Practice Quiz 4

(no calculators allowed)

1) The **impulse response** for the LTI system $y(t)=\frac{1}{2}[x(t)-x(t-1)]$ is

a) $h(t)=\frac{1}{2}[u(t)-u(t-1)]$ b) $h(t)=\frac{1}{2}[\delta(t)-\delta(t-1)]$ c) neither of these

2) The **impulse response** for the LTI system $y(t)=\int_{-\infty}^{t+1} e^{-(t-\lambda)}x(\lambda)d\lambda$ is

a) $h(t)=e^{-t}u(t)$ b) $h(t)=e^{-t}u(t+1)$ c) $h(t)=e^{-t}\delta(t)$ d) none of these

3) The **impulse response** for the LTI system $y(t)=2x(t)+\int_{-\infty}^{t-2} e^{-(t-\lambda)}x(\lambda+3)d\lambda$ is

a) $h(t)=2u(t)+e^{-(t+3)}u(t+1)$ b) $h(t)=2\delta(t)+e^{-(t+3)}u(t+1)$
c) $h(t)=2\delta(t)+e^{-(t+3)}u(t)$ d) $h(t)=2\delta(t)+e^{-(t+3)}u(t-2)$
e) $h(t)=2\delta(t)+e^{-(t+3)}u(t+3)$ f) none of these

4) The **impulse response** for the LTI system $\dot{y}(t)+y(t)=x(t-1)$ is

a) $h(t)=e^{t}u(t)$ b) $h(t)=e^{-t}u(t)$ c) $h(t)=e^{-(t-1)}u(t)$
d) $h(t)=e^{-(t-1)}u(t-1)$ e) $h(t)=e^{(t-1)}u(t-1)$ f) none of these

5) The **impulse response** for the LTI system $\dot{y}(t)-2y(t)=3x(t+1)$ is

a) $h(t)=3e^{2(t+1)}u(t+1)$ b) $h(t)=3e^{-2(t+1)}u(t+1)$ c) $h(t)=3e^{-2(t+1)}u(t-1)$
d) $h(t)=3e^{-2(t+1)}u(t)$ e) $h(t)=3e^{2(t+1)}u(t)$ f) none of these

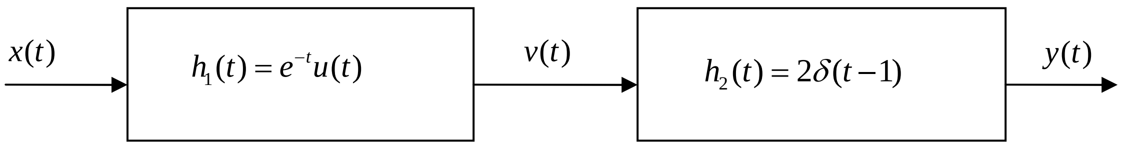
6) The **unit step response** of a system with impulse response $h(t)=e^{-(t-1)}u(t-1)$ is

a) $y(t)=[1-e^{-(t-1)}]\,u(t-1)$ b) $y(t)=[1-e^{-(t-1)}]\,u(t)$ c) $y(t)=[1-e^{(t-1)}]\,u(t)$
d) $y(t)=[1-e^{(t-1)}]\,u(t-1)$ e) none of these

7) If the unit step response of a system is $y(t)=A(1-e^{-t/\tau})\,u(t)$, the **impulse response** of the system is

a) $h(t)=\frac{A}{\tau}e^{-t/\tau}\delta(t)$ b) $h(t)=\frac{A}{\tau}e^{-t/\tau}u(t)$ c) $h(t)=\frac{A}{\tau}e^{-t/\tau}$ d) $h(t)=A\tau e^{-t/\tau}u(t)$

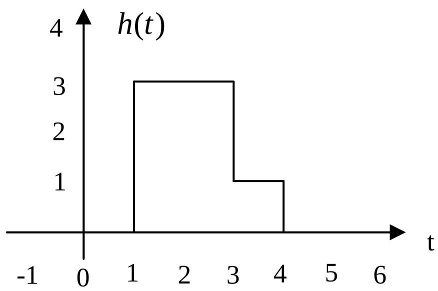
8) The **impulse response** of the system

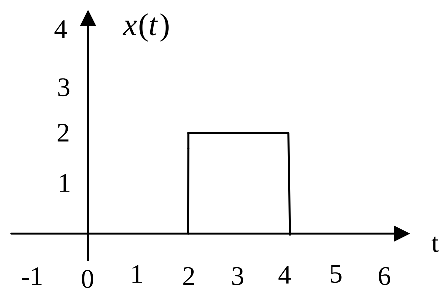


is

a) $h(t) = 2e^{-t}u(t)$ b) $h(t) = 2e^{-t}\delta(t-1)$ c) $h(t) = 2e^{-(t-1)}u(t-1)$ d) $h(t) = 2e^{-(t-1)}u(t)$

Problems **9 - 12** refer to the following linear time invariant (LTI) system, with impulse response $h(t)$ shown below on the left, and input $x(t)$ shown below on the right. The output of the system, $y(t)$, is the convolution of the impulse response with the input, $y(t) = h(t) * x(t)$.





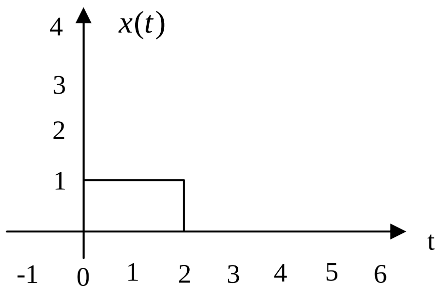
9) Is this LTI system causal? a) Yes b) No

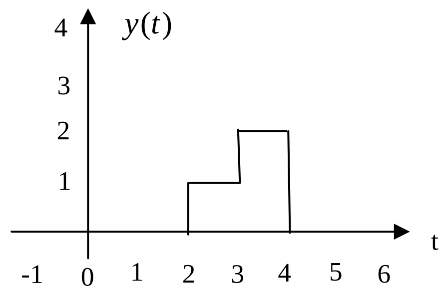
10) The maximum value of $y(t)$ is a) 4 b) 5 c) 6 d) 12 e) 14

11) $y(t)$ is zero until what time? a) 0 b) 1 c) 2 d) 3 e) 4

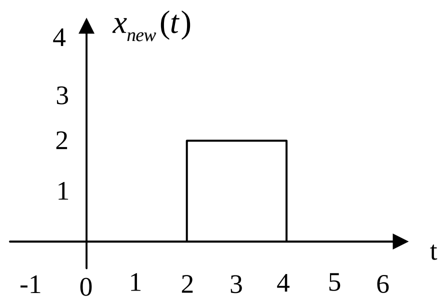
12) $y(t)$ will return to zero at what time? a) 6 b) 7 c) 8 d) 9 e) 10

13) Assume we know a system is a linear time invariant (LTI) system. We also know the following input $x(t)$ – output $y(t)$ pair:



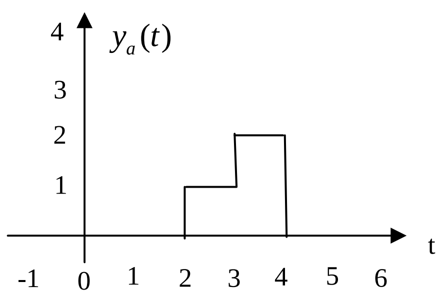


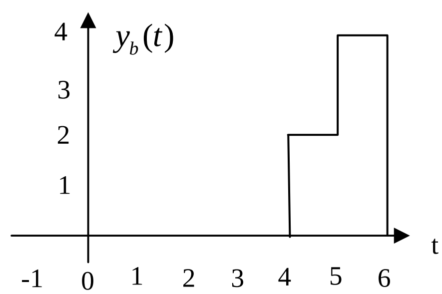
If the input to the system is now $x_{new}(t)$

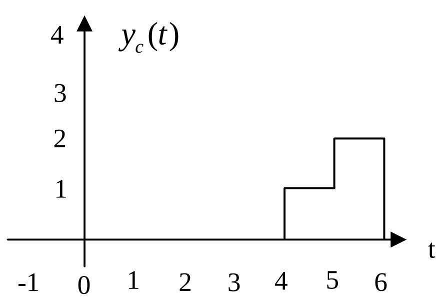


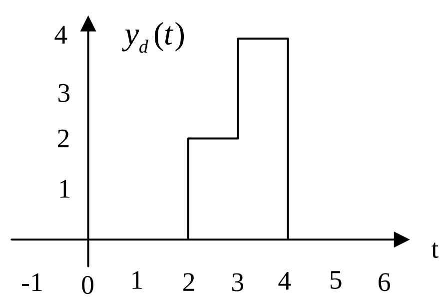
Which of the following best represents the output of the system?

a) $y_a(t)$ b) $y_b(t)$ c) $y_c(t)$ d) $y_d(t)$

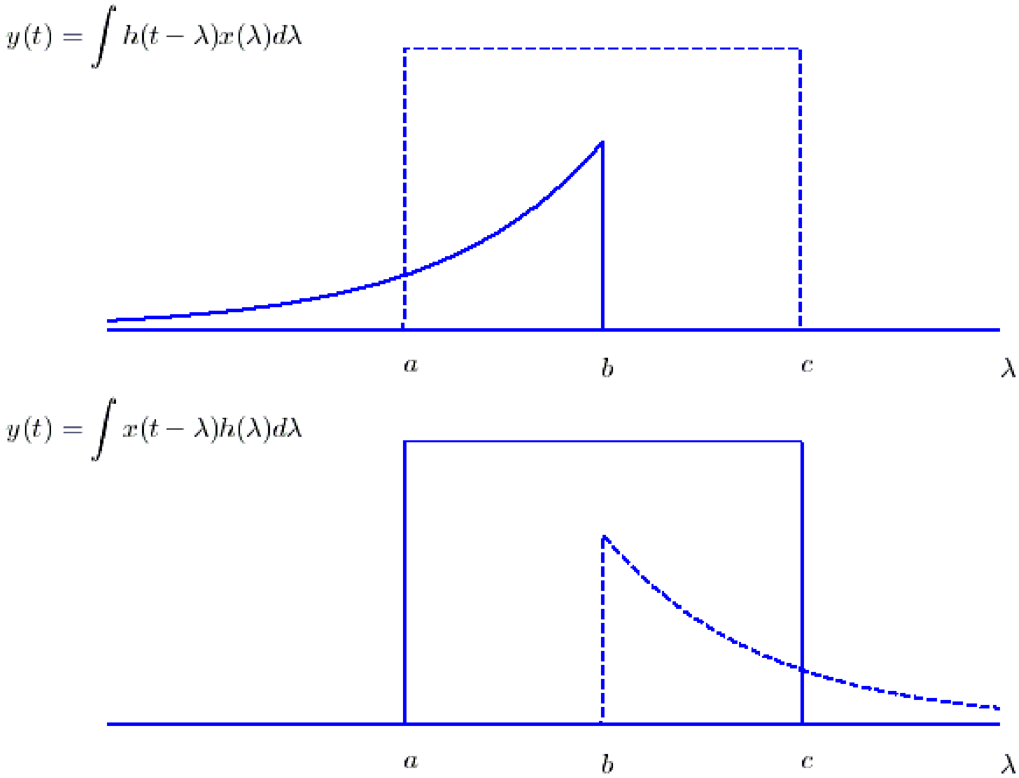








For problems **14- 19**, assume we are going to convolve the impulse response $h(t) = 2e^{-t/0.8}$u(t) with input x(t) = 3 rect$\left(\frac{t}{2}\right)$.



For problems **14-16**, assume we perform the convolution using the form $y(t) = \int h(t-\lambda)x(\lambda)d\lambda$, depicted in the top panel in the above figure.

14) The parameter *a* is equal to a) 0 b) 1 c) -1 d) t e) λ f) none of these

15) The parameter *b* is equal to a) 0 b) 1 c) -1 d) t e) λ f) none of these

16) The parameter *c* is equal to a) 0 b) 1 c) -1 d) t e) λ f) none of these

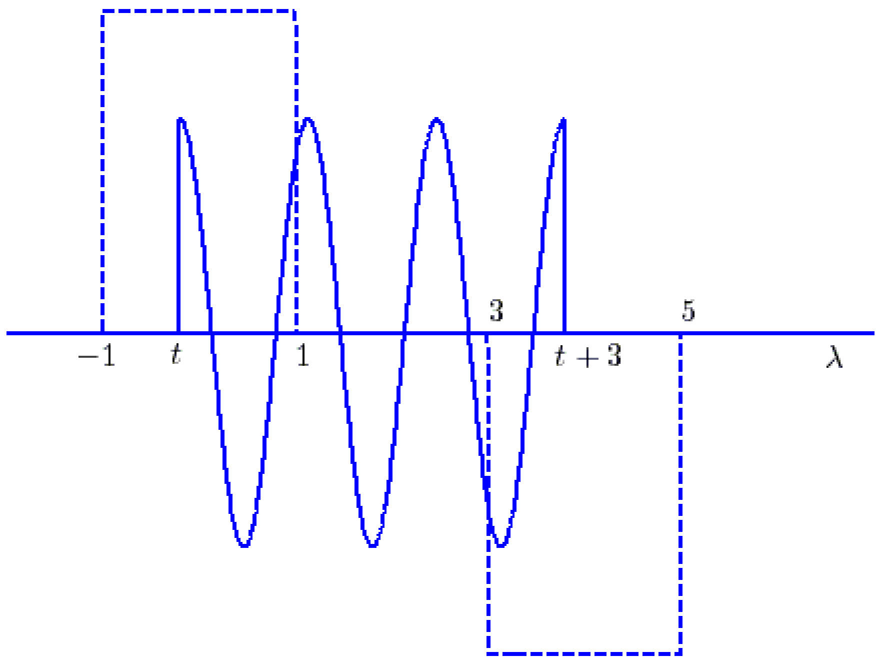
For problems **17-19**, assume we perform the convolution using the form $y(t) = \int h(\lambda)x(t-\lambda)d\lambda$, depicted in the bottom panel in the above figure.

17) The parameter *a* is equal to a) $t-1$ b) $t+1$ c) -1 d) 1 e) none of these

18) The parameter *b* is equal to a) $t-1$ b) $t+1$ c) -1 d) 1 e) none of these

19) The parameter *c* is equal to a) $t-1$ b) $t+1$ c) -1 d) 1 e) none of these

For problems **20-25**, assume we are convolving two functions, and at some point we have the configuration shown below:



The output at this time can be written as the sum of two integrals,

$$y(t) = \int_a^b x(\lambda)h(t-\lambda)d\lambda + \int_c^d x(\lambda)h(t-\lambda)d\lambda \backslash$$

20) The value of the parameter a is a) -1 b) 1 c) 3 d) 5 e) t f) $t+3$

21) The value of the parameter b is a) -1 b) 1 c) 3 d) 5 e) t f) $t+3$

22) The value of the parameter c is a) -1 b) 1 c) 3 d) 5 e) t f) $t+3$

23) The value of the parameter d is a) -1 b) 1 c) 3 d) 5 e) t f) $t+3$

24) This sketch is valid for

a) $-1 < t < 1$ b) $3 < t < 5$ c) $0 < t < 2$ d) $0 < t < 1$ e) none of these

25) Is this a causal system? a) yes b) no c) it is not possible to tell

Answers: 1-b, 2-b, 3-b, 4-d, 5-a, 6-a, 7-b, 8-c, 9-a, 10-d, 11-d, 12-c, 13-b,
14- c, 15-d, 16-b, 17-a, 18-e, 19-b, 20-e, 21-b, 22-c, 23-f, 24-d, 25-b