学院_____ 姓名 _____ 学号_____ 任课老师_____选课号_____

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电子科技大学二零零七至二零零 八学年第 1 学期期 期末 考试

《数字信号处理》 课程考试题 A 卷 （ 120 分钟） 考试形式： 开卷 考试日期 2008 年 1 月 24 日

课程成绩构成：平时 20分， 期中 20分， 实验 20 分， 期末 40 分

一	二	三	四	五	六	七	八	期中成绩	期末成绩	平时成绩	实验成绩	课程成绩	评卷教师

Test of Digital Signal Processing

（Give the answer of the following problems in English as possible as you can）

Note: Problem 1 to 5 must be answered. You can choose to solute either one or both of problem 6 and 7, if both, the higher score will be accounted .

1. Which one of the following comments is not correct ? ( )

(a) The DFT can be thought of the sampled version of the DTFT .

(b) The FFT is the efficient computation algorithm for the DFT .

(c) A linear-phase digital filter can be realized by either FIR or IIR systems .

(d) If H(z) is the transfer function of an LPF filter , then H(-z) can be thought of an HPF filter in general .

2. Two systems have impulse responses as follows:

$h_1[n] = \delta[n] + \delta[n-1]$ **,** $h_2[n] = \delta[n] - \delta[n-1]$**, respectively.**

（1）Determine the DTFTs of h1[n] and h2[n].

（2）Determine and sketch their magnitude responses .

（3）Which type of linear-phase system are they belong to?

（4）If input x[n] = 2cos(πn) ， determine the output sequences of these two systems respectively.

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3. Consider the system transfer function: $H(z)=\dfrac{z+3}{z^2-\frac{3}{4}z+\frac{1}{8}}$

(1) Sketch the pole-zero plot of H(z);

(2) Discuss the type of inverse Z-transform (left-sided, right-sided, and two-sided sequences) associated with each of all possible ROCs of H(z).

(3) Determine the expression of causal impulse response h[n].

4. Figure 4（a） is identical to Figure 4.2 of our textbook, which illustrates the discrete-time processing of a continuous-time signal. The ideal sampler and ideal interpolator work at the same sampling frequency F_T . Assume the discrete-time processing block represents an ideal bandpass digital filter with frequency response $H(e^{j\omega})$ illustrated in Figure 4（b）.

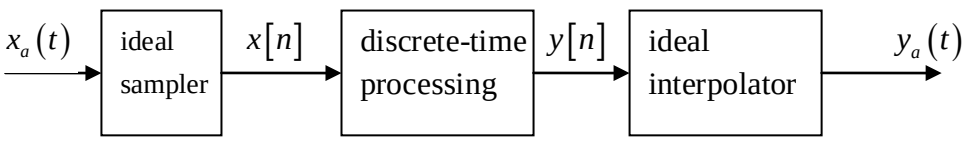

Figure 4(a)

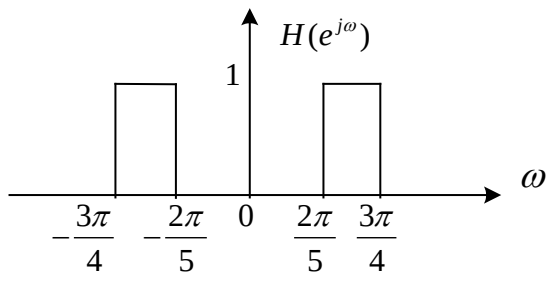

Figure 4(b)

Let $x_a(t) = \cos(2\pi \times 100t) + \sin(2\pi \times 125t) + 1.5\cos(2\pi \times 150t)$.

(1) If $F_T = 100Hz$ **, determine** $x[n]$, $y[n]$ **and** $y_a(t)$.

(2) If $F_T = 150Hz$ **, determine** $x[n]$, $y[n]$ **and** $y_a(t)$.

5. Let X[k] be an 8-point DFT of a length-8 real sequence x[n]. The 5 samples of X[k] are given by X[0]=0, X[1]=0, X[2]=4, X[3]=0, X[4]=0.

(1) Determine and sketch X[k].

(2) Determine the value of $\sum_{n=0}^{7} x^2[n]$**.**

(3) If $G[k] = X[< k+2 >_8]$**, sketch G[k] and determine the expression of g[n] which is the 8-point IDFT of G[k].**

6. Using windowed Fourier series method, design a causal bandpass FIR digital filter with following specifications:

center frequency 5kHz

pass band edges 3.5 kHz and 6.5 kHz

stop band edges 1.5 kHz and 8.5 kHz

stop band attenuation 50 dB, passband ripple can be ignored.

Sampling frequency F_T=20kHz.

Please determine the expression of the impulse response of the FIR digital filter designed.

7. The normalized transfer function of order-2 lowpass Butterworth analog filter is as follows: $H_{an}(s)=\dfrac{1}{s^2+\sqrt{2}s+1}$**.**

By means of bilinear transform, design an order-2 low-pass IIR digital filter with -3dB cutoff frequency at 1000Hz and sampling frequency at 4000Hz. You are expected to determine the expression of transfer function in closed form and sketch an implement block-diagram in any cannonic form.