BLG354-ASSIGNMENT -1-

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1 Q1

1.1 PART A

In the first question, first we need to plot the given signals along t=-100 or n=-100 to t or n=100. To implement the plotting operation, I utilize **stem** function while dealing with a discrete signal which are first second and third signals. On the other hand, while creating the graph of the continuous functions, I use **plot** function, which are fourth and fifth functions.
In the following, one can see the visual for the first part.

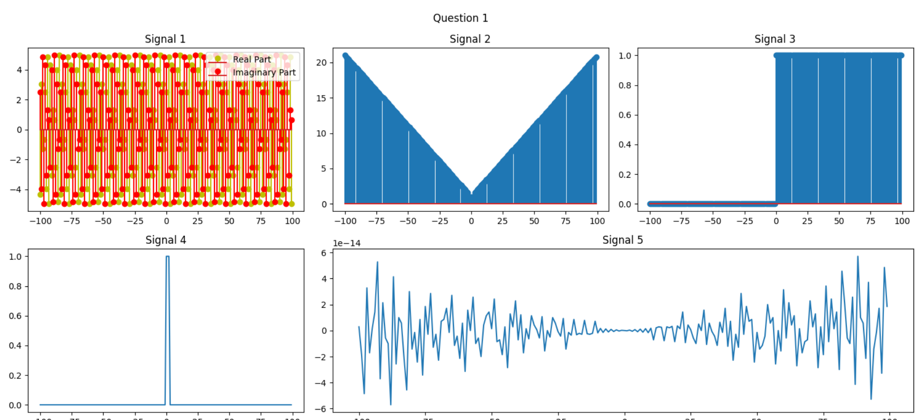

Figure 1: Q1-A OUTPUT

1.2 PART B

In this part of the first question, we still deal with the same signals by making a little modification so that y(t)= t* x(t/2).
In the question, we draw only the continuous signals which are the fourth and fifth signals as I mention in the first part.

In the code, I provide a function, where I first set undefined parts to 0 and return the modified function as I am requested to implement in the question. Having modified the functions accordingly, I make the plot of them. Below, I share the output of the part B of the first question.

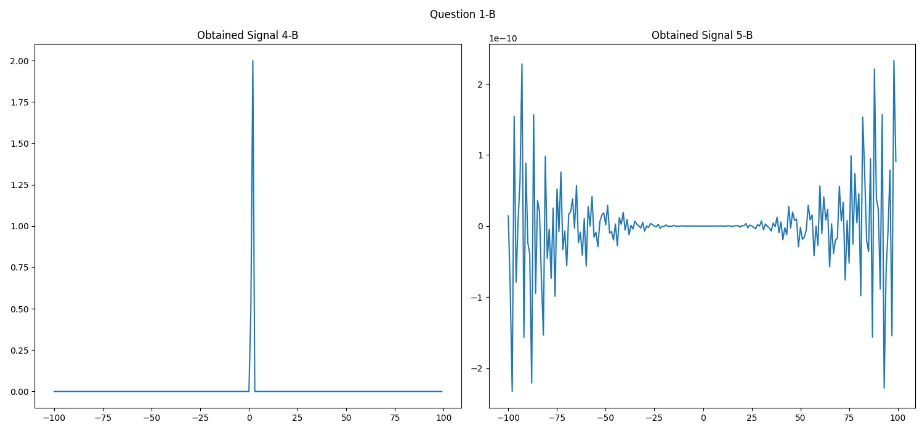

Figure 2: Q1-B OUTPUT

1.3 PART C

In this part, we implement another modification to the signals which are discrete. Here, the first, second, and third signals should be modified according to the equation:$\mathbf{y(t)=} \sum_{m=-\infty}^{n} \mathbf{x[m]}$

To achieve the modified version of the signals, I present a obtain signal function, and create the visual of the discrete signals using stem function. Below, one can see the outputs of the obtained signals.

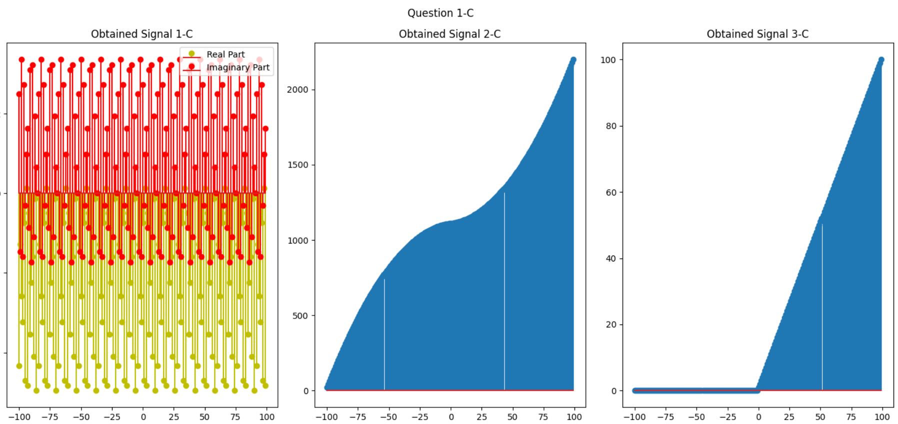

Figure 3: Q1-C OUTPUT

2 Q2

In the second question, we need to determine the properties of the given signals.
A) **y(t)=** t^2**x(t+10)**
Signal A is neither memoryless or nor causal. Since it depends on the future and current t inputs, on the one hand it has memory, on the other hand it is not causal. In addition, Signal A is invertible since for any different input signal that is derived from X it has different output. Lastly, it acts as if it is a multiple of t^2 which is the basic parabolic function, it has no boundary. Therefore, it is not stable
1-) Has memory,non-causal, invertible, unstable
B) **y(t)= 7***x^2 **+5x(t) +3**
Signal B is memoryless and causal signal since it only depends on the current input t. Since it has boundary, it is stable. It does not have unique distinct outputs for distinct inputs. Therefore, it is not invertible.
2) Has no memory, causal, stable ,not invertible
C) **y(t)=** $\sum\limits_{m=-\infty}^{n}$ **x[m]**
Signal C needs to have knowdledge about the previous input values. Therefore, it is not a memoryless signal. On the other hand, since it depends only the prior inputs and does not need to anticipate further inputs, it is a causal signal. In addition, since some values may appear more than once for distinct inputs, the signal is not invertible. Lastly, the signal is not stable , because it is not bounded.
3) Has memory, not invertible,causal, unstable
D) **0.5x[6n-2]+ 0.5x[6n+2]**
Signal D is not memoryless because it needs the prior and further values such as 6n+2 and 6n-2 of x to calculate y. It is not causal as well, since it depends on the future input values. Since it has distinct values for distinct inputs, it is

invertible. Lastly, it is not stable since it is not bounded.
4)Has memory,invertible,non-causal,stable

3 Q3

y[n]= a0*x[n] + a1*x[n-1]+a2*x[n-2]+a3*x[n-3]

3.1 Q3-A

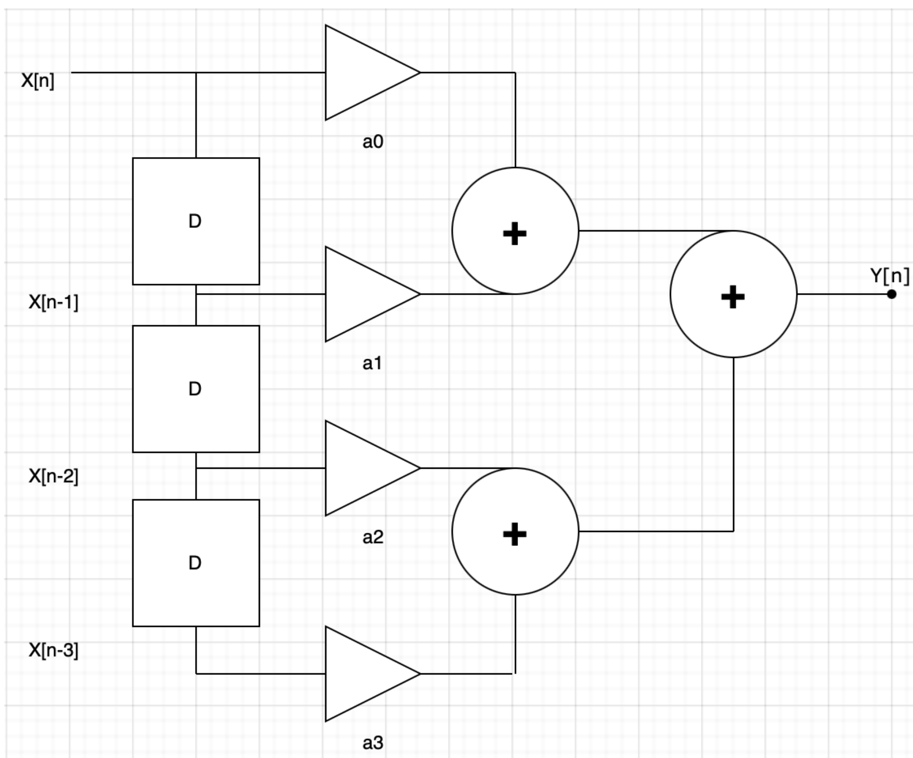

Figure 4: Q3-A OUTPUT

3.2 Q3-B

Under the term BIBO stable, we can understand the case that the output is bounded for the given bounded input. While analyzing this stability, we can be confronted with several cases:
1) Input is bounded, and output is bounded as well. Then we have a BIBO stable signal.

2) Input is not bounded. However, the output is bounded. For instance y(t)= sin(x(t)) where x is an unbounded input, whereas sinus function ranges from -1 to +1. Then, our signal does not satisfy the condition of BIBO stability.
When considering our case, our signal consists of the summation of the multiples of the same signal with delays.Therefore, we can definitely conclude, that since for the bounded input signal x(t) the shifted versions are bounded as well, and the summation of these signals with multiples cannot result in infinite value, the system y(t) is BIBO stable.

3.3 Q3-C

3.3.1 Q3-C.A

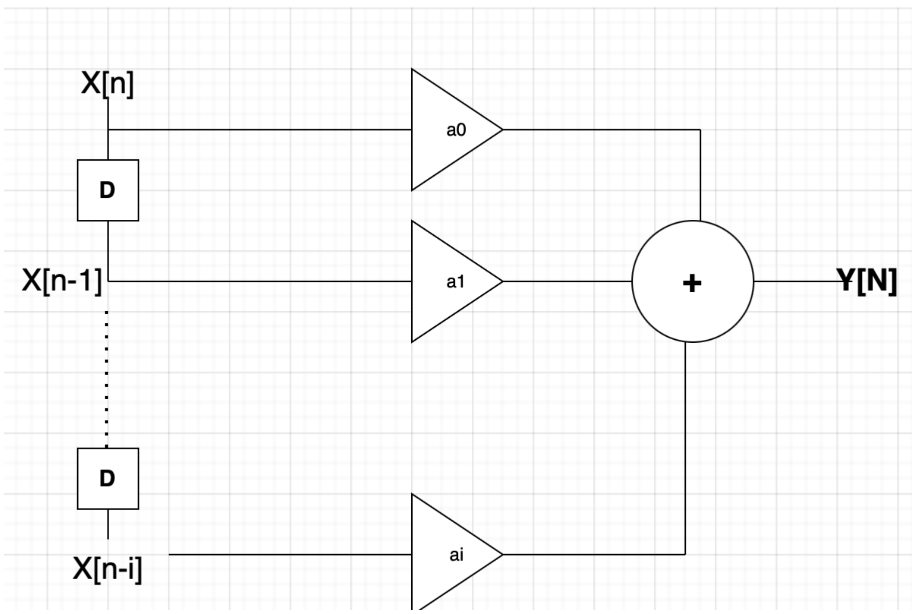

Figure 5: Q3-C.A OUTPUT

3.3.2 Q3-C.B

Even though the input is bounded, because of the fact that we obtain the summation of infinite amount of input, the summation goes to infinity, which makes the result BIBO not stable.

4 Q4

In the last question, we are asked to use the continuous system x1(t) = u(t+4) - u(t - 4) + u(t + 3) - u(t-3) + u(t+1) - u(t-1) and its discrete variant x2[n] = u[n+4]- u[n-4] +u[n+3] -u[n-3]+u[n+1]-u[n-1] to plot the following graphs.

y(t)= x1(t/2) +x1(2t)
y(t)= $\sum_{m=1}^{20} x_1(t/k)$
$y[n] = x2[n/2] + x1[2t]$
$y[n] = \sum_{m=1}^{20} x_1 s$

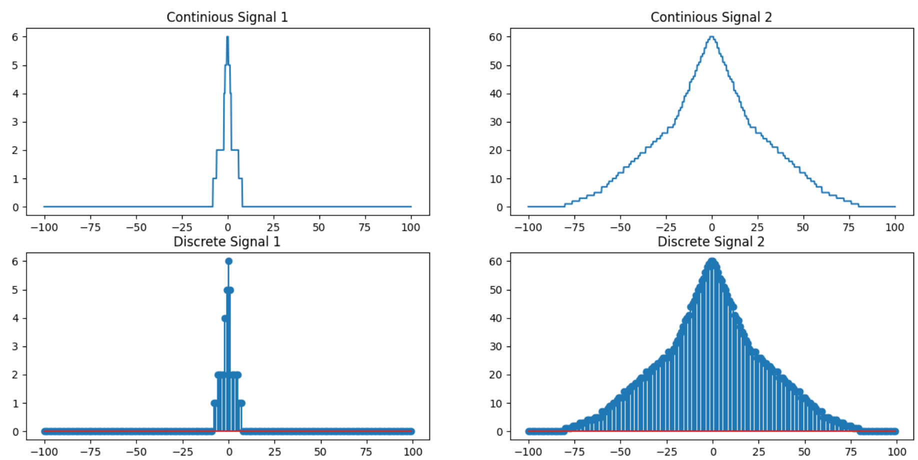

Figure 6: Q4 OUTPUT