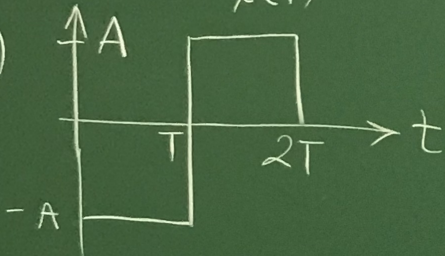


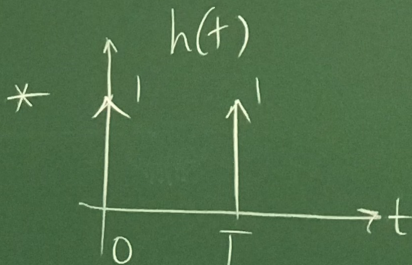
14 Jan 2020

Quiz 1

1)



Two bits transmitted



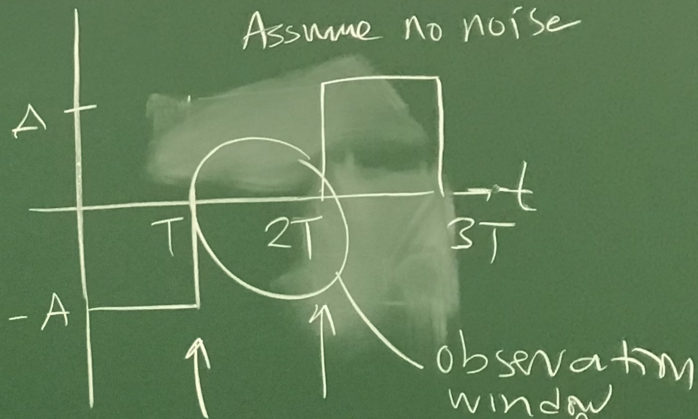
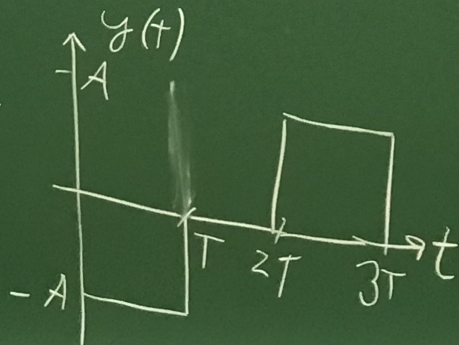
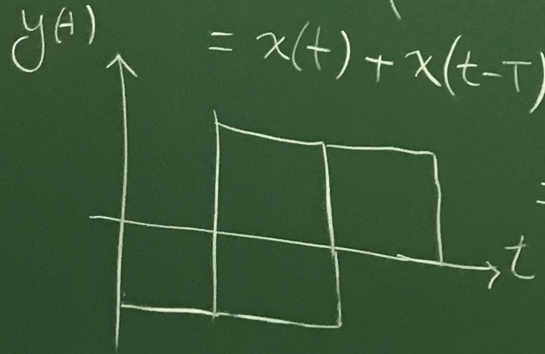
caution: $1^2 + 1^2 > 1$

→ conservation of energy is violated

$$y(t) = x(t) * h(t)$$

$$= x(t) * (\delta(t) + \delta(t-T))$$

$$= x(t) + x(t-T)$$



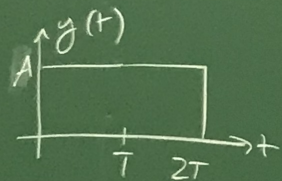
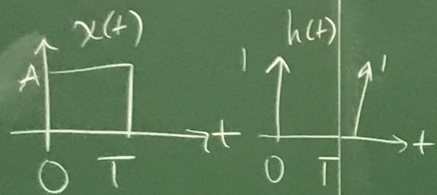
Assume no noise

Assume symbol-by-symbol detection

time to make a decision for the 1st bit

(-)

for the 2nd bit
1 or -1
with 50% likelihood



$$E_x \triangleq \int_{-\infty}^{\infty} x^2(t) dt = A^2 T$$

$$E_y \triangleq 2A^2 T > E_x$$

$$h(t) = \sum_i \alpha_i \delta(t - iT)$$

normalized ch impulse response $\rightarrow \sum \alpha_i^2 = 1$

2) $Y = \alpha X$

\downarrow RV
 \downarrow f_X

$$E[Y] = \mu_Y = E[\alpha X] = \alpha E[X] = \alpha \mu_X$$

$$\begin{aligned} \sigma_Y &\triangleq \sqrt{E[Y^2] - E^2[Y]} \\ &= \sqrt{E[\alpha^2 X^2] - \alpha^2 \mu_X^2} \\ &= \sqrt{\alpha^2 (E[X^2] - \mu_X^2)} \\ &= \alpha \sigma_X \end{aligned}$$

