

Signals and Systems: Model Exit-Exam

1. Most of the signals found in nature are _____

- a) Continuous-time and discrete-time
 - b) Continuous-time and digital
 - c) Digital and Analog
 - d) Analog and Continuous-time
2. Discrete time signal is derived from continuous time signal by _____ process.
- a) Addition
 - b) Multiplication
 - c) Sampling
 - d) Addition and multiplication

3. If $x(-t) = -x(t)$ then the signal is said to be _____

- a) Even signal
 - b) Odd signal
 - c) Periodic signal
 - d) Non periodic signal
4. A system which is linear is said to obey the rules of
- a) Scaling
 - b) Additivity
 - c) both scaling and additivity
 - d) homogeneity
5. Determine the odd component of the signal: $x(t) = \cos t + \sin t$.
- a) $\sin t$
 - b) $2\sin t$
 - c) $\cos t$
 - d) $2\cos t$
6. Which of the following systems is time invariant?
- a) $y(t) = x(2t) + x(t)$
 - b) $y(t) = x(t) + x(1-t)$
 - c) $y(t) = -x(t) + x(1-t)$
 - d) $y(t) = x(t) + x(t-1)$

7. Which of the following systems is memoryless?
- a) $y(t) = x(2t) + x(t)$
 - b) $y(t) = x(t) + 2x(t)$
 - c) $y(t) = -x(t) + x(1-t)$
 - d) $y(t) = x(t) + 2x(t+2)$
8. Which is not an example for memory system?
- a) Capacitive circuit
 - b) Inductive circuit
 - c) Resistive circuit
 - d) Parallel RC circuit
9. How do you define convolution?
- a) Weighted superposition of time shifted responses
 - b) Addition of responses of an input signal
 - c) Multiplication of various shifted responses of a stable system
 - d) Superposition of various outputs
10. Which of the following is an example for non-causal system?
- a) $y[n] = \frac{1}{3} \{x[n-1] + x[n] + x[n-2]\}$
 - b) $y[n] = \frac{1}{3} \{x[n-1] + x[n] + x[n+1]\}$
 - c) $y[n] = \frac{1}{2} \{x[n-1] + x[n]\}$
 - d) $y[n] = \frac{1}{2} \{x[n] + x[n-2]\}$
11. What is the value of $h[n] * d[n-1]$, $d[n]$ being the delta function.
- a) $h[n-2]$
 - b) $h[n]$
 - c) $h[n-1]$
 - d) $h[n+1]$
12. If h_1 , h_2 and h_3 are cascaded, find the overall impulse response
- a) $h_1 * h_2 * h_3$
 - b) $h_1 + h_2 + h_3$
 - c) h_3
 - d) all of the above

13. The convolution of $x(n) = \{1, 2, 3, 1\}$ and $h(n) = \{1, 2, 1, -1\}$, origin at 2, is

- a) $\{1, 4, 8, 8, 3, -2, -1\}$, origin at 4
- b) $\{1, 4, 8, 8, 3, -2, 1\}$, origin at 4
- c) $\{1, 3, 8, 8, 3, -2, -1\}$, origin at 4
- d) $\{1, 4, 8, 3, -2, -1\}$, origin at 4

14. What is Fourier series?

- a) The representation of periodic signals in a mathematical manner
- b) The representation of non-periodic signals in a mathematical
- c) The representation of non-periodic signals in terms of complex exponentials or sinusoids
- d) The representation of periodic signals in terms of complex exponentials or sinusoids

15. Which of the following is the Analysis equation of Fourier Transform?

- a) $F(\omega) = \int_{-\infty}^{\infty} f(t)e^{j\omega t} dt$
- b) $F(\omega) = \int_0^{\infty} f(t)e^{-j\omega t} dt$
- c) $F(\omega) = \int_0^{\infty} f(t)e^{j\omega t} dt$
- d) $F(\omega) = \int_{-\infty}^{\infty} f(t)e^{-j\omega t} dt$

16. Which of the following is the synthesis equation of Fourier Transform?

- a) $f(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} F(\omega)e^{-j\omega t} d\omega$
- b) $f(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} F(\omega)e^{j\omega t} d\omega$
- c) $f(t) = \frac{1}{2\pi} \int_0^{\infty} F(\omega)e^{-j\omega t} d\omega$
- d) $f(t) = \frac{1}{2\pi} \int_0^{\infty} F(\omega)e^{j\omega t} d\omega$

17. What is the Fourier transform of an exponential signal $f(t) = e^{-at}u(t)$, $a > 0$?

- a) $\frac{1}{a+j\omega}$
- b) $\frac{1}{a-j\omega}$
- c) $\frac{1}{-a+j\omega}$
- d) $\frac{1}{-a-j\omega}$

18. What is the Laplace transform of $\delta(t)$? a

- a) 1
- b) 0
- c) ∞
- d) 2

19. Find the Laplace transform of $e^{-at}u(t)$ and its ROC

- a) $\frac{1}{s-a}$, $\text{Re}\{s\} > -a$
- b) $\frac{1}{s}$, $\text{Re}\{s\} > a$
- c) $\frac{1}{s+a}$, $\text{Re}\{s\} > a$
- d) $\frac{1}{s+a}$, $\text{Re}\{s\} > -a$

20. What is the inverse Laplace transform of $\frac{1}{(s+1)^2}$?

- a) $te^t u(t)$
- b) $te^{-t} u(t)$
- c) $tu(t)$
- d) $e^t u(t)$

21. What is the inverse Laplace transform of $\frac{s}{s^2 a^2 + b^2}$?

- a) $\frac{1}{a^2} \cos\left(\frac{a}{b}\right)t$
- b) $\frac{1}{a^2} \cos\left(\frac{b}{a}\right)t$
- c) $\frac{1}{a^2} \sin\left(\frac{b}{a}\right)t$
- d) $\frac{1}{a^2} \sin\left(\frac{a}{b}\right)t$

22. What is the Z-transform of $y[n] = x[n+2]u[n]$?

- a) $z^2 x(Z) - z^2 x(0) - zx(1)$
- b) $z^2 x(Z) + z^2 x(0) - zx(1)$
- c) $z^2 x(Z) - z^2 x(0) + zx(1)$
- d) $z^2 x(Z) + z^2 x(0) + zx(1)$

23. What is the Z-transform of $x[n] = n^2 u[n]$?

- a) $\frac{z(z-1)}{(z-1)^3}$
- b) $\frac{z(z+1)}{(z-1)^3}$
- c) $\frac{z(z+1)}{(z+1)^3}$
- d) $\frac{z(z-1)}{(z+1)^3}$

24. The value of $Z^{-1}\left\{\frac{z^2}{(z-a)(z-b)}\right\}$ is

- a) $\frac{a^{n+1}-b^{n+1}}{a+b}$
- b) $\frac{a^{n+1}-b^{n+1}}{a-b}$
- c) $\frac{a^{n+1}+b^{n+1}}{a-b}$
- d) $\frac{a^{n+1}+b^{n+1}}{a+b}$

25. Which of the following is **false** about signal

- a) It is any process that can transform input into output
- b) It is a function that holds information about any physical quantities or variables
- c) It can be represented as a function of an independent variable
- d) All of the above
- e) None

26. Which of the following can be an example of the system

- a) The thermostat in the house that controls the air conditioner turns on and off.
- b) The computerized system is controlled by a clock used to feed the timing of all operations.
- c) water tank which is fed by an input flow of liquid and discharges the fluid through an orifice at the bottom
- d) All of the above
- e) None

27. If $h(t) = 7e^{-2t-3}$ the simplified value $\frac{h\left(\frac{jt-3}{2}\right) + h\left(\frac{-jt-3}{2}\right)}{2}$ equals

- a) $7 \cos(t)$
- b) $7e^{-3} \cos(t)$
- c) $7 \sin(t)$
- d) None

28. From the following alternatives the Linear time invariant systems most of the time act as _____

- a) Comparator
- b) Filter
- c) Integrator

- d) All of the above
- e) None

29. From the following statement which one is a **false** statement

- a) A periodic signal is a power signal if its energy content per period is finite
- b) The Sum of two continuous-time periodic signals may not be periodic
- c) If the signal is a random signal whose values are specified for any given time
- d) the product of an even signal and an odd signal is an odd signal
- e) none

30. which of the following are the property of the time-invariant system

- a) The total response of any LTI system is the sum of its zero-input and zero-state responses.
- b) in a time-invariant system, an arbitrary input signal $x(t)$ must *cause* a response $y(t)$
- c) if a time shift (delay or advance) in the input signal causes the same time shift in the output signal
- d) all of the above
- e) none

31. which of the following is **false** about discrete signal $x[n]$

- a) $x[n]$ a right-sided sequence if $x[n] = 0, \forall n < n_0$ for some finite integer n_0
- b) a causal sequence if $x[n] = 0, \forall n < n_0$, for some nonnegative integer, $n_0 \geq 0$
- c) a left-sided sequence if $x[n] = 0, \forall n \leq n_0$ for some finite integer n_0
- d) all of the above

32. which of the following is **true** about discrete-time LIT systems with impulse response

$$h[n] = \alpha^n u[n]$$

- a) the system is casual
- b) the system is BIBO stable if $|\alpha| < 1$
- c) the system is BIBO unstable if $|\alpha| \geq 1$
- d) all of the above
- e) none

33. let's consider the signal $y(t) = x(t-5) - x(3-t)$ which of the following is the true

- a) $y(t)$ is homogeneous
- b) $y(t)$ is additive
- c) $y(t)$ is liner
- d) All of the above
- e) None

34. Which of the following represent features of Laplace's transform

- a) It is one of the mathematical tools used to obtain the solution of linear ordinary integrodifferential equation
- b) It can convert integrodifferential equations into a simple algebraic equation
- c) It can manipulate the algebraic equation by simple algebraic rules to obtain the expression in suitable forms
- d) all of the above
- e) None

35. Which of the following statement **true** about the time or frequency scaling of Fourier

transform $\left(x(\alpha t) \xleftrightarrow{\text{fourier transform}} \frac{1}{\alpha} X(j\omega / \alpha) \right)$ with scaling time variable $\alpha \in \mathbb{R}$

- a. For $\alpha > 1$, the Fourier transform of the signal expands to higher frequencies
- b. For $\alpha < 1$, the Fourier transform of the signal compressed to lower frequencies
- c. For $\alpha > 1$, the signal $x(\alpha t)$ is compressed in time
- d. all of the above
- e. None

36. Which of the following is the value of the Fourier transform of the aperiodic saw tooth signal $x(t)$ shown in Figure

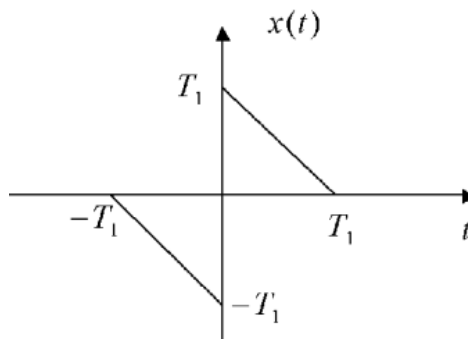


Figure 2

a) $\frac{2T_1}{j\omega} - \frac{2j \sin(\omega T_1)}{(j\omega)^2}$	c) $\frac{2T_1}{j\omega} - \frac{2j \sinh(\omega T_1)}{(j\omega)^2}$
b) $\frac{2T_1}{j\omega} - \frac{2j \cos(\omega T_1)}{(j\omega)^2}$	d) $\frac{2T_1}{j\omega} - \frac{2j \cosh(\omega T_1)}{(j\omega)^2}$

37. Which of the following statements is correct

- a) The energy or power in the time domain representation is the same as the energy or power in the frequency domain representation
- b) Energy is used for non-periodic time domain signals and power applies to periodic time domain signals
- c) The power or energy spectrum of the signal is defined as the square of the magnitude spectrum
- d) all of the above
- e) None

38. Which of the following is the property of Region of Convergence (ROC) $x[n]$ in Z-transform

- a) ROC can't contain any poles
- b) If $x[n]$ is a finite-duration sequence, then the ROC is the entire z-plane, except for possibly $z = 0$ or $|z| = \infty$
- c) If $x[n]$ is a right-sided sequence, then the ROC extends outward from the outermost pole in $X(z)$.
- d) all of the above
- e) None

39. The change of input signal shape when transmitted through system is called _____

- a) Distortion
- b) Interpolation
- c) Summation
- d) None

40. Which of the following shows the ROC for $x(t) = e^{-2t}u(t) + e^{-3t}u(t)$

- a) $\text{Re}(s) > -2$
- c) $-3 < \text{Re}(s) < -2.5$

b) $-2.5 < \text{Re}(s) < -2$

d) $\text{Re}(s) > -3$

41. let's consider the system transfer function $G(s) = \frac{1}{s^2 + s - 2}$, which of the following property show the system become neither casual nor stable

a) $\text{Re}(s) > 1$

c) $-2 < \text{Re}(s) < 1$

b) $\text{Re}(s) < -2$

d) none

42. For the following transfer function $G(z) = \frac{10 - 2z^{-1}}{a^2 + 2az^{-1} + z^{-2}}$, for what ranges of the transfer function become stable and casual

a) $|a| > 1$

c) $|a| \geq 1$

b) $|a| < 1$

d) $|a| \leq 1$

43. Which of the following is true about the following difference equation for input $x[n]$ and output $y[n]$, the system is represented as

$$y[n] = \cos\left(5\pi n + \frac{\pi}{5}\right) + x[n]x[n-3]$$

a) The system is bounded input bounded output stable

b) The system is a liner time-invariant system

c) The system is a memoryless

d) all of the above

e) None

44. time scaling would not work for one of the following signals

a) step

c) impulse

b) ramp

d) none

45. different operations on signals performed on signals_____

a) amplitude

d) a and b

b) frequency

e) a and c

c) time

46. which of the following is the property of odd signals

a) $x(t) = -x(t)$

c) $x(t) = x(2t)$

b) $x(t) = x(-t)$

d) $x(t) = -x(-t)$

47. Which of the following is true about the property of impulse signal

a) $x[n]\delta[n] = x[0]\delta[n]$

c) $x[n]\delta[n] = \delta[n]$

b) $x[n]\delta[n] = x[0]$

d) $x[n]\delta[n] = x[n]$

48. Form the following signal which of the following stable signal

a) $y(t) = 2\log(x(t))$

c) $y(t) = \cos(x(t))$

b) $y(t) = e^{2x(t)}$

d) $y(t) = 5tx(t)$

49. When considering two LTI systems with impulse response $h_1(t)$ and $h_2(t)$ and those are connected in parallel then output is given by

a) $y(t) = x(t) * (h_1(t) + h_1(t))$

b) $y(t) = x(t) + (h_1(t) + h_1(t))$

c) $y(t) = x(t) * (h_1(t) * h_1(t))$

d) None

50. Which of the following true about convolution sum

$$\text{a) } x[n]*h[n]=\sum_{k=-\infty}^{\infty} x[n]*h[n-k]$$

$$\text{b) } x[n]*h[n]=\sum_{k=-\infty}^{\infty} x[k]*h[n-k]$$

c) $x[n] * h[n] = \sum_{k=-\infty}^{\infty} x[k] * h[k-n]$

$$\text{d) } x[n] * h[k] = \sum_{k=-\infty}^{\infty} x[n] * h[k-n]$$

Answer

1. d
2. c
3. b
4. c
5. c
6. d
7. b
8. c
9. a
10. b
11. c
12. a
13. a
14. d
15. d
16. b
17. a
18. a
19. d
20. b
21. b
22. a
23. b
24. b
25. a
26. d
27. a
28. b
29. c
30. d

31. c

32. d

33. d

34. d

35. d

36. b

37. d

38. d

39. a

40. a

41. b

42. a

43. a

44. a

45. e

46. b

47. a

48. c

49. a

50. b