, but it is not necessary to confined to $|z|>1$ and (z-1)x(z)has no pole on or outside the unit circle then

$$x(\infty) = \underset{z\rightarrow 1}{\text{lt}}\ (z-1)\ x(z)$$

45. Define system function?

The ratio between z transform of out put signal y(z) to z transform of input signal x(z) is called system function of the particular system

$$H(z)= \frac{Y(z)}{X(Z)}$$

46. What are the conditions of stability of a causal system ?

All the poles of the system are with in the unit circle.

The sum of impulse response for all values of n is bounded

$$\sum_{n=-\infty}^{\infty} h(n) < \infty$$

47. Determine z transform and roc of the signal $\{\underset{\uparrow}{1},2,3,4\}$

$$X(z) = \sum_{n=-\infty}^{-\infty} x(n)z^{-n}$$

$$= \sum_{n=0}^{3}x(n)z^{-n} \quad =x(0)z^{-0}+x(1)z^{-1}+x(2)z^{-2}+x(3)z^{-3}$$

$$= 1z^{-0}+2z^{-1}+3z^{-2}+4z^{-3}$$

roc is entire z plane except z = 0

48. Determine z transform and roc of the signal $\{1,2,3,\underset{\uparrow}{4}\}$

$$X(z) = \sum_{n=-\infty}^{\infty} x(n)z^{-n}$$

$$X(z)= \sum_{n=-3}^{0} x(n)z^{-n} \qquad = x(-3)z^{3}+x(-2)z^{2}+x(-1)z^{1}+x(0)$$

$$= 4+3z^{1}+2z^{2}+1z^{3}$$

ROC is entire z plane except $z=\infty$

49. Determine z transform and roc of the signal $\{1,\underset{\uparrow}{2},3,4\}$

$$X(z)=\sum_{n=-\infty}^{\infty} x(n)\, z^{-n}$$

$$X(z)=\sum_{n=-1}^{2} x(n)z^{-n} \quad = x(-1)z^{1} + x(0)z^{0} + x(1)z^{-1} + x(2)z^{-2}$$

$$= 1z^{1}+2+3z^{-1}+4z^{-2}$$

ROC is entire z plane except $z=\infty,0$

50. Find the z transform and roc of $a^{n}u(n)$

$$X(z) = \sum_{n=-\infty}^{\infty} x(n)z^{-n}$$

$$X(z) = \sum_{n=0}^{\infty} a^{n} z^{-n}=1/(1-az^{-1}) \qquad \text{roc}\,|z|>a.$$

51. Find the z transform and roc of $-a^{n}u(-n-1)$

$$X(z)= \sum_{n=-\infty}^{\infty} x(n)z^{-n}$$

$$X(z)= - \sum_{n=-\infty}^{-1} a^{n} z^{-n}$$

$$= -\sum_{n=1}^{\infty}(a^{-1}z)^{n} \quad = 1/(1-az^{-1}) \qquad \text{roc}\,|z|<a.$$

52. The z-transform of a sequence x(n) is x(z),what is the z transform of nx(n)

If $z\{x(n)\}=x(z)$ then $z\{nx(n)\}=-zd(x(z))/dz$

53. Find the z-transform of (a) A digital impulse (b) A digital step.

(a)Since x(n) is zero except for n = 0, where x(n) is 1, we find x(z) = 1.

(b) Since x(n) is zero except for $n\geq 0$, where x(n) is 1, we find

$$x(z) = \sum_{n=0}^{\infty} Z^{-n} = \frac{1}{1-z^{-1}}$$

54. What is the relationship between z-transform and DTFT?

The z-transform of x(n) is given by

$$x(z) = \sum_{n=-\infty}^{\infty} x(n)\, Z^{-n} \quad ; \text{where } z = re^{j\omega} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Substituting z in x(z) we get,

$$x(z) = \sum_{n=-\infty}^{\infty} x(n)\, r^{-n} e^{-j\omega n} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ (2)$$

The Fourier transform of x(n) is given by

$$x(e^{j\omega}) = \sum_{n=-\infty}^{\infty} x(n)\, e^{-j\omega n} \qquad \ldots\ldots\ldots\ldots\ldots\ldots..(3)$$

Equation (2) and (3) are identical, when r = 1.

In the z-plane this corresponds to the locus of points on the unit circle $|z| = 1$. Hence $X(e^{j\omega})$ is equal to H(z) evaluated along the unit circle, or $X(e^{j\omega}) = x(z)|_{z = ej\omega}$ For $X(e^{j\omega})$ to exist, the ROC of x(z) must include the unit circle.

55. What are the different methods of evaluating inverse z-transform?

It can be evaluated using several methods.

i. Long division method
ii. Partial fraction expansion method
iii. Residue method
iv. Convolution method

56. Define DFT of a discrete time sequence.

The dft is used to convert a finite discrete time sequence x(n) to an N point frequency domain sequencex(k).The Npoint DFTof a finite sequence x(n) of length L,(L<N) is defined as

$$x(k) = \sum_{n=0}^{N-1} x(n) e^{-j2\pi nk/N} \qquad K=0,1,2,3,\ldots N-1$$

57. Define IDTFT

The IDTFT of the sequence of length N is defined as

$$X(n)=(1/N\ ) \sum_{k=0}^{N-1} x(k) e^{j2\pi nk/N} \qquad n=0,1,2,3,\ldots N-1$$

58. Define DTFT and IDTFT of a sequence?

The DTFT (Discrete Time Fourier Transform) of a sequence x(n) is defined as

$$X(w) = \sum_{n=-\infty}^{\infty} x(n) e^{-jwn}$$

The IDTFT is defined as $x(n)= 1/2\ \pi \int_{-\pi}^{\pi} x(w)\, e^{jwn}\, dw$

59. What is the drawback in DTFT?

The drawback in discrete time fourier transform is that it is continuous function of w and cannot be processed by digital systems.

60. What is the relation between DFT and DTFT?

Let x(n) be a sequence. DTFT{x(n)}=x(w) and DFT{X(n)}=x(k).x(k) is a N point sequence which is obtained by sampling one period of x(w) at N equal intervals.

$$X(\omega)\Big|_{\omega=2\pi k/N} = X(K)$$

61. Calculate DFT of the sequence x(n)={1,1,2,2}

$$x(k)= \sum_{n=0}^{N-1} x(n)e^{-j2\pi nk/N} \qquad K=0,1,2,3,\ldots N-1$$

$$x(k)= \sum_{n=0}^{3} x(n)e^{-j2\pi nk/N} \qquad K=0,1,2,3$$

N=4

$$= x(0)+x(1)e^{-jk\pi/2}+x(2)e^{-jk\pi}+x(3)e^{-j3k\pi/2}$$

$$= 1+ e\text{-}^{jk\pi/2}-2e^{-jk\pi}-2e^{-j3k\pi/2} \qquad K=0,1,2,3$$

62. List any four properties of DFT
    a. Periodicity
    b. Linearity
    c. Time reversal
    d. Circular time shift
63. State periodicity property with respect to DFT.
    If x(k) is N-point DFT of a finite duration sequence x(n), then
    x(n+N) = x(n) for all n.
    x(k+N) = x(k) for all k.
64. State periodicity property with respect to DFT.
    If $x_1(k)$ and $x_2(k)$ are N-point DFTs of finite duration sequences $x_1(n)$ and $x_2(n)$, then DFT [a $x_1(n)$ + b $x_2(n)$] = a $x_1(k)$ + b $x_2(k)$, a, b are constants.
65. State time reversal property with respect to DFT.
    If DFT[x(n) =x(k), then
    DFT[$x((-n))_N$] = DFT[x(N-n)] = $x((-k))_N$ = x(N-k)
66. State circular time shifting property with respect to DFT.
    If DFT[x(n)] = x(k), then DFT [x((n-l))] = x(k) $e^{-j2\pi kl/N}$
67. Assume two finite duration sequences $x_1(n)$ and $x_2(n)$ are linearly combined. Let $x_3(n)$ = a $x_1(n)$ + b $x_2(n)$. What is the DFT of $x_3(n)$?
    Given $x_3(n)$ = a $x_1(n)$ + b $x_2(n)$.
    Let DFT[$x_1(n)$] = $x_1(k)$ and DFT[$x_2(n)$] = $x_2(k)$, then
    DFT[$x_3(n)$] = DFT [a $x_1(n)$ + b $x_2(n)$]
    = a DFT[$x_1(n)$] +b DFT[$x_2(n)$]
    = a $x_1(k)$ + b $x_2(k)$

68. Compute the DFT of $x(n) = \delta(n - k_1)$

Given $x(n) = \delta(n - k_1) = 1$, when $n = k_1$

0, otherwise

$$x(k)= \sum_{n=0}^{N-1} x(n)e^{-j2\pi nk/N} \qquad K=0,1,2,3,\ldots N-1$$

$$x(k)= \sum_{n=0}^{N-1} \delta(n - k_1)e^{-j2\pi nk/N} \qquad K=0,1,2,3,\ldots N-1$$

$$= e^{-j2\pi k_1 k/N}$$

69. What are the two methods used for sectional convolution?

(a) Overlap and add method

(b) Overlap and save method

70. Define circular convolution.

Let $x_1(n)$ and $x_2(n)$are finite duration sequences both of length n with DFTs $x_1(k)$ and $x_2(k)$. If $x_3(k) = x_1(k)\ x_2(k)$, then the sequence $x_3(k)$ can be obtained by circular convolution, defined as

$$x(k) = \sum_{n=0}^{N-1} x_1(m)\ x_2((n))_N$$

71. Why FFT is needed?

FFT is needed to compute DFT with reduced number of calculations. DFT is required for spectrum analysis and filtering operations on the signals using digital computers.

72. Calculate the number of multiplications needed in the calculation of DFT and FFT with 64 point sequence.

The number of complex multiplications required using direct computation is $N^2 = 64^2 = 4096$.

The number of complex multiplications required using FFT is

$$N \log_2 \frac{N}{2} = 64 \log_2 \frac{64}{2} = 192$$

73. What is the main advantage of FFT?

FFT reduces the computation time required to compute discrete fourier transform.

74. Calculate the number of multiplications needed in the calculation of DFT using FFT with 32 point sequence.

The number of complex multiplications required using FFT is

$$\frac{N}{2} \log_2 N = \frac{32}{2} \log_2 32 = 80$$

75. What is FFT?

FFT is a method for computing the DFT with reduced number of calculations using symmetry and periodicity properties of twiddle factor W^k_N. The computational efficiency is achieved by decomposing of an N-point DFT into successively smaller DFTs to increase the speed of computation.

76. How many multiplications and additions are required to compute N-point DFT using radix-2 FFT?

$\frac{N}{2} \log_2 N$ multiplications and $N \log_2 N$ additions

77. What is meant by radix-2 FFT?

If the number of output points N can be expressed as a power of 2, i.e., $N = 2^M$ Where M is an integer then this algorithm is known as radix-2 algorithm.

78. What is DIT radix2 algorithm.

The radix 2 DIT FFT is an efficient algorithm for computing DFT.The idea is to break N point sequence in to two sequences ,the DFT of which can be combined to give DFT of the original N-point sequence. Initially the N point sequence is divided in to two N/2 point sequences ,on the basis of odd and even and the DFTs of them are evaluated and combined to give N-point sequence. Similarly the N/2 DFT s are divided and expressed in to the combination of N/4 point DFTs. This process is continued until we left with 2-point DFTs

79. What is DIF radix2 algorithm.

The radix 2 DIFFFT is an efficient algorithm for computing DFT in this the out put sequence x(k) is divided in to smaller and smaller. The idea is to break N point sequence in to two sequences ,$x_1(n)$ and $x_2(n)$ consisting of the first N/2 points of x(n)and last N/2 points of x(n) respectively. Then we find N/2 point sequences f(n) and g(n).f(n)=x1(n)+x2(n)and g(n)= (x1(n)+x2(n))W_N^n·Similarly the N/2 DFT s are divided and expressed in to the combination of N/4 point DFTs. This process is continued until we left with 2-point DFTs

80. What are the differences between DIT and DIF algorithms?

For DIT the input is bitreversed and the output is in natural order ,and in DIF the input is in natural order and output is bitreversed.In butterfly the phase factor is multiplied before the add and subtract operation but in DIF it is multiplied after add-subtract operation

81. What is the basic operation of DIT algorithm?

The basic operation DIT algorithm is called butterfly in which two inputs G(n) and H(n)are combined to give $x_1(k)$ and $x_2(k)$

$$x_1(k)= G(n)+W_N^k H(n)$$
$$x_2(k)= G(n)-W_N^k H(n)$$

W_N^k is the twiddle factor

82. What is the basic operation of DIF algorithm?

The basic operation DIF algorithm is called butterfly in which two inputs G(n) and H(n)are combined to give $x_1(k)$ and $x_2(k)$

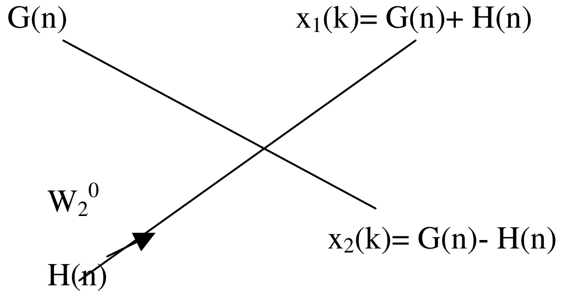
$$x_1(k)= G(n)+ H(n)$$

$$x_2(k)=\{G(n)- H(n)\}\ W_N^k$$

W_N^k is the twiddle factor

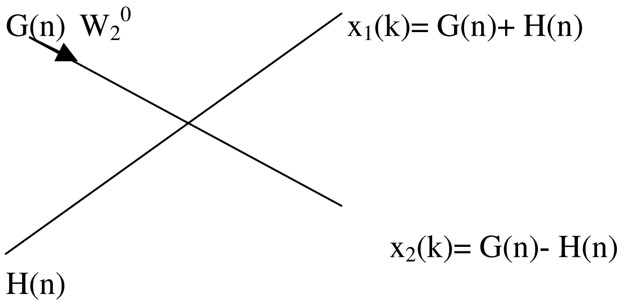
83. Draw the flow-graph of a two-point DFT for a decimation in time decomposition

The flow-graph of a two-point DFT for decimation in time algorithm is



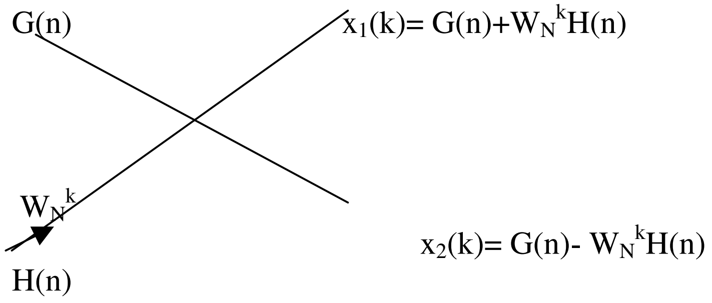
84. Draw the flow-graph of a two-point DFT for a decimation in frequency decomposition

The flowgraph of a twopoint DFT for decimation in frequency algorithm is



85. Draw the basic butterfly diagram for decimation in time algorithm

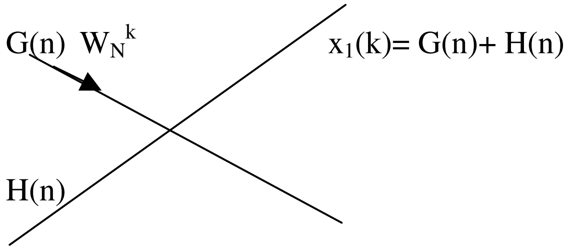
The flowgraph of a twopoint DFT for a decimation in time algorithm is



G(n)andH(n) are inputs and $x_1(k)$,$x_2(k)$ are outputs W_N^k is phase factor

86. Draw the basic butterfly for a decimation in frequency decomposition

The butterflyof a twopoint DFT for a decimation in frequency algorithm is



$x_2(k)= \{G(n)- H(n)\} W_N^k$

G(n)andH(n) are inputs and $x_1(k)$,$x_2(k)$ are outputs W_N^k is phase factor

87. Arrange the 8 point sequence x(n)={1,2,3,4,-1,-2,-3,-4} inn bit reversed order.

    Normal order x(n)={1,2,3,4,-1,-2,-3,-4}

    Bit reversal order x(n)={1,-1,3,-3, 2,-2,4,-4}

88. How we can calculate IDFT using FFT algorithm?

    -The inverse DFT of N point sequence x(k) is defined as

$$X(n)=(1/N)\sum_{k=0}^{N-1}[x^*(k)W_N^{nk}]^* \qquad n=0,1,2,3,\ldots N-1$$

    a. Take conjugate of x(k)
    b. Compute N point DFT of x*(k) using radix 2 FFT.
    c. Take conjugate of output sequence.
    d. Divide the output sequence by N.

89. What are the applications of FFT?
    1. linear filtering
    2. correlation
    3. spectrum analysis

90. What are the twiddle factors involved in the first stage of computation in 8 point DIT radix-2, FFT algorithm?

    $W_8^0, W_8^1, W_8^2, W_8^3$

91.What is filter?

Filter is a frequency selective device ,which amplify particular range of frequencies and attenuate particular range of frequencies.

92.What are the types of digital filter according to their impulse response?

IIR(Infinite impulse response)filter

FIR(Finite Impulse Response)filter.

93. How phase distortion and delay distortion are introduced?

The phase distortion is introduced when the phase characteristics of a filter is nonlinear with in the desired frequency band.

The delay distortion is introduced when the delay is not constant with in the desired frequency band.

94.whar are FIR filters?

The filter designed by selecting finite number of samples of impulse response (h(n) obtained from inverse fourier transform of desired frequency response H(w)) are called FIR filters

95. Write the steps involved in FIR filter design

Choose the desired frequency response $H_d(w)$

Take the inverse fourier transform and obtain $H_d(n)$

Convert the infinite duration sequence $H_d(n)$ to h(n)

Take Z transform of h(n) to get H(Z)

96. What are advantages of FIR filter?

Linear phase FIR filter can be easily designed .

Efficient realization of FIR filter exists as both recurrisive and non recursive structures.
FIR filter realized non recursively are stable.
The round off noise can be made small in non recursive realization of FIR filter
97. what are the disadvantages of FIR FILTER

The duration of impulse response should be large to realize sharp cutoff filters.
The non integral delay can lead to problems in some signal processing applications.

98.what is the necessary and sufficient condition for the linear phase characteristic of a FIR filter?

The phase function should be a linear function of w, which inturn requires constant group delay and phase delay.

99. List the well known design technique for linear phase FIR filter design?

Fourier series method and window method
Frequency sampling method.
Optimal filter design method.

100.Define IIR filter?

The filter designed by considering all the infinite samples of impulse response are called IIR filter.