Name:

Problem	Points	Score
1a	10	
1b	10	
1c	10	
2a	10	
2b	10	
2c	10	
2d	10	
3a	10	
3b	10	
3c	10	
Total	100	

Notes:

1. The exam is closed books/closed notes - except for one page of notes.

2. Please show ALL work. Incorrect answers with no supporting explanations or work will be given no partial credit.

3. Please indicate clearly your answer to the problem.

Problem No. 1:

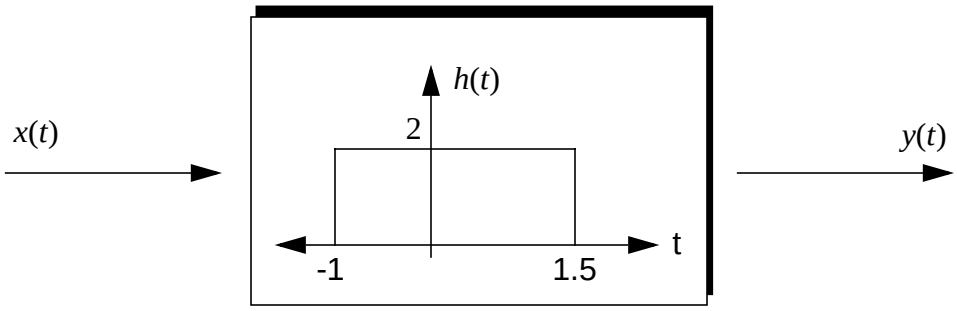
(a) Explain the concept of a linear time-invariant causal system. Give an example of a physical system, excluding any type of electrical circuit, that demonstrates this concept. Points will be awarded according to the originality of the example, the insight demonstrated by the example, and the complexity of the example.

(b) State and prove the time-delay theorem for the Fourier transform. Note that partial credit will only be given for well-structured, logically-consistent proofs.

(c) State and prove the time-delay theorem for the Z-transform. Note that partial credit will only be given for well-structured, logically-consistent proofs.

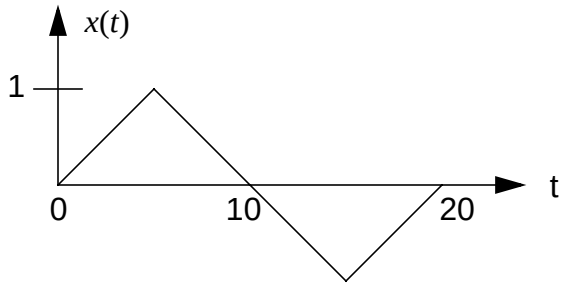
Problem No. 2:

Given the linear system shown below:



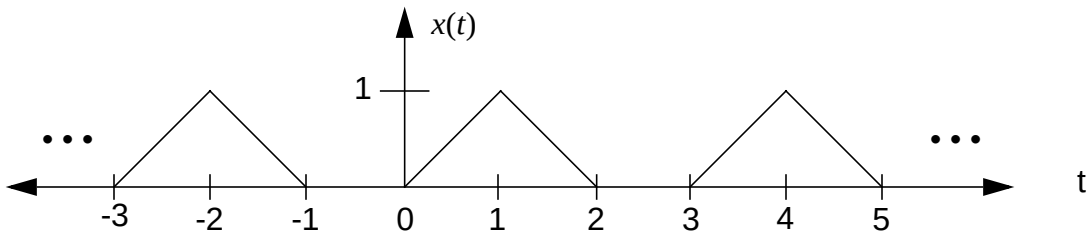
(a) Compute $y(t)$ for $x(t) = \delta(t) + \delta(t-1) + \delta(t-2)$.

(b) Compute $y(t)$ if $x(t)$ is given by:



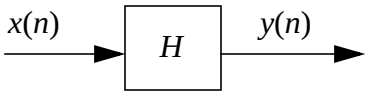
(c) Compute $y(t)$ for $x(t) = A\sin(4\pi t + \theta)$:

(d) Sketch and explain $|Y(f)|$ if $x(t)$ is given by:



Problem No. 3:

For the discrete system shown:



(a) The impulse response of the system is given by:

$$h(n) = \delta(n) + 2\delta(n-4) + \delta(n-7)$$

Compute $y(n)$ when $x(n) = \delta(n) - \delta(n-2)$:

(b) Compute $X(k)$ using a DFT where N=8:

(c) Compute $Y(k)$ using a DFT. From $Y(k)$, compute $y(n)$. Discuss any differences or similarities between this result and the result of part (a).