Cairo University
Faculty of Engineering
Electronics & Communication Department

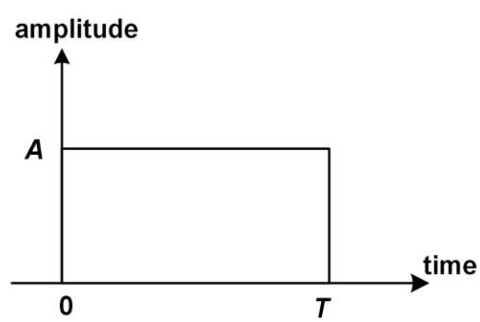
ELC325B
3rd year 2021– 2022

Assignment 2

Part I: Solve the following question:

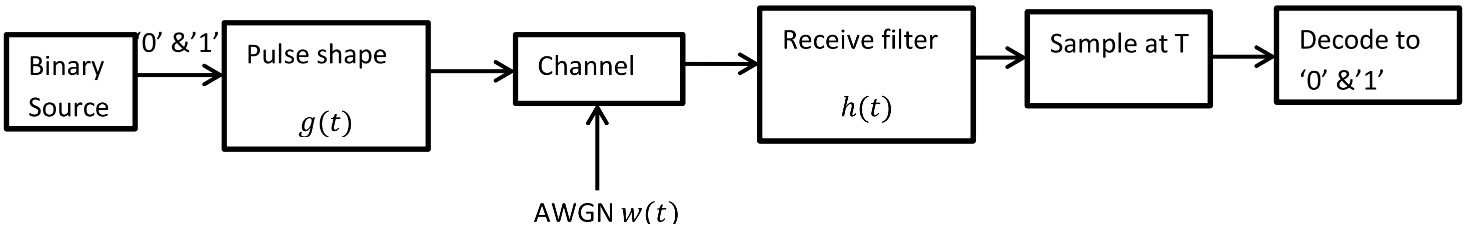
Given the pulse shape in Fig.1 and assuming that '1' and '0' are represented by a positive and a negative pulse, respectively.

a) **Plot the transmitted baseband waveform $s(t)$ for the bit sequence $b_0 = '0'$, $b_1 = '1'$ and $b_2 = '1'$**
b) **Plot the matched filter output due to signal only, i.e., ignore the noise**
c) **Mark the sampling instants to detect b_0, b_1 and b_2.**
d) **Plot the block diagram of the transmitter**
e) **Plot the block diagram of the receiver**

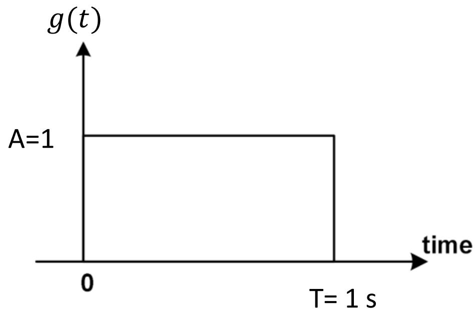


Part II: Simulation:

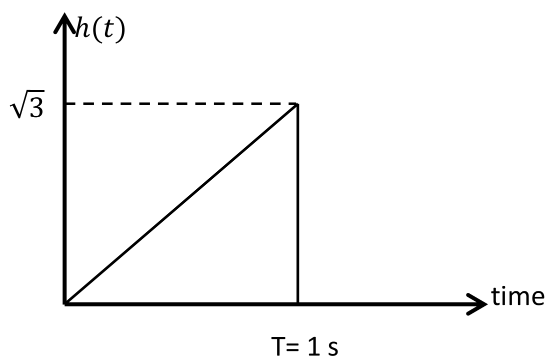
Consider the following communication system.



- **The output of the binary source is a series of random 0's and 1's.**
- **The pulse shape $g(t)$ is given below, where '1' is represented by $g(t)$ and '0' by $-g(t)$**



- **The channel is ideal (i.e. its impulse response is $\delta(t)$).**
- **The noise is an AWGN with zero mean and variance $No/2$.**
- **Consider the three following cases:**
  a) **The receive filter $h(t)$ is a matched filter with unit energy**
  b) **The receive filter $h(t)$ is not existent (i.e. $h(t) = \delta(t)$)**
  c) **The receive filter $h(t)$ has the following impulse response**



<u>Part II Requirements:</u>

1. **Derive the probability of error in the three mentioned cases.**

2. **Write a Matlab code that generates random bits, simulates the above communication system, and calculates the probability of error <u>for the three mentioned cases</u>.**
3. **Plot the output of the receive filter <u>for the three mentioned cases</u>**
4. **On the same figure, plot the theoretical and simulated Bit Error Rate (BER) Vs E/No (where E is the average symbol energy) <u>for the three mentioned cases</u>. Take E/No to be in the range -10 dB: 20:dB. (Use a semilogy plot)**
5. **Is the BER an increasing or a decreasing function of E/No? Why?**
6. **Which case has the lowest BER? Why?**

<u>Deliverables:</u>

- **Please deliver a single report that contains the solution to part I and part II.**
- **The solution of Part II should contain the theoretical derivation, the Matlab code, the required figures, and your comments to 5 and 6.**