MAT 321 Practice Quiz 3 Answer Sheet

Spring 2022

Quiz ID: TESTID Name: _____

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MAT 321 **Practice Quiz 3** Spring 2022

Unless otherwise indicated, all signals and systems will be assumed to be discrete time, with time values given as all integer multiples of one sample.

1. Let **u** be the two-sided phasor signal with values $e^{i\theta t}$, and **v** be the one-sided phasor signal with the same values but zero for $t < 0$, and **x** be the finite stretch of a phasor, with the same values as **v** but zero for $t \geq n$. Also, let **y** be the windowed phasor signal which is **x** multiplied by the Hamming window. Which signal has the best *resolution* of the frequency θ?

   a) **u** b) **v** c) **x** d) **y** e) none of them

2. Same signals as in the previous question. Which signals have infinitely many frequencies with non-zero contribution to the spectrum (or frequency content) of the signal?

   a) **v** and **x** only b) **v** only c) all of them d) all but **u** e) none of them

3. Same signals as in the previous question. Which signals have frequency content graph with more than one critical point, where the graph has derivative zero or is undefined?

   a) **u** and **v** only b) **x** only c) **x** and **y** only d) **y** only e) all of them

4. Same signals as in the previous question. If we sample the frequency content of the signal **x** at the ω-values $\frac{2\pi}{N}k$ for $k = 0, 1, \ldots, n-1$ we get the magnitude of ...

   a) a Fourier coefficient b) a Z-transform c) a Transfer function d) a DFT e) none of these

5. Consider the accumulator system:

$$y_t = \sum_{k=-\infty}^{t} x_k.$$

   Which of the following input signals will have at least one output undefined? Assume the definition holds for all t, unless indicated otherwise.

   i) $x_t = (-1)^t$ ii) $x_t = \frac{(-1)^t}{t}, x_0 = 0.$ iii) $x_t = (-1)^t, t \geq 0,\ x_t = 0, t < 0.$

   a) i) and ii) only b) ii) and iii) only c) iii) only d) ii) only e) i) only

6. Same system as in the previous problem. Which of the following input signals will have unbounded output (for those outputs which are defined)?

i) $x_t = \frac{(-1)^t}{t}, x_0 = 0$ ii) $x_t = \frac{(-1)^t}{t}, t > 0,\ x_t = 0, t \leq 0.$ iii) $x_t = \frac{1}{t}, t > 0,\ x_t = 0, t \leq 0.$

a) i) and ii) only b) ii) and iii) only c) iii) only d) ii) only e) i) only

7. Same system as in the previous problem. What is the transfer function of this system?

a) $\frac{1}{1-z^{-1}}$ b) $\frac{1}{1-z^{-2}}$ c) $\frac{1}{(1-z^{-1})^2}$ d) $\frac{1}{1-2z^{-1}+z^{-2}}$ e) $1-z^{-1}$

8. Same system as in the previous problem. What is the Z-transform of the impulse response of this system?

a) $\frac{1}{1-z^{-1}}$ b) $\frac{1}{1-z^{-2}}$ c) $\frac{1}{(1-z^{-1})^2}$ d) $\frac{1}{1-2z^{-1}+z^{-2}}$ e) $1-z^{-1}$

9. Which of the following signals are absolutely summable? (Recall that this means that the sum of the absolute values of all the signal values converges.) Assume that each signal is zero for $t \leq 0$.

i) $x_t = \frac{(-1)^t}{t}, x_0 = 0,$ ii) $x_t = 2^{-t},$ iii) $x_t = 2^t.$

a) i) and ii) only b) ii) and iii) only c) iii) only d) ii) only e) i) only

10. Which of the following impulse responses will give a system which is BIBO stable? Assume that each signal h_t is zero for $t \leq 0$.

i) $h_t = \frac{(-1)^t}{t^2},$ ii) $h_t = (1.1)^{-t},$ iii) $h_t = 1.$

a) i) and ii) only b) ii) and iii) only c) iii) only d) ii) only e) i) only