



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, NOV/ DEC 2018

COURSE NO: EL/CE 463

COURSE NAME: DIGITAL SIGNAL AND IMAGE PROCESSING

CLASS: EL/CE IV

TIME: 3 HOURS

Name: _____ Index Number: _____

Answer all questions in Section A and any other two in Section B. Circle your answers in Section A.

SECTION A

1. Determine the convolution sum of two sequences $x(n) = \{3, 2, 1, 2\}$ and $h(n) = \{1, 2, 1, 2\}$

a. $y(n) = \{3, 8, 8, 12, 9, 4, 4\}$

c. $y(n) = \{3, 8, 8, 12, 9, 1, 4\}$

b. $y(n) = \{3, 8, 3, 12, 9, 4, 4\}$

d. $y(n) = \{3, 8, 8, 1, 9, 4, 4\}$

2. DSP stands for?

a. Digital signal processing

c. Double signal processor

b. Discrete signal processing

d. None of the above

3. **The DFT is preferred for**

1) Its ability to determine the frequency component of the signal

2) Removal of noise

3) Filter design

4) Quantization of signal

a. 1, 2 and 3 are correct

c. 1 and 3 are correct

b. 1 and 2 are correct

d. All the four are correct

4. The transforming relations performed by DTFT are:

1) Linearity

2) Modulation

3) Shifting

4) Convolution

a. 1, 2 and 3 are correct

c. 1 and 3 are correct

b. 1 and 2 are correct

d. All the four are correct

5. Condition for aliasing problem

a. $f_s < f_m$

b. $f_s < 2f_m$

- c. $f_s = f_m$ d. All of the above
6. Calculate DFT of $x(n) = \{1, 0, 1, 0\}$.
- a. $x(k) = \{2, 0, 2, 0\}$ c. $x(k) = \{2, 0, 1, 0\}$
b. $x(k) = \{1, 0, 1, 0\}$ d. None
7. One of the drawbacks of DSP is
- a. Digital processing needs pre and post processing devices c. No memory storage
b. high cost d. none of above
8. One of the advantages of DSP are:
- a. Predictable c. Sharing a single processor among a number of signals by time sharing
b. Repeatable d. All of the above
9. The process of converting discrete time continuous valued signal into discrete time discrete valued (digital) signal is known as
- a. Sampling c. Coding
b. Quantization d. None of the above
10. The function given by the equation $x(n) = 1, \text{ for } n=0; =0, \text{ for } n \neq 0$ is a
- a. Step function c. Triangular Function
b. Ramp Function d. Impulse Function
11. Which of the following relation is true?
- a. $r_{xy}(l) = r(-l)$ c. $r_{xy}(l) = r_{yx}(-l)$
b. $r_{xy}(l) = r_{yx}(l)$ d. None of the above
12. The system described by the equation $y(n) = ay(n-1) + b x(n)$ is a recursive system.
- a. True b. False
13. **The interface between an analog signal and a digital processor is**
- a. D/A converter c. Modulator
b. A/D Converter d. Demodulator
14. One area of application of Convolution

- a. FIR Filtering
- b. Addition
- c. Manipulation
- d. None of the above

15. What does correlation give?

- a. It gives a measure of similarity between two data sequences.
- b. It gives a measure of dis-similarity between two data sequences
- c. a & b
- d. None of the above

16. Find the response of an FIR filter with impulse response $h(n) = \{1, 2, 4\}$ to the input sequence

$$x(n) = \{1, 2\}.$$

- a. $y(n) = \{1, 4, 8, 8\}$
- b. $y(n) = \{1, 4, 8, 6\}$
- c. $y(n) = \{1, 2, 8, 8\}$
- d. None of the above

17. The basic relationships between pixels are the following except

- a. Neighborhood
- b. Paths
- c. Adjacency
- d. Illumination

18. The inverse Fourier transform

- a. converts from the frequency domain to the time domain
- b. converts from the time domain to the frequency domain
- c. converts from the phasor domain to the magnitude domain
- d. is used to make real-time spectrum analyzers

19. The filter coefficients are stored in:

- a. Binary registers
- b. Digital system
- c. Binary Memory
- d. None of the above

20. The poles and zeros of a system can provide a great deal of information about the behavior of the system

- a. True
- b. False

21. Region of stability can be described as:

- a. $Z = 1$
- b. $Z > 1$
- c. $|z| < 1$
- d. $Z < 1$

22. _____ Is an Informal Method of finding inverse Z transform
- a. Contour integration
 - b. Inspection method using Z Transform Tables
 - c. Contour differentiation
 - d. None of the above
23. Convolution can be performed by these methods except
- a. Tabular Method
 - b. Observation Method
 - c. Graphical Method
 - d. Formula Method
24. $L[\bullet]$ is a *Linear System* iff $L[ax_1+bx_2] = a L[x_1]+b L[x_2]$
- a. True
 - b. False
25. _____ is a Gray-Level approach
- a. Image Negatives
 - b. Image Positives
 - c. Log Transform Inverse
 - d. Log Inverse Transform
26. Methods of image enhancement include
- i. Spatial Domain
 - ii. Frequency Domain Filtering
 - iii. Time Domain
 - b. i, ii and iii
 - c. i and ii
 - d. ii and iii
 - e. i and iii
27. Blurring can be modeled as the convolution of a high resolution (original) image with a low pass filter.
- a. True
 - b. False
28. If each component is quantized into 256 levels [0:255], the total number of different colors that can be produced is
- a. 2^8
 - b. 2^3
 - c. 2^{24}
 - d. 2^{256}
29. Colors are distinguished from one another based
- a. brightness
 - b. name
 - c. hue
 - d. saturation
30. A digital image can be represented as a matrix
- a. True
 - b. False

SECTION B:

- 1 a. Applications of digital signal processing (DSP) may be divided into two categories: 'real time' and 'non real time'. Explain these terms and give one example of a common application in each category. (6 marks)
- b. Determine the stability of the following system

$$H(z) = \frac{z^{-1} - 0.5z^{-2}}{1 + 1.2z^{-1} + 0.45z^{-2}} \quad (4 \text{ Marks})$$

- c. The use of the MATLAB SP toolbox to design a 6th order low-pass FIR digital filter by the 'Remez exchange algorithm' produces the following matrix of coefficients:

$$[-0.0272 \quad 0.1250 \quad 0.2772 \quad 0.3537 \quad 0.2772 \quad 0.1250 \quad -0.0272]$$

Write a high-level language program to demonstrate how this digital filter may be implemented using integer arithmetic on a 16-bit fixed point DSP processor

2. Write a two-page tutorial on one area of application of Digital Signal Processing (15 Marks)
- 3 a. List two methods of Image Segmentation? Give a brief characterization of Colours. (6 Marks)
- b. Write a Matlab script code to
- Read an image "pout.tif" (256 gray levels).
 - Calculate and plot the Cumulative Distribution Function for the image 'pout.tif'
 - Add labels, text and title for your plot. (4 Marks)
- c. Find the z-transform of the sequence defined by

$$x[n] = [3(2)^n - 4(3)^n]u[n] \quad (5 \text{ Marks})$$

Examiner: Prof B. Alese