Cairo University
Faculty of Engineering
Electronics & Communication Department

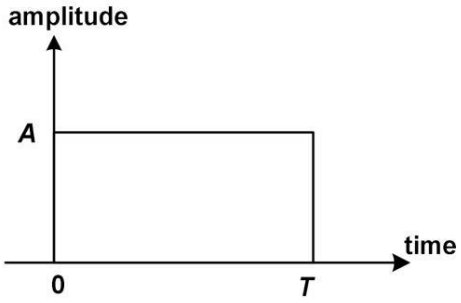
ELC325B
3rd year 2020-2021

Assignment

Part I: Solve the following question:

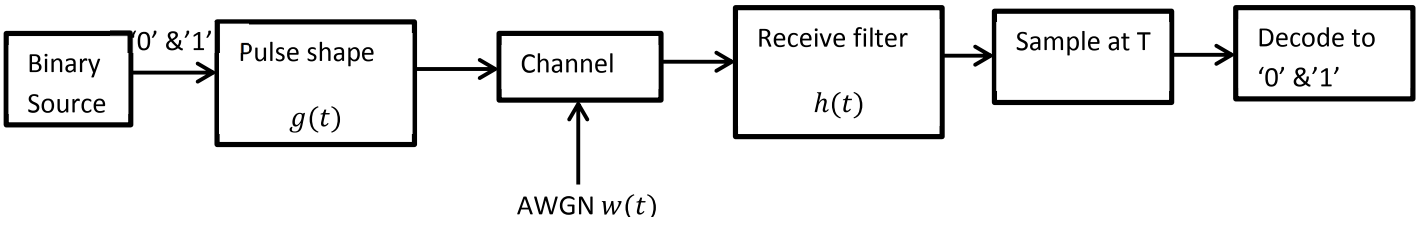
1) Using the rect( ) pulse shape in Figure 1 and assuming binary phase shift keying (BPSK) modulation,

   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

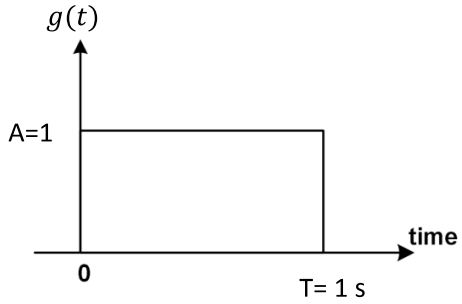


Part II: Simulation:

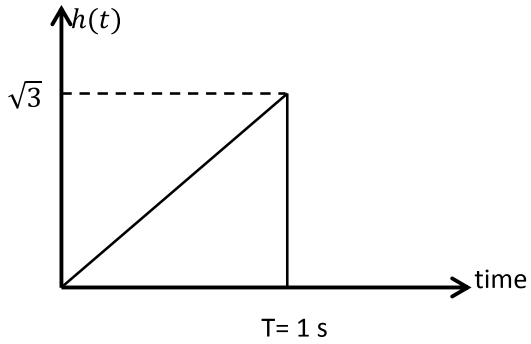
Consider the following communication system.



- **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**



Part II Requirements:

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

Deliverables:

- **Please deliver a single report that contains the solution to part I and part II.**
- **The solution of Part II should contain the Matlab code, the required figures, and your comments to 4 and 5.**

Submission Policies:

- **You can work in groups of two students. Copying is not allowed, and ANY kind of cheating will get ZERO.**
- **Each group should submit a pdf file including the code and the report.**
- **Submission will be through blackboard. The submission deadline is 31/5/2021**

- **You are responsible for the clarity of your solution.**
- **Do NOT use theoretical analysis to solve part II. You should simulate the communication system.**
- **The figures should be clear with a legend and axes labels. Please do not use colors if you'll print in black and white (use clear markers and different line styles instead)**
- **Your comments should be "concise" and do not exceed 2 lines.**
- **Please keep your report neat and clean. Do not use pale pencils and do not scratch in the report**