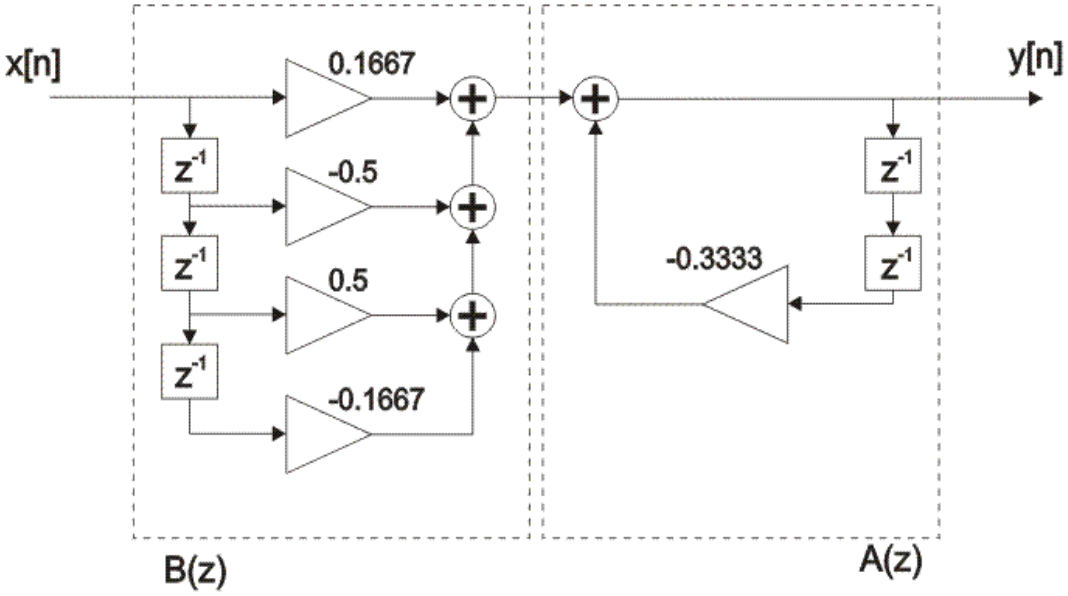
Assignment 1

Due May 31, 18:00 (Brightspace)

Important: Late submissions will **NOT** be accepted. Please submit your SystemC files for Question 1 as a single compressed folder, following the guidelines posted on *https://www.ece.uvic.ca/~daler/courses/ece466/examples.html*, and submit another folder for Question 2. Your SystemC code submissions must be self-contained, i.e., ready to be compiled and executed on the ***ugls.ece*** lab machines.

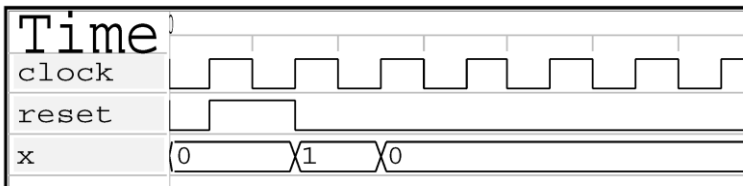
1. *[20 points]* Consider the digital filter shown below, where $\mathbf{z^{-1}}$ means a delay of 1 clock cycle. In addition to the **clock** and **reset** inputs, the filter has one `float`-type input **x** and one `float`-type output **y**.



First, write a behavioral description of this filter using a single **SC_MODULE** with two processes: **SC_METHOD** (producing **y** and the inputs for $\mathbf{z^{-1}}$ registers as needed, sensitive to **x** and the outputs of $\mathbf{z^{-1}}$ registers as needed), and **SC_CTHREAD** (updating the outputs of $\mathbf{z^{-1}}$ registers at positive clock edges). This coding approach is similar to the way we describe a **Mealy-type FSM** (as output **y** is directly affected by input **x**).

Second, create a stimulus generator and a result monitor (printing out the values of **x** and **y**) that are clocked by the same **clock** signal. Your testbench must start with a reset, then send a 1-cycle unit pulse to **x** (as shown on the next page), and observe the pulse response on **y**.

Finally, create `sc_main()` with waveform tracing of **reset**, **clock**, **x**, and **y** over 12 clock cycles, using the clock period of 10 ns.



2. *[20 points]* Recall our filter from the previous question. First, create individual SystemC modules for the **`float`**-type adder, multiplier, and clocked $\mathbf{z^{-1}}$ register with (synchronous) reset. Next, create instances of these modules as needed and connect them together to obtain a top-level structural description of this filter. Finally, include your testbench and **`sc_main()`** with waveform tracing (from the previous question). Confirm that your structural and behavioral descriptions of our filter produce identical pulse responses.