

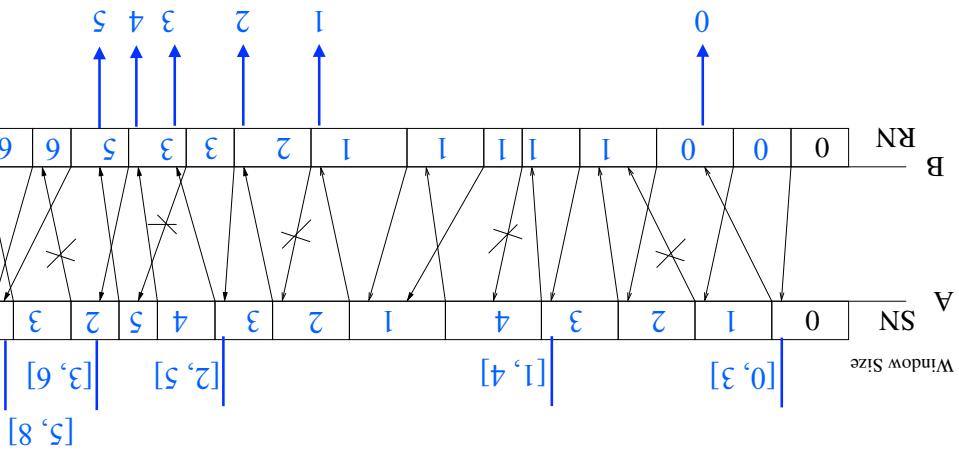
Assignment 2

Due Friday Oct. 23, 11:00pm.

In this question, we review how Go-Back n ARQ can be used to ensure a reliable data transfer. Use $n = 4$ for Question (a)-(c). Use the convention that B when A has to retransmit packets it starts with the SN at the beginning of the window and retransmits packets in order of their sequence number.

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- The diagram illustrates the sliding window mechanism for the proposed algorithm. It consists of two horizontal timelines, A (SN) and B (RN), with values and arrows indicating dependencies. Three window sizes are highlighted: $[0, 3]$, $[1, 4]$, and $[2, 5]$.
- Timeline A (SN):** Contains values 0, 1, 2, 3, 4, 5, 2, 3, 4, 5, 2, 3, 4. Arrows show dependencies from A to B. Some arrows are crossed out with an 'X'.
- Timeline B (RN):** Contains values 0, 0, 0, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 3. Blue arrows point down from the first three zeros to values 0, 1, and 2 respectively.

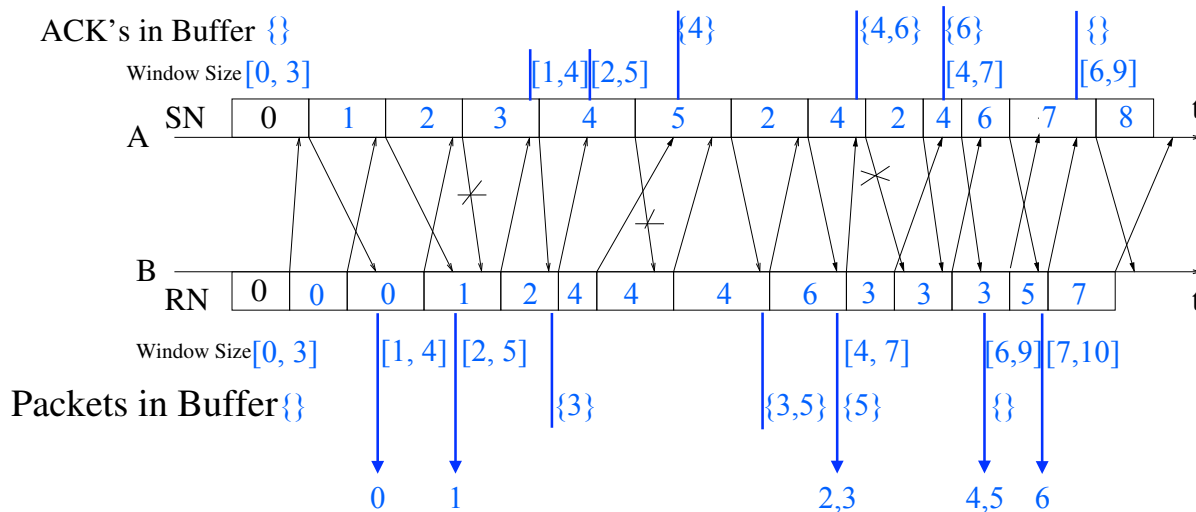
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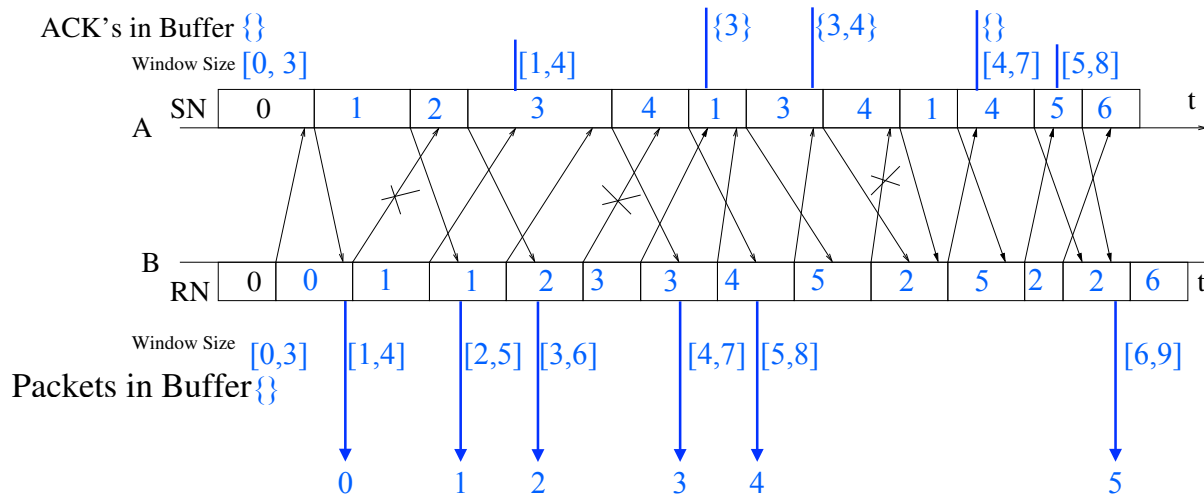
Question 2: Selective Repeat ARQ

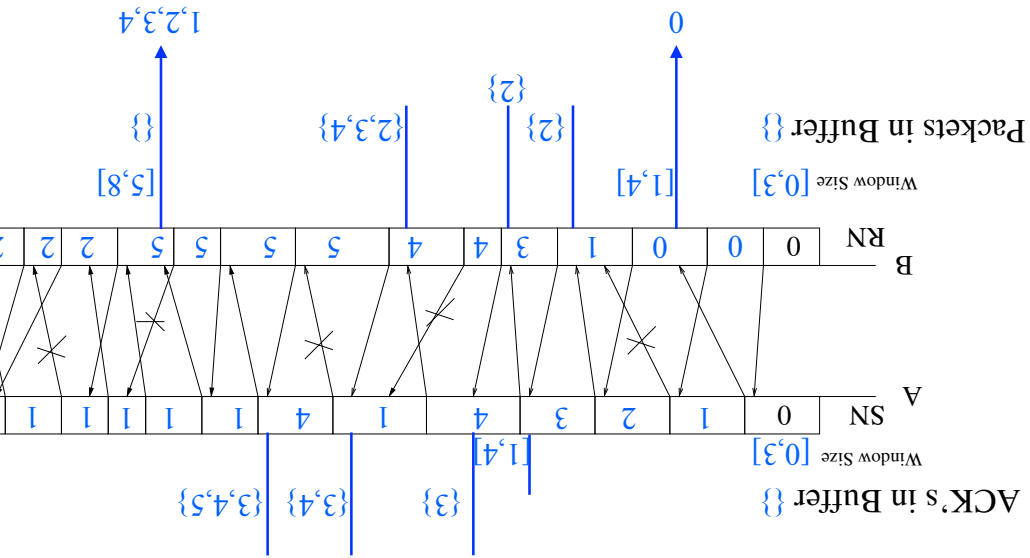
In this question, we review how Selective Repeat ARQ can be used to ensure a reliable data transfer. Use $n = 4$ for Question (a)-(c). Use the convention that B always acknowledges the last error-free packet from A , and when A has to retransmit packets it starts with the SN at the beginning of the window and retransmits packets that have not yet been acknowledged by B in order of their sequence number.

- (a) (Error in Transmission from A to B) Fill in the values for SN and RN , indicate the window size at A and B , as well as the packets delivered to the next higher layer.



- (b) (Error in Transmission from B to A): Repeat (a).





Question 3: Stop-and-Wait ARQ

Consider the situation where two peer processes, A and B , implement Stop-and-Wait ARQ to send data from A to B . The communication channel (link) between A and B (and B and A) is such that all packets that arrive are in the same order as transmitted. Below, we make different assumptions whether packets can arrive with errors and whether packets can be lost. For the different assumptions, indicate **whether it is necessary** to use sequence numbers SN for the packets sent from A to B , as well **whether it is necessary** to use request numbers RN for ACK's sent from B to A . To answer each sub-question, first indicate your answer by checking either "YES" or "NO". If you checked "YES" for SN and/or RN , then give a counter-example that shows that the protocol fails if we do not use SN and/or RN .

- (a) Assume that packets (from A to B) and ACK's (from B to A) can have an arbitrary and variable delay, but the delay is always finite. Furthermore assume that packets and ACK's are **never lost** and always arrive **error free**.

	YES	NO
SN		
RN		

- (b) Assume that packets (from A to B) and ACK's (from B to A) can have an arbitrary and variable delay, but the delay is always finite.. Furthermore assume that packets and ACK's are **never lost** and that **ACK's always arrive error free**. However, **packets might arrive with errors**.

	YES	NO
SN		
RN		

- (c) Assume that packets (from A to B) and ACK's (from B to A) can have an arbitrary and variable delay, but the delay is always finite. Furthermore assume that **ACK's are never lost** and **ACK's always arrive error free**. However, **packets might are lost or arrive with errors**.

	YES	NO
SN		
RN		

Question 4: Modulus m

For Go-Back n ARQ and Selective Repeat ARQ we have to be careful how we apply a modulus m to the sequence number. In this question, we illustrate this issue.

- (a) Give an example where Go-Back n with modulus m fails if $m = n$. Use $n = 5$ for your example.
- (b) Give an example where Selective Repeat with modulus m fails if $m = 2n - 1$. Use $n = 5$ for your example.

Cover sheet for Assignment 2

Complete this page and attach it to the front of your assignment.

Name: _____
(Underline your last name)

Student number: _____

I declare that this assignment is solely my own work, and is in accordance with the University of Toronto Code of Behavior on Academic Matters.

Signature: _____