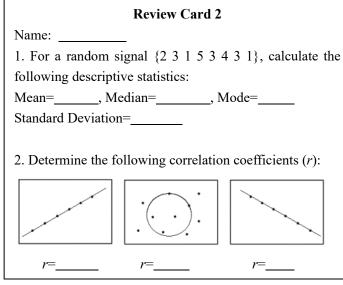
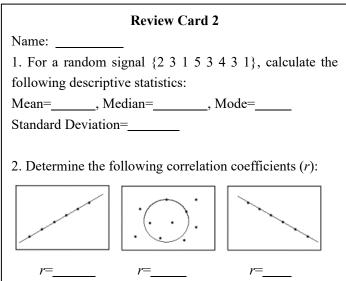
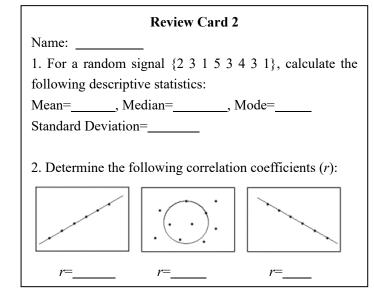
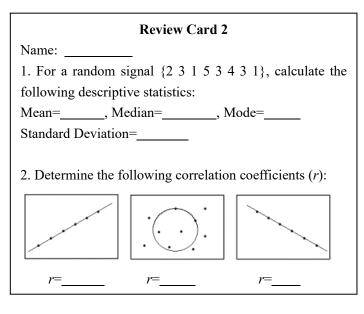


Review Card 2	Review Card 2
Name:	Name:
1. For a random signal {2 3 1 5 3 4 3 1}, calculate the	1. For a random signal {2 3 1 5 3 4 3 1}, calculate the
following descriptive statistics:	following descriptive statistics:
Mean=, Median=, Mode=	Mean=, Median=, Mode=
Standard Deviation=	Standard Deviation=
2. Determine the following correlation coefficients (r):	2. Determine the following correlation coefficients (r):





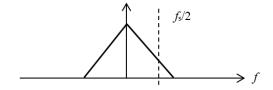




# **Review Card 3**

Name: \_\_\_\_\_

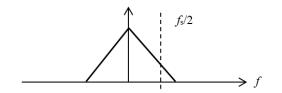
- 1. If an ADC has a resolution of 12 bit and a reference voltage of 5 volts, the digital output for an analog input of 1.56 volts will be = \_\_\_\_\_ (in decimal form)
- 2. If we want to digitize an analog signal with frequency of interest not higher than 8 kHz, the minimal sampling frequency should be \_\_\_\_\_\_; The anti-aliasing filter prior to digitizing is a \_\_\_\_\_\_(analog or digital) \_\_\_\_\_ (low- or high- pass) filter with a cut-off frequency of \_\_\_\_\_\_.
- 3. Draw the side effect if an analog signal is sampled as follows:



#### **Review Card 3**

Name: \_\_\_\_

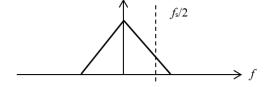
- 1. If an ADC has a resolution of 12 bit and a reference voltage of 5 volts, the digital output for an analog input of 1.56 volts will be = \_\_\_\_\_ (in decimal form)
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- 3. Draw the side effect if an analog signal is sampled as follows:



#### **Review Card 3**

Name:

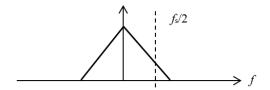
- 1. If an ADC has a resolution of 12 bit and a reference voltage of 5 volts, the digital output for an analog input of 1.56 volts will be = \_\_\_\_\_ (in decimal form)
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- 3. Draw the side effect if an analog signal is sampled as follows:



## **Review Card 3**

Name: \_\_\_\_\_

- 1. If an ADC has a resolution of 12 bit and a reference voltage of 5 volts, the digital output for an analog input of 1.56 volts will be = \_\_\_\_\_ (in decimal form)
- 2. If we want to digitize an analog signal with frequency of interest not higher than 8 kHz, the minimal sampling frequency should be \_\_\_\_\_\_; The anti-aliasing filter prior to digitizing is a \_\_\_\_\_\_(analog or digital) \_\_\_\_\_ (low- or high- pass) filter with a cut-off frequency of \_\_\_\_\_.
- 3. Draw the side effect if an analog signal is sampled as follows:



Name: Read the datasheet of a DAC chip from Texus Instruments below and answer the following questions:  DESCRIPTION The DACISSBW is a very low power 16bst 126 digitals aware converted (DAC) for transmitting and digital aware converted (DAC) for transmitting and digitals aware converted (DAC) for transmitting and digital converted digitals aware converted (DAC) for transmitting and digital converted digitals aware converted (DAC) for transmitting and digital converted digital converted digital digitals aware converted (DAC) for transmitting and digital converted digital digitals aware converted (DAC) for transmitting and digital converted digital digital digital digitals aware converted (DAC) for transmitting and digital		Review Card 4
below and answer the following questions:  DESCRIPTION The DACESTREPTON T	Name:	Name:
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The DAC(1615897 is a very two power 16-bit 12 digitals emailing content contents content to the DAC 1615897 has a simple DAC surrent top. The DAC(1615897 has a simple DAC	below and answer the following questions:	below and answer the following questions:
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represents is; the output analog voltage will be for a digital input of 0x78.    Review Card 4	3 For a reference voltage of 3 3y, the voltage that 1 LSB	3 For a reference voltage of 3 3v, the voltage that 1 LSB
Review Card 4  Name: for a digital input of 0x78.  Review Card 4  Name: for a digital input of 0x78.  Read the datasheet of a DAC chip from Texas Instruments below and answer the following questions:  DESCRIPTION  The DAC1615897 is a very low power 16-bit ΣΔ digital-b-analog converter (DAC) for transmitting an digital-b-analog converter (DAC) for transmitting an experiment of the DAC1615897 has a simple 4-wire SPI for data transfer and configuration of the DAC functions. To reduce power and component count in compact loop-powered applications, the DAC1615897 for the power consumption of the DAC1615897 results in additional current being available for the remaining portion of the system. The loop drive of the DAC1615897 rise and features makes the DAC1615897 ideal for 2- and 4-wire industrial transmitters. The DAC1615897 is available in a 16-pin 4 mm × 4 mm WGFN package and is specified over the extended industrial temperature range of -40°C to -115°C.  1. The resolution of the DAC chip is: (parallel 并行 or serial 串行), because ; the output analog voltage will be	_	
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below and answer the following questions:  DESCRIPTION  The DAC161S997 is a very low power 16-bit ΣΔ digital-to-analog converter (DAC) for transmitting an analog output current over an industry standard 4- 20mA current loop. The DAC161S997 has a simple DAC furcions. To reduce power and component count in compact loop-powered applications, the DAC161S997 contains an internal ultra-low power voltage reference and an internal oscillator. The low power consumption of the DAC161S997 results in additional current being available for the remaining portion of the system. The loop drive of the DAC161S997 interfaces to a Highway Addressable Remote Transducer (HART) modulator, allowing injection of FSK modulated digital data into the 4-20mA current loop. This combination of specifications and features makes the DAC161S997 ideal for 2- and 4-wire industrial transmitters. The DAC161S997 is available in a 16-pin 4 mm × 4 mm WGFN package and is specified over the extended industrial temperature range of -40°C to +105°C.  1. The resolution of the DAC chip is:  2. The way it transfers data between the chip and the computer is (parallel 并行 or serial 串行), because 3. For a reference voltage of 3.3v, the voltage that 1 LSB represents is; the output analog voltage will be		
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represents is; the output analog voltage will be _ represents is; the output analog voltage will be _	Read the datasheet of a DAC chip from Texas Instruments below and answer the following questions:  DESCRIPTION  The DAC161S997 is a very low power 16-bit ΣΔ digital-to-analog converter (DAC) for transmitting an analog output current over an industry standard 4-20mA current loop. The DAC161S997 has a simple 4-wire SPI for data transfer and configuration of the DAC functions. To reduce power and component count in compact loop-powered applications, the DAC161S997 contains an internal outlra-low power voltage reference and an internal oscillator. The low power consumption of the DAC161S997 results in additional current being available for the remaining portion of the system. The loop drive of the DAC161S997 interfaces to a Highway Addressable Remote Transducer (HART) modulator, allowing injection of FSK modulated digital data into the 4-20mA current loop. This combination of specifications and features makes the DAC161S997 ideal for 2- and 4-wire industrial transmitters. The DAC161S997 is available in a 16-pin 4 mm × 4 mm WQFN package and is specified over the extended industrial temperature range of -40°C to +105°C.  1. The resolution of the DAC chip is:  2. The way it transfers data between the chip and the computer is (parallel 并行 or serial 串行),	Read the datasheet of a DAC chip from Texas Instruments below and answer the following questions:  DESCRIPTION  The DAC161S997 is a very low power 16-bit ΣΔ digital-to-analog converter (DAC) for transmitting an analog output current over an industry standard 4-20mA current loop. The DAC161S997 has a simple 4-wire SPI for data transfer and configuration of the DAC functions. To reduce power and component count in compact loop-powered applications, the DAC161S997 contains an internal ultra-low power voltage reference and an internal oscillator. The low power consumption of the DAC161S997 results in additional current being available for the remaining portion of the system. The loop drive of the DAC161S997 interfaces to a Highway Addressable Remote Transducer (HART) modulator, allowing injection of FSK modulated digital data into the 4-20mA current loop. This combination of specifications and features makes the DAC161S997 ideal for 2- and 4-wire industrial transmitters. The DAC161S997 is available in a 16-pin 4 mm × 4 mm WQFN package and is specified over the extended industrial temperature range of -40°C to +105°C.  1. The resolution of the DAC chip is:  2. The way it transfers data between the chip and the computer is (parallel 并行 or serial 串行),
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Review Card 5	Review Card 5
Name:	Name:
1. Complete the number conversion between different bases:	1. Complete the number conversion between different bases:
(1101.0111) <sub>2</sub> =() <sub>10</sub>	(1101.0111) <sub>2</sub> =() <sub>10</sub>
$(4F.6E)_{16} = (\underline{\hspace{1cm}})_{10}$	$(4F.6E)_{16} = (\underline{})_{10}$
$(87.35)_{10} = ()_2$	$(87.35)_{10} = ()_2$
$(CD.6A)_{16} = ()_2$	(CD.6A) <sub>16</sub> =() <sub>2</sub>
(99.025) <sub>10</sub> =() <sub>16</sub>	(99.025) <sub>10</sub> =() <sub>16</sub>
(11100110.01111001) <sub>2</sub> =() <sub>16</sub>	(11100110.01111001) <sub>2</sub> =() <sub>16</sub>
(11100110.01111001) <sub>2</sub> =() <sub>8</sub>	(11100110.01111001) <sub>2</sub> =() <sub>8</sub>
2. The range of a signed char (8-bit, 2s complement) is: _	2. The range of a signed char (8-bit, 2s complement) is:
3. Represent (-13) <sub>10</sub> in different ways (6 bit):	3. Represent (-13) <sub>10</sub> in different ways (6 bit):
Sign-and-Magnitude:	Sign-and-Magnitude:
1s Complement:	1s Complement:
2s Complement:	2s Complement:

Review Card 5	
Name:	Name:
1. Complete the number conversion between different bases:	1. Complete th
(1101.0111) <sub>2</sub> =() <sub>10</sub>	(1101.0111) <sub>2</sub> =
$(4F.6E)_{16} = (\phantom{aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa$	$(4F.6E)_{16} = ($ _
$(87.35)_{10} = ()_2$	$(87.35)_{10} = ($
(CD.6A) <sub>16</sub> =() <sub>2</sub>	$(CD.6A)_{16} = ($ _
(99.025) <sub>10</sub> =() <sub>16</sub>	(99.025) <sub>10</sub> =(_
(11100110.01111001) <sub>2</sub> =() <sub>16</sub>	(11100110.01
(11100110.01111001) <sub>2</sub> =() <sub>8</sub>	(11100110.01
2. The range of a signed char (8-bit, 2s complement) is: _	2. The range of
3. Represent (-13) <sub>10</sub> in different ways (6 bit):	3. Represent (
Sign-and-Magnitude:	Sign-and-Mag
1s Complement:	1s Compleme
2s Complement:	2s Compleme

Review Card 5	
Name:	
1. Complete the number conversion between di	fferent bases:
(1101.0111) <sub>2</sub> =(	)10
(4F.6E) <sub>16</sub> =(	)10
(87.35) <sub>10</sub> =(	)2
(CD.6A) <sub>16</sub> =(	)2
(99.025) <sub>10</sub> =(	)16
(11100110.01111001) <sub>2</sub> =(	)16
(11100110.01111001) <sub>2</sub> =(	)8
2. The range of a signed char (8-bit, 2s compler	nent) is: _
3. Represent (-13) <sub>10</sub> in different ways (6 bit):	
Sign-and-Magnitude:	
1s Complement:	
2s Complement:	

Review Card 6		
Name:		
1. For an 8-bit binary number 1001 1101,		
(A) If it represents an <b>unsigned</b> number, the decimal value is		
;		
(B) If it represents a <b>signed</b> number, the decimal value is:		
a) if it is in sign-and-magnitude form;		
b) if it is in 1s complement form;		
c) if it is in 2s complement form;		
2. The three parts of a float number is:,		
and The advantage of float number is:		
In		
IEEE standard, it uses bits to represent a number		
of single precision, andbits for double		
precision.		
3. Rewrite the following number in <b>base-2</b> normalized form		
and represent it by a 10-digit float number (4 digit for		
exponent part):		
(A) $(13.25)_{10}$		
a) normalized form:		
b) float-number representation:		
(B) (-0.1325) <sub>10</sub>		
a) normalized form:		
b) float-number representation (2s complement):		

# **Review Card 6** 1. For an 8-bit binary number 1001 1101, (A) If it represents an **unsigned** number, the decimal value is (B) If it represents a **signed** number, the decimal value is: a) \_\_\_\_\_ if it is in sign-and-magnitude form; b) \_\_\_\_\_ if it is in 1s complement form; c) \_\_\_\_\_ if it is in 2s complement form; 2. The three parts of a float number is: \_\_\_\_\_, \_\_\_ and \_\_\_\_\_. The advantage of float number is: \_\_\_\_ <u>.</u> In IEEE standard, it uses \_\_\_\_\_ bits to represent a number of single precision, and \_\_\_\_\_bits for double precision. 3. Rewrite the following number in base-2 normalized form and represent it by a 10-digit float number (4 digit for exponent part): (A) $(13.25)_{10}$ a) normalized form: b) float-number representation: (B) (-0.1325)<sub>10</sub> a) normalized form: b) float-number representation (2s complement):

Review Card 7	Review Card 7
Name:	Name:
1. A linear time-invariant system should have the following	1. A linear time-invariant system should have the following
three properties:, and	three properties:, and
2. Decide whether the system described by the following	2. Decide whether the system described by the following
formula is a linear time-invariant system:	formula is a linear time-invariant system:
y(n) = nx(n)	y(n) = nx(n)
♦ Linear?	♦ Linear?
↑ Time-invariant?	♦ Time-invariant?
Review Card 7	Review Card 7
Name:	Name:
1. A linear time-invariant system should have the following	1. A linear time-invariant system should have the following
three properties:, and	three properties:, and
2. Deside whether the greaters described by the fellowing	2. Deside whether the greaters described by the following
2. Decide whether the system described by the following	2. Decide whether the system described by the following
formula is a linear time-invariant system:	formula is a linear time-invariant system: y(n) = nx(n)
y(n) = nx(n)	
♦ Linear?	♦ Linear?
↑ Time-invariant?	♦ Time-invariant?
Review Card 7	Review Card 7
Name:	Name:
1. A linear time-invariant system should have the following	1. A linear time-invariant system should have the following
three properties:, and	three properties:, and
·	·
2. Decide whether the system described by the following	2. Decide whether the system described by the following
formula is a linear time-invariant system:	formula is a linear time-invariant system:
y(n) = nx(n)	y(n) = nx(n)
♦ Linear?	♦ Linear?
	♦ Time-invariant?
Review Card 7	Review Card 7
Name:	Name:
1. A linear time-invariant system should have the following	1. A linear time-invariant system should have the following
three properties:, and	three properties:, and
·	
2. Decide whether the system described by the following	2. Decide whether the system described by the following
formula is a linear time-invariant system:	formula is a linear time-invariant system:
y(n) = nx(n)	y(n) = nx(n)
♦ Linear?	♦ Linear?

♦ Time-invariant? \_\_\_\_\_

♦ Time-invariant? \_\_\_\_\_

D. I. G. 10	
Review Card 8	Review Card 8
Name:	Name:
1. There are usually three ways to uniquely characterize a	1. There are usually three ways to uniquely characterize a
LTI system:, and	LTI system:, and
<b>2.</b> Please rewrite $x(n)$ by the form of impulse decomposition:	2. Please rewrite $x(n)$ by the form of impulse decomposition:
0 0 -2 -1 2 0 0 -4 -3 1 0 1 3 4 5 n	0 0 -2 -1 2 0 0 -4 -3 1 0 1 3 4 5 n
0 0 -2 -1   2   0 0	0 0 -2 -1   2   0 0
-1 -1	-2 -1 -1
x(n)=	x(n)=
3. If the length of an input $x(n)$ is 8 points and the length of	3. If the length of an input $x(n)$ is 8 points and the length of
the system impulse response $h(n)$ is 7 points, then the	the system impulse response $h(n)$ is 7 points, then the
convolution of $x(n)$ and $h(n)$ would be points.	convolution of $x(n)$ and $h(n)$ would be points.
4. Please calculate the convolution of the following two	4. Please calculate the convolution of the following two
discrete signals through both the input and output side	discrete signals through both the input and output side
algorithms:	algorithms:
$x(n) = \{1,3,4,2,5\}$	$x(n) = \{1,3,4,2,5\}$
$h(n) = \{6,5,7\}$	$h(n) = \{6,5,7\}$
(A) The input side algorithm:	(A) The input side algorithm:
$y_0(n) = \{$ }	$y_0(n) = \{$ }
y <sub>1</sub> (n)= {}}	$y_1(n) = \{\underline{\hspace{1cm}}\}$
$\mathbf{y}_{2}(n) = \{\underline{\hspace{1cm}}\}$	$y_2(n) = \{ \underline{\hspace{1cm}} \}$
$y_3(n) = \{ \underline{\hspace{1cm}} \}$	$y_3(n) = \{ \underline{\hspace{1cm}} \}$
y <sub>4</sub> (n)= {}	y <sub>4</sub> (n)= {}
Convolution={}	Convolution={}
<b>(B)</b> Draw the steps as $h(n)$ moved along $x(n)$ , as well as the	<b>(B)</b> Draw the steps as $h(n)$ moved along $x(n)$ , as well as the
corresponding element of $y(n)$ for each step:	corresponding element of $y(n)$ for each step:

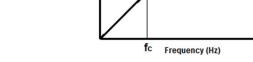
Review Card 9	Review Card 9	
Name:	Name:	
1. For a continuous signal $f(t)$ , the formula of its Fourier transform is:; For a discrete signal $x(n)$ , the formula of its Fourier transform is:	1. For a continuous signal $f(t)$ , the formula of its Fourier transform is:; For a discrete signal $x(n)$ , the formula of its Fourier transform is:	
<b>2.</b> If the sampling frequency is 20Hz and a signal $x(n)$ has 10 points, then $x(n)$ can be decomposed into(填数目) sinusoid components. The frequencies of these sinusoids are:	<b>2.</b> If the sampling frequency is 20Hz and a signal $x(n)$ has 10 points, then $x(n)$ can be decomposed into(填数目) sinusoid components. The frequencies of these sinusoids are:	
<b>3.</b> If the sampling frequency is 10Hz and a signal $x(n)$ has 10 points, then frequency resolution of the spectrum $\Delta f = $	<b>3.</b> If the sampling frequency is 10Hz and a signal $x(n)$ has 10 points, then frequency resolution of the spectrum $\Delta f = $	
Assuming that the first 6 points of $X(k)$ [the Fourier transform of $x(n)$ ] are: 4, 3+4i, -2+3i, 4-2i, -1-i, -3.  (A) How many points are missing for $X(k)$ ?	Assuming that the first 6 points of $X(k)$ [the Fourier transform of $x(n)$ ] are: 4, 3+4i, -2+3i, 4-2i, -1-i, -3.  (A) How many points are missing for $X(k)$ ?	
The missing points are:	The missing points are:  (B) Draw the amplitude and phase spectrum:	
(B) Draw the ampricude and phase spectrum.	(b) Braw the ampheude and phase spectrum.	
Review Card 9	Review Card 9	

	Review Card 9
N	ame:
1.	For a continuous signal $f(t)$ , the formula of its Fourier
tra	ansform is:; For a
di	screte signal $x(n)$ , the formula of its Fourier transform is:
2.	If the sampling frequency is 20Hz and a signal $x(n)$ has 10
po	pints, then $x(n)$ can be decomposed into(填数目)
si	nusoid components. The frequencies of these sinusoids are:
po A tra (A	If the sampling frequency is 10Hz and a signal $x(n)$ has 10 pints, then frequency resolution of the spectrum $\Delta f = $ ssuming that the first 6 points of $X(k)$ [the Fourier ansform of $x(n)$ ] are: 4, 3+4i, -2+3i, 4-2i, -1-i, -3.  A) How many points are missing for $X(k)$ ?
	he missing points are:
(E	B) Draw the amplitude and phase spectrum:

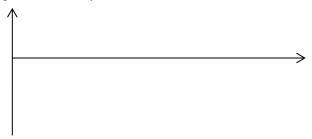
Review Card 9		
Name:		
1. For a continuous signal $f(t)$ , the formula of its Fourier		
transform is:; For a		
discrete signal $x(n)$ , the formula of its Fourier transform is:		
·		
<b>2.</b> If the sampling frequency is 20Hz and a signal $x(n)$ has 10		
points, then x(n) can be decomposed into(填数目)		
sinusoid components. The frequencies of these sinusoids are:		
·		
<b>3.</b> If the sampling frequency is 10Hz and a signal $x(n)$ has 10		
points, then frequency resolution of the spectrum $\Delta f =$		
Assuming that the first 6 points of $X(k)$ [the Fourier		
transform of $x(n)$ ] are: 4, 3+4i, -2+3i, 4-2i, -1-i, -3.		
(A) How many points are missing for $X(k)$ ?		
The missing points are:		
<b>(B)</b> Draw the amplitude and phase spectrum:		

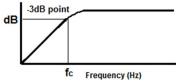
Review Card 10
Name:
1. If the sampling frequency is 1000Hz and the length of
$x(n)$ is 500, then frequency resolution $\triangle f$ of the Fourier
transform of x(n) is:
Is it possible to separate 80Hz and 82Hz?
Is it possible to separate 80Hz and 81Hz?
Is it possible to separate 79Hz and 81Hz?
Is it possible to separate 1000Hz and 1002Hz?
2. For frequencies of 10Hz, 30Hz, 40Hz and 50Hz, what is the fundamental frequency? The third harmonic is The second harmonic of the power line frequency in China is
3. If the length of h(n) is 500 and the sampling frequency is 1000Hz, what is the frequency resolution of H[f]?
4. For a system below, list two methods to calculate y[n]
$x[n] \longrightarrow h[n] \longrightarrow y[n]$
TIME DOMAIN  FREQUENCY DOMAIN
$X[f] \longrightarrow H[f] \longrightarrow Y[f]$
Method (1):
Method (2):
If both x[n] and h[n] have 100 points, y[n] will have
points and Y[f] will have points. In this case, will the
y[n] be the same for the two methods? If no, what
can you do to make the y[n] results the same?

P. I. G. 144	D 1 6 14			
Review Card 11	Review Card 11			
Name:	Name:			
1.If the amplitude spectrum of a system is as flows:	1.If the amplitude spectrum of a system is as flows:			
dB  fc Frequency (Hz)  (1) It is a(high-pass or low-pass) system.  (2) What does -3dB of the y-axis mean?	dB  dB  dB  fc Frequency (Hz)  (1) It is a (high-pass or low-pass) system.  (2) What does -3dB of the y-axis mean?			
(3) If y-axis is 0dB, it means the amplitude is zero, right and why?	(3) If y-axis is 0dB, it means the amplitude is zero, right and why?			
2. If the sampling frequency is 10Hz and the system always delays the input signal by one point, please draw the phase spectrum of the system:	2. If the sampling frequency is 10Hz and the system always delays the input signal by one point, please draw the phase spectrum of the system:			
Review Card 11	Review Card 11			
Name:  1.If the amplitude spectrum of a system is as flows:	Name:  1.If the amplitude spectrum of a system is as flows:			
dB 3dB point	dB 3dB point			



- (1) It is a \_\_\_(high-pass or low-pass) system.
- (2) What does -3dB of the y-axis mean?
- (3) If y-axis is 0dB, it means the amplitude is zero, right and why?\_\_
- 2. If the sampling frequency is 10Hz and the system always delays the input signal by one point, please draw the phase spectrum of the system:





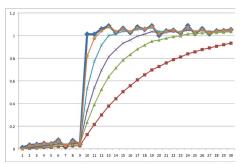
- (1) It is a (high-pass or low-pass) system.
- (2) What does -3dB of the y-axis mean?
- (3) If y-axis is 0dB, it means the amplitude is zero, right and why?\_\_\_\_\_
- 2. If the sampling frequency is 10Hz and the system always delays the input signal by one point, please draw the phase spectrum of the system:



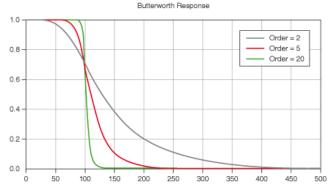
## **Review Card 12**

Name:

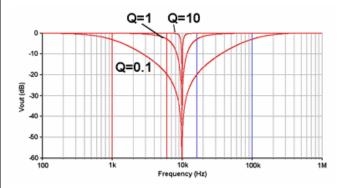
- 1. Which type of filter is better in performance, analog or digital?
- 2. There are two ways to evaluate the performance of a digital filter: in time domain and in frequency domain.
- Time Domain
- (A) What type of system response is used?
- (B) What parameters are used?
- (C) The responses of several filters are as follows, which filter do you think is best? (Mark the curve)



- Frequency Domain
- (A) What type of system response is used?
- (B) What parameters are used?
- (C) The responses of several filters are as follows, which filter do you think is best? (Mark the curve)



What type of filter is above?

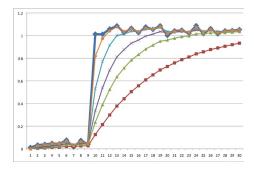


What type of filter is above?

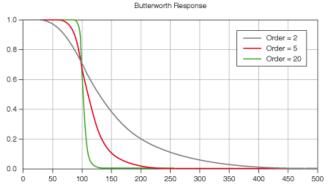
#### **Review Card 12**

Name: \_\_\_\_\_

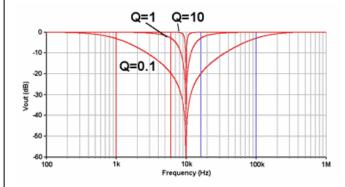
- 1. Which type of filter is better in performance, analog or digital?
- 2. There are two ways to evaluate the performance of a digital filter: in time domain and in frequency domain.
- ♦ Time Domain
- (A) What type of system response is used?
- (B) What parameters are used?
- (C) The responses of several filters are as follows, which filter do you think is best? (Mark the curve)



- ♦ Frequency Domain
- (A) What type of system response is used?
- (B) What parameters are used?
- (C) The responses of several filters are as follows, which filter do you think is best? (Mark the curve)



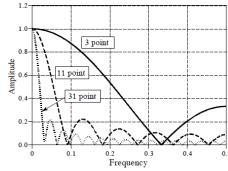
What type of filter is above?



What type of filter is above?

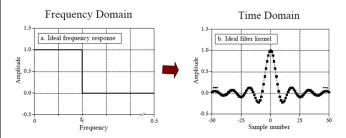
Review Card 13 (Matlab)				
Name:				
1. The easiest way to produce a vector x from 1 to 10 is:				
2. If x=[1 2 3] (行向量) and y=[4 5 6], how to combine x				
and y to form z=[1 2 3 4 5 6]?				
3. If a='I like', b='Matlab', what is the variable type of a				
and b? How to combine a and b to form				
c='I like Matlab'?				

Review Card 14		
Name:		
The Moving Average Filter (MAF)		
1. For a four-point MAF, draw the impulse response h(n):		
2. Is it a high-pass or low-pass filter?		
3. The aim we use the MAF is to		
4. See figure below of MAF's with different averaging		
points. The advantage of using more points (such as 31		
points) is, and the disadvantage		
is:		
1.2		

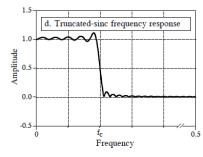


## The Windowed-Sinc Filter (WSF)

1. How do we get the filter kernel of WSF from its frequency response (see below)?



2. The actual frequency response is different from its ideal response (see below), why?



- 3. We see that the response above is poor, how to solve the problem?
- 4. What's the two parameters when designing WSF? \_

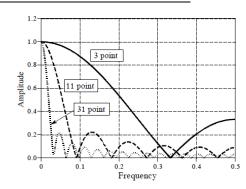
### **Review Card 14**

Name: \_\_\_\_\_

# The Moving Average Filter (MAF)

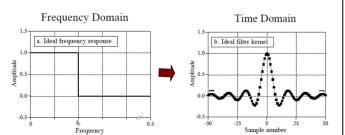
1. For a four-point MAF, draw the impulse response h(n):

- 2. Is it a high-pass or low-pass filter?
- 3. The aim we use the MAF is to \_\_\_\_
- 4. See figure below of MAF's with different averaging points. The advantage of using more points (such as 31 points) is \_\_\_\_\_\_\_, and the disadvantage is: \_\_\_\_\_\_.

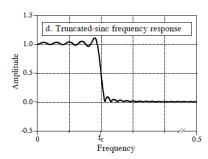


## The Windowed-Sinc Filter (WSF)

1. How do we get the filter kernel of WSF from its frequency response (see below)?



2. The actual frequency response is different from its ideal response (see below), why?

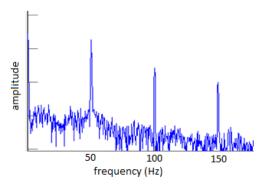


- 3. We see that the response above is poor, how to solve the problem?
- 4. What's the two parameters when designing WSF? \_

## **Review Card 15**

Name:

When measuring ECG signals, Xiaoming found that the recorded signal was not as what he expected. After performing a FFT, he found that there were large spikes in the spectrum, which were so large that it was impossible for him to observe the actual ECG signals. Please help him to find a solution to extract the ECG signals from such a noisy recording.



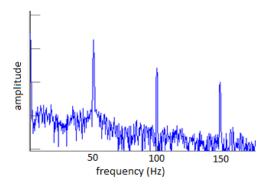
- 1. Where did the interferences come from?
- 2. Please draw the frequency response of the filter that can remove the interferences.

- 3. What type of filter is the one you draw above? (Moving average, Windowed-Sinc, or Custom filter)
- 4. Please describe the steps to get the h(n) of this filter?

#### **Review Card 15**

Name:

When measuring ECG signals, Xiaoming found that the recorded signal was not as what he expected. After performing a FFT, he found that there were large spikes in the spectrum, which were so large that it was impossible for him to observe the actual ECG signals. Please help him to find a solution to extract the ECG signals from such a noisy recording.



- 1. Where did the interferences come from?
- 2. Please draw the frequency response of the filter that can remove the interferences.

3. What type of filter is the one you draw above? (Moving average, Windowed-Sinc, or Custom filter)

4. Please describe the steps to get the h(n) of this filter?

		1		
Review Card 16		Review Card 16		
Name:		Name:		
1. Compare FIR and IIR filter:	IID	1. Compare F	IR and IIR filter	
FIR   冲击响应	IIR	冲击响应	FIR	IIR
(是/否)有		(是/否)有		
限长度    负反馈 (有/		限长度 负反馈(有/		
无)		无)		
输出 y(n)与     (输入/输		输出 y(n)与 (输入/输		
(    八		出り有关		
需要计算的		需要计算的		
<u>参数                                   </u>		参数 计算量		
线性相位		线性相位		
(是/否)		(是/否)		
2. Assume that the input and out	put of a filter satisfies the		-	output of a filter satisfies the
following equation: $2x(n) + 4x(n-1) + 6x(n-2) = 7x$	(n) + 2n(n-2)	following equ		-7v(n)+8v(n-2)
2y(n) + 4y(n-1) + 6y(n-2) = 7x				= 7x(n) + 8x(n-2)
(1). Please calculate the $H(z)$ of th	e system:	(1). Please ca	culate the H(z)	of the system:
(2). The recursive coefficients of t	ha filtar is	(2) The requir	sive coefficients	of the filter is:
A=	ne filter is:		sive coefficients	
B=				
(3) What Matlab function can be	used to plot the frequency			be used to plot the frequency
response of a filter, given coefficient				ficients A and B?
response of a finer, given eccinien	into it and D.	Tesponse of a	mitter, given coo	
Review Ca	·d 16			
Review Can	rd 16	Name:	Review	Card 16
Review Can Name:  1. Compare FIR and IIR filter:	rd 16	Name:1. Compare F	Review	Card 16
Name:  1. Compare FIR and IIR filter: FIR	rd 16	1. Compare F	Review	Card 16
Name:  1. Compare FIR and IIR filter:  FIR  中击响应		1. Compare F 冲击响应(是	Review IR and IIR filter	<b>Card 16</b>
Name:  1. Compare FIR and IIR filter:  FIR  中 击 响 应 (是/否)有 限长度		1. Compare F 冲击响应(是 /否)有限长 度	Review IR and IIR filter	<b>Card 16</b>
Name:  1. Compare FIR and IIR filter:  FIR  中 击 响 应 (是/否)有 限长度 负反馈(有/		1. Compare F 冲击响应(是 /否)有限长 度 负反馈(有/	Review IR and IIR filter	<b>Card 16</b>
Name:		1. Compare F 冲击响应(是 /否)有限长 度 负反馈(有/ 无)	Review IR and IIR filter	<b>Card 16</b>
Name:		1. Compare F	Review IR and IIR filter	<b>Card 16</b>
Name:		1. Compare F	Review IR and IIR filter	<b>Card 16</b>
Name:		1. Compare F	Review IR and IIR filter	<b>Card 16</b>
Name:		1. Compare F	Review IR and IIR filter	<b>Card 16</b>
Name:		1. Compare F	Review IR and IIR filter	<b>Card 16</b>
Name:	IIR	1. Compare F	Review IR and IIR filter FIR	<b>Card 16</b>
Name:  1. Compare FIR and IIR filter:  FIR  中 击 响 应 (是/否)有 限长度 负反馈(有/ 无) 输出 y(n)与 (输入/输 出)有关 需要计算的 参数 计算量 线性相位 (是/否)  2. Assume that the input and out following equation:	put of a filter satisfies the	1. Compare F	Review  IR and IIR filter  FIR  at the input and aation:	Card 16  :  IIR  output of a filter satisfies the
Name:	put of a filter satisfies the	1. Compare F	Review  IR and IIR filter  FIR  at the input and aation:	Card 16
Name:  1. Compare FIR and IIR filter:  FIR  中 击 响 应 (是/否)有 限长度 负反馈(有/ 无) 输出 y(n)与 (输入/输 出)有关 需要计算的 参数 计算量 线性相位 (是/否)  2. Assume that the input and out following equation:	put of a filter satisfies the $(n) + 8x(n-2)$	1. Compare F	Review  IR and IIR filter  FIR  at the input and aation:	Card 16  :  IIR  output of a filter satisfies the $7x(n) + 8x(n-2)$
Name:	put of a filter satisfies the $(n) + 8x(n-2)$	1. Compare F	Review  IR and IIR filter  FIR  at the input and ation: $-1$ + 6 $y$ ( $n$ - 2) =	Card 16  :  IIR  output of a filter satisfies the $7x(n) + 8x(n-2)$
Name:	put of a filter satisfies the $(n) + 8x(n-2)$ e system:	1. Compare F	Review  IR and IIR filter  FIR  at the input and lation: $-1) + 6y(n-2) = 1$ lculate the H(z) of	Card 16  :  IIR  output of a filter satisfies the $7x(n) + 8x(n-2)$ of the system:
Name:	put of a filter satisfies the $(n) + 8x(n-2)$ e system:	1. Compare F	Review  IR and IIR filter  FIR  at the input and ation: $-1) + 6y(n-2) = 0$ Iculate the H(z) of the sive coefficients	Card 16  :  IIR  output of a filter satisfies the $7x(n) + 8x(n-2)$ of the system:
Name:	put of a filter satisfies the $(n) + 8x(n-2)$ e system:	1. Compare F	Review  IR and IIR filter  FIR  at the input and lation: $-1) + 6y(n-2) = 1$ Iculate the H(z) of sive coefficients	Card 16  :  IIR  output of a filter satisfies the $7x(n) + 8x(n-2)$ of the system:
Name:	put of a filter satisfies the $(n)+8x(n-2)$ e system:	1. Compare F	Review  IR and IIR filter  FIR  at the input and ation: $-1) + 6y(n-2) = 0$ Iculate the H(z) of the sive coefficients	Card 16  :  IIR  output of a filter satisfies the $=7x(n)+8x(n-2)$ of the system:
Name:	put of a filter satisfies the $(n)+8x(n-2)$ e system:	1. Compare F	Review  IR and IIR filter  FIR  at the input and lation: $-1) + 6y(n-2) = 1$ Iculate the H(z) of the sive coefficients that the function care	Card 16  :  IIR  output of a filter satisfies the $7x(n) + 8x(n-2)$ of the system:

Review Card 17	Review Card 17
Name:	Name:
Draw the typical frequency responses of the following	Draw the typical frequency responses of the following
low-pass IIR filters: Butterworth, Chebyshev Type I,	low-pass IIR filters: Butterworth, Chebyshev Type I,
Checbyshev Type II and Elliptic filters (assuming a cut-off	Checbyshev Type II and Elliptic filters (assuming a cut-off
of 0.5)	of 0.5)
A. Which has the flattest response?	A. Which has the flattest response?  B. Which has the fastest roll-off?  C. Which has ripples in pass-band?  D. What are the Matlab functions for the four types of filters, respectively?  E. After getting the A and B coefficients by using one of the above functions, Xiaming used them to filter input signal <i>x</i> immediately, do you think it is OK?  F. If no, what step do you think Xiaoming missed?
Danism Card 17	Devices Could 17
Review Card 17 Name:	Review Card 17 Name:
Draw the typical frequency responses of the following t	Draw the typical frequency responses of the following
Draw the typical frequency responses of the following low-pass IIR filters: Butterworth, Chebyshev Type I.	Draw the typical frequency responses of the following low-pass IIR filters: Butterworth, Chebyshev Type I.
low-pass IIR filters: Butterworth, Chebyshev Type I,	low-pass IIR filters: Butterworth, Chebyshev Type I,
low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off	low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off
low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off	low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off of 0.5)
low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off of 0.5)	low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off of 0.5)
low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off of 0.5)	low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off of 0.5)  A. Which has the flattest response?
low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off of 0.5)  A. Which has the flattest response?  B. Which has the fastest roll-off?  C. Which has ripples in pass-band?  D. What are the Matlab functions for the four types of filters,	low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off of 0.5)  A. Which has the flattest response?  B. Which has the fastest roll-off?  C. Which has ripples in pass-band?  D. What are the Matlab functions for the four types of filters,
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low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off of 0.5)  A. Which has the flattest response?  B. Which has the fastest roll-off?  C. Which has ripples in pass-band?  D. What are the Matlab functions for the four types of filters, respectively?  E. After getting the A and B coefficients by using one of the	low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off of 0.5)  A. Which has the flattest response?  B. Which has the fastest roll-off?  C. Which has ripples in pass-band?  D. What are the Matlab functions for the four types of filters, respectively?  E. After getting the A and B coefficients by using one of the
low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off of 0.5)  A. Which has the flattest response?  B. Which has the fastest roll-off?  C. Which has ripples in pass-band?  D. What are the Matlab functions for the four types of filters, respectively?  E. After getting the A and B coefficients by using one of the above functions, Xiaming used them to filter input signal x	low-pass IIR filters: Butterworth, Chebyshev Type I, Checbyshev Type II and Elliptic filters (assuming a cut-off of 0.5)  A. Which has the flattest response?  B. Which has the fastest roll-off?  C. Which has ripples in pass-band?  D. What are the Matlab functions for the four types of filters, respectively?  E. After getting the A and B coefficients by using one of the above functions, Xiaming used them to filter input signal x
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