PROJECT_REPORT

Computer Networks CSE335

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1.0 Alternating Bit version

1.1 Functions:

A_output(struct msg message):

where message is a structure of type msg, containing data to be sent to the B-side. This routine will be called whenever the upper layer at the sending side (A) has a message to send.

The algorithm flow:

First we check if there is a packet that was sent and **not yet acknowledged if so** we **drop** incoming message till the message in transit is acknowledged, then we set the packet sequence number and set the packet acknowledgement number. Then copy content of message into packet, and calculate the packet check sum, then send the packet and wait for acknowledgement.

Code:

```
A_output(message) struct msg message;
{
   if (waiting_on_ack)
   {
      printf("new message arrived at A: can't send there is still a packet in transit\n");
      return;
   }
   struct pkt packet;
   packet.seqnum = sender_sequence_bit;
   packet.acknum = 0; // no need for it for the sender
   memcpy(packet.payload, message.data, sizeof(packet.payload));
   packet.checksum = check_sum(&packet);
   prev_packet = packet;
   waiting_on_ack = 1;
   printf("sending a packet with sequence: %d from A\n", packet.seqnum);
   print_packet(&packet);
   tolayer3(0, packet);
   starttimer(0, TIMER_INCREMENT);
}
```

A_input(struct pkt packet):

This routine will be called whenever a packet sent from the B-side (i.e., as a result of a tolayer3() being called by a B-side procedure) arrives at the A-side. packet is the (possibly corrupted) packet sent from the B-side.

Algorithm flow:

First check the check sum validity and the packet acknowledgment number. If true, stop the timer and then toggle the sender sequence bit, else if packet is corrupted we wait for timer timeout to resend.

Code:

```
A_input(packet) struct pkt packet;
{

   if (validate_checksum(&packet) && packet.acknum == sender_sequence_bit)
   {
      printf("ack for packet sequence: %d received from B\n", packet.acknum);
      stoptimer(0);
      waiting_on_ack = 0;
      sender_sequence_bit ^= 0x1;
   }
   else
      printf("nack or corrupted ack received at A, waiting for time out to resend\n");
}
```

A_timerinterrupt():

This routine will be called when A's timer expires (thus generating a timer interrupt).

Algorithm flow:

Resend the packet on the network from A to B, then start the timer.

Code:

```
A_timerinterrupt()
{
   printf("time out resending packet with sequence: %d to B\n", prev_packet.seqnum);
   tolayer3(0, prev_packet);
   starttimer(0, TIMER_INCREMENT);
}
```

A_init():

This routine will be called once, before any of your other A-side routines are called.

Algorithm flow:

Set the sender sequence bit & waiting on ack variable to zero that signifies that no packets have yet to be acknowledged.

Code:

```
A_init()
{
   sender_sequence_bit = 0;
   waiting_on_ack = 0;
}
```

B_input(struct pkt packet):

Where the packet is a structure of type pkt. This routine will be called whenever a packet sent from the A-side to the B-side.

Algorithm flow:

First validate the packet check sum and sequence number. If true, send to application layer, then send ack to A. else if the packet check sum or sequence number are not valid, send negative acknowledgment to A.

Code:

```
B_input(packet) struct pkt packet;
{

   if ((validate_checksum(&packet)) && packet.seqnum == receiver_sequence_bit)
   {
      printf("correct packet with sequence: %d recevied at B sending ack\n", packet.seqnum);
      print_packet(&packet);
      tolayer5(1, packet.payload);

      struct pkt ack = {0, receiver_sequence_bit, 0, {0}};
      ack.checksum = check_sum(&ack);
      tolayer3(1, ack);

      receiver_sequence_bit ^= 0x1;
   }
   else
   {

      printf("corrupt or duplicate packet with sequence: %d recevied at B, sending nack\n",
packet.seqnum);
      print_packet(&packet);
      struct pkt nack = {0, (receiver_sequence_bit ^ 0x1), 0, {0}};
      nack.checksum = check_sum(&nack);
      tolayer3(1, nack);
   }
}
```

B_init():

This routine will be called once, before any of the other B-side routines are called. It is used for initialization.

Algorithm flow:

Set the receiver sequence bit to zero.

Code:

```
B_init()
{
   receiver_sequence_bit = 0;
}
```

check_sum(struct pkt *p):

Takes a packet as input and returns the checksum of packet.

Algorithm flow:

Return bitwisen not of the sum of seqnum, acknum, and payload.

Code:

```
int check_sum(struct pkt *p)
{
   int sum = 0;

   // since check sum is an int; it's large enough that we won't have to check for wrap around
   sum += p->seqnum;
   sum += p->acknum;

   for (int i = 0; i < sizeof(p->payload); i++)
   {
      sum += p->payload[i];
   }

   return ~(sum);
}
```

validate_checksum(struct pkt *p):

Takes a packet as input and returns **1** if checksum is valid **0** otherwise

Algorithm flow:

Sum every element in the packets and checks if the result is all ones in binary (i.e 0xffffffff).

```
int validate_checksum(struct pkt *p)
{

   unsigned int sum = 0;

   sum += p->seqnum;
   sum += p->acknum;
   sum += p->checksum;

   for (int i = 0; i < sizeof(p->payload); i++)
   {
      sum += p->payload[i];
   }

   if (sum == 0xffffffff)
      return 1;
   else
      return 0;
}
```

1.2 Test Cases

Test_Case_A:

```
shehab@DESKTOP-M1LMPJS MINGW64 ~/Desktop/a_textbooks/7th semester/networks cse 335/project (master)
$ ./a.exe
-----  Stop and Wait Network Simulator Version 1.1 --------

Enter the number of messages to simulate: 10
Enter  packet loss probability [enter 0.0 for no loss]:0.0
Enter packet corruption probability [0.0 for no corruption]:0.0
Enter average time between messages from sender's layer5 [ > 0.0]:5.0
Enter TRACE:0
sending a packet with sequence: 0 from A
packet content: aaaaaaaaaaaaaaaaaaa
correct packet with sequence: 0 recevied at B sending ack
packet content: aaaaaaaaaaaaaaaaaaa
new message arrived at A: can't send there is still a packet in transit
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: ccccccccccccccccccc
correct packet with sequence: 1 recevied at B sending ack
packet content: ccccccccccccccccccc
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
ack for packet sequence: 1 received from B
sending a packet with sequence: 0 from A
packet content: fffffffffffffffffff
correct packet with sequence: 0 recevied at B sending ack
packet content: fffffffffffffffffff
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: iiiiiiiiiiiiiiiiiii
correct packet with sequence: 1 recevied at B sending ack
packet content: iiiiiiiiiiiiiiiiiii
new message arrived at A: can't send there is still a packet in transit
 Simulator terminated at time 47.591816
 after sending 10 msgs from layer5

shehab@DESKTOP-M1LMPJS MINGW64 ~/Desktop/a_textbooks/7th semester/networks cse 335/project (master)
$
```

Test_Case_B:

```
shehab@DESKTOP-M1LMPJS MINGW64 ~/Desktop/a_textbooks/7th semester/networks cse 335/project (master)
$ ./a.exe
-----  Stop and Wait Network Simulator Version 1.1 --------

Enter the number of messages to simulate: 50
Enter  packet loss probability [enter 0.0 for no loss]:0.3
Enter packet corruption probability [0.0 for no corruption]:0.0
Enter average time between messages from sender's layer5 [ > 0.0]:10.0
Enter TRACE:0
sending a packet with sequence: 0 from A
packet content: aaaaaaaaaaaaaaaaaaa
correct packet with sequence: 0 recevied at B sending ack
packet content: aaaaaaaaaaaaaaaaaaa
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: bbbbbbbbbbbbbbbbbbb
correct packet with sequence: 1 recevied at B sending ack
packet content: bbbbbbbbbbbbbbbbbbb
ack for packet sequence: 1 received from B
sending a packet with sequence: 0 from A
packet content: ccccccccccccccccccc
correct packet with sequence: 0 recevied at B sending ack
packet content: ccccccccccccccccccc
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: ddddddddddddddddddd
correct packet with sequence: 1 recevied at B sending ack
packet content: ddddddddddddddddddd
ack for packet sequence: 1 received from B
sending a packet with sequence: 0 from A
packet content: eeeeeeeeeeeeeeeeeee
correct packet with sequence: 0 recevied at B sending ack
packet content: eeeeeeeeeeeeeeeeeee
new message arrived at A: can't send there is still a packet in transit
time out resending packet with sequence: 0 to B
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
corrupt or duplicate packet with sequence: 0 recevied at B, sending nack
packet content: eeeeeeeeeeeeeeeeeee
time out resending packet with sequence: 0 to B
new message arrived at A: can't send there is still a packet in transit
corrupt or duplicate packet with sequence: 0 recevied at B, sending nack
packet content: eeeeeeeeeeeeeeeeeee
new message arrived at A: can't send there is still a packet in transit
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
```

```
sending a packet with sequence: 1 from A
packet content: kkkkkkkkkkkkkkkkkkkk
time out resending packet with sequence: 1 to B
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
correct packet with sequence: 1 recevied at B sending ack
packet content: kkkkkkkkkkkkkkkkkkkk
ack for packet sequence: 1 received from B
sending a packet with sequence: 0 from A
packet content: nnnnnnnnnnnnnnnnnnn
correct packet with sequence: 0 recevied at B sending ack
packet content: nnnnnnnnnnnnnnnnnnn
new message arrived at A: can't send there is still a packet in transit
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: pppppppppppppppppppp
correct packet with sequence: 1 recevied at B sending ack
packet content: pppppppppppppppppppp
ack for packet sequence: 1 received from B
sending a packet with sequence: 0 from A
packet content: qqqqqqqqqqqqqqqqqqqq
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
correct packet with sequence: 0 recevied at B sending ack
packet content: qqqqqqqqqqqqqqqqqqqq
new message arrived at A: can't send there is still a packet in transit
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: vvvvvvvvvvvvvvvvvvv
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
time out resending packet with sequence: 1 to B
new message arrived at A: can't send there is still a packet in transit
time out resending packet with sequence: 1 to B
new message arrived at A: can't send there is still a packet in transit
time out resending packet with sequence: 1 to B
new message arrived at A: can't send there is still a packet in transit
correct packet with sequence: 1 recevied at B sending ack
packet content: vvvvvvvvvvvvvvvvvvv
time out resending packet with sequence: 1 to B
new message arrived at A: can't send there is still a packet in transit
corrupt or duplicate packet with sequence: 1 recevied at B, sending nack
packet content: vvvvvvvvvvvvvvvvvvv
ack for packet sequence: 1 received from B
```

```
ack for packet sequence: 1 received from B
sending a packet with sequence: 0 from A
packet content: ddddddddddddddddddddd
correct packet with sequence: 0 recevied at B sending ack
packet content: ddddddddddddddddddddd
time out resending packet with sequence: 0 to B
corrupt or duplicate packet with sequence: 0 recevied at B, sending nack
packet content: ddddddddddddddddddddd
new message arrived at A: can't send there is still a packet in transit
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: fffffffffffffffffff
new message arrived at A: can't send there is still a packet in transit
time out resending packet with sequence: 1 to B
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
correct packet with sequence: 1 recevied at B sending ack
packet content: fffffffffffffffffff
new message arrived at A: can't send there is still a packet in transit
ack for packet sequence: 1 received from B
sending a packet with sequence: 0 from A
packet content: lllllllllllllllllll
time out resending packet with sequence: 0 to B
new message arrived at A: can't send there is still a packet in transit
correct packet with sequence: 0 recevied at B sending ack
packet content: lllllllllllllllllll
time out resending packet with sequence: 0 to B
new message arrived at A: can't send there is still a packet in transit
corrupt or duplicate packet with sequence: 0 recevied at B, sending nack
packet content: lllllllllllllllllll
time out resending packet with sequence: 0 to B
corrupt or duplicate packet with sequence: 0 recevied at B, sending nack
packet content: lllllllllllllllllll
new message arrived at A: can't send there is still a packet in transit
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: pppppppppppppppppppp
correct packet with sequence: 1 recevied at B sending ack
packet content: pppppppppppppppppppp
time out resending packet with sequence: 1 to B
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
corrupt or duplicate packet with sequence: 1 recevied at B, sending nack
packet content: pppppppppppppppppppp
ack for packet sequence: 1 received from B
ack for packet sequence: 1 received from B
sending a packet with sequence: 0 from A
packet content: sssssssssssssssssss
correct packet with sequence: 0 recevied at B sending ack
packet content: sssssssssssssssssss
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: ttttttttttttttttttt
new message arrived at A: can't send there is still a packet in transit
correct packet with sequence: 1 recevied at B sending ack
packet content: ttttttttttttttttttt
ack for packet sequence: 1 received from B
sending a packet with sequence: 0 from A
packet content: vvvvvvvvvvvvvvvvvvv
new message arrived at A: can't send there is still a packet in transit
time out resending packet with sequence: 0 to B
new message arrived at A: can't send there is still a packet in transit
 Simulator terminated at time 479.247742
 after sending 50 msgs from layer5

shehab@DESKTOP-M1LMPJS MINGW64 ~/Desktop/a_textbooks/7th semester/networks cse 335/project (master)
$
```

Test_Case_C:

```
shehab@DESKTOP-M1LMPJS MINGW64 ~/Desktop/a_textbooks/7th semester/networks cse 335/project (master)
$ ./a.exe
-----  Stop and Wait Network Simulator Version 1.1 --------

Enter the number of messages to simulate: 10
Enter  packet loss probability [enter 0.0 for no loss]:0.0
Enter packet corruption probability [0.0 for no corruption]:0.3
Enter average time between messages from sender's layer5 [ > 0.0]:10
Enter TRACE:0
sending a packet with sequence: 0 from A
packet content: aaaaaaaaaaaaaaaaaaa
correct packet with sequence: 0 recevied at B sending ack
packet content: aaaaaaaaaaaaaaaaaaa
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: bbbbbbbbbbbbbbbbbbb
correct packet with sequence: 1 recevied at B sending ack
packet content: bbbbbbbbbbbbbbbbbbb
ack for packet sequence: 1 received from B
sending a packet with sequence: 0 from A
packet content: ccccccccccccccccccc
correct packet with sequence: 0 recevied at B sending ack
packet content: ccccccccccccccccccc
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: ddddddddddddddddddd
corrupt or duplicate packet with sequence: 1 recevied at B, sending nack
packet content: Zddddddddddddddddddd
nack or corrupted ack received at A, waiting for time out to resend
time out resending packet with sequence: 1 to B
new message arrived at A: can't send there is still a packet in transit
new message arrived at A: can't send there is still a packet in transit
correct packet with sequence: 1 recevied at B sending ack
packet content: ddddddddddddddddddd
new message arrived at A: can't send there is still a packet in transit
ack for packet sequence: 1 received from B
sending a packet with sequence: 0 from A
packet content: hhhhhhhhhhhhhhhhhhh
correct packet with sequence: 0 recevied at B sending ack
packet content: hhhhhhhhhhhhhhhhhhh
new message arrived at A: can't send there is still a packet in transit
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A
packet content: jjjjjjjjjjjjjjjjjjj
 Simulator terminated at time 96.340828
 after sending 10 msgs from layer5

shehab@DESKTOP-M1LMPJS MINGW64 ~/Desktop/a_textbooks/7th semester/networks cse 335/project (master)
$
```

2.0 Go Back N Version

2.1 Functions:

A_output(struct msg message):

Where message is a structure of type msg, containing data to be sent to the B-side. This routine will be called whenever the upper layer at the sending side (A) has a message to send.

Algorithm flow:

First the sender A set packet sequence number and sends the packet then sends the next sequence number packet without receiving an ACK signal from the receiver.

Code:

```
A_output(message) struct msg message;
{

    // checking if buffer has space left
    if (!(buffer.capacity > 0)) {
        printf("new message arrived but droped because buffer is full\n");
        return;
    }

    // buffering packet
    struct pkt packet;
    packet.seqnum = buffer.tail;
    packet.acknum = 0; // no need for it for the sender
    memcpy(packet.payload, message.data, sizeof(packet.payload));
    packet.checksum = check_sum(&packet);
    buffer.packets[buffer.tail] = packet;
    buffer.tail = (buffer.tail + 1) % BUFFER_SIZE;
    buffer.capacity--;

    // checking that nextseqnum doesn't pass the window (buffer wrap around condi
tions)
    int case1 = (buffer.nextseqnum >= buffer.base &&  buffer.nextseqnum < (buffer
.base + WINDOW_SIZE)) ? 1 : 0;
```

```
    int case2 = (buffer.nextseqnum < buffer.base && buffer.nextseqnum < (buffer.b
ase + WINDOW_SIZE) % BUFFER_SIZE) ? 1 : 0;

    // sending nextseqnum packet
    if (case1 || case2) {
        printf("sending a packet with sequence: %d from A ", buffer.packets[buffe
r.nextseqnum].seqnum);
        print_packet(&(buffer.packets[buffer.nextseqnum]));
        tolayer3(0, buffer.packets[buffer.nextseqnum]);

        if (buffer.base == buffer.nextseqnum) {
            starttimer(0, TIMER_INCREMENT);
        }
        buffer.nextseqnum = (buffer.nextseqnum + 1) % BUFFER_SIZE;
    }
    else {
        printf("new message arrived but buffred because unacked packets exceed wi
ndow\n");
    }
}
```

A_input(struct pkt packet):

Where packet is a structure of type pkt. This routine will be called whenever a packet sent from the B-side (i.e., as a result of a tolayer3() being done by a B-side procedure) arrives at the A-side. packet is the (possibly corrupted) packet sent from the B-side.

Algorithm flow:

First check the check sum validity and the packet acknowledgment number,then If no more packets left to send stop the timer.

Code:

```
A_input(packet) struct pkt packet;
{
    // validating packet & making sure acknum is between base and base+window
    if (validate_checksum(&packet) && (buffer.base <= packet.acknum) ||
                                        ( (packet.acknum < buffer.base) && (packe
t.acknum <= (buffer.base+WINDOW_SIZE)%BUFFER_SIZE) ))
```

```
    {
        printf("ack for packet sequence: %d received from B\n", packet.acknum);
        int acked_packets = (packet.acknum < buffer.base) ? (packet.acknum + BUFF
ER_SIZE - buffer.base + 1) : (buffer.base - packet.acknum + 1);
        buffer.capacity += acked_packets;
        buffer.base = (packet.acknum + 1) % BUFFER_SIZE;
        update_window();

        // if no packets left to send stop timer
        if (buffer.base == buffer.nextseqnum) {
            stoptimer(0);
        }
        // else restart timer
        else {
            stoptimer(0);
            starttimer(0, TIMER_INCREMENT);
        }
    }
    else {
        printf("recived corrupted or already acknowledge ack: %d at A waiting for
 time out to resend\n", packet.acknum);
    }

}
```

A_timerinterrupt():

This routine will be called when A's timer expires (thus generating a timer interrupt).

Algorithm flow:

resend the timed-out packet, then restart the timer.

Code:

```
A_timerinterrupt()
{
        printf("time out resending packet from base sequence: %d to B\n", buffer.base);
        starttimer(0, TIMER_INCREMENT);
        resend_window();
}
```

A_init():

This routine will be called once, before any of your other A-side routines are called.

Algorithm flow:

Initializes the buffer and sequence number.

Code:

```
A_init()
{
        buffer.base = 0;
        buffer.nextseqnum = 0;
        buffer.capacity = 256;
        buffer.tail = 0;
}
```

B_input(struct pkt packet):

Where the packet is a structure of type pkt. This routine will be called whenever a packet sent from the A-side to the B-side.

Algorithm flow:

First validate the packet check sum and EXPECTED sequence number. If true, print the packet and send the packet payload, then calculate the acknowledgment check sum and send the acknowledgment to A. if the packet check sum and sequence number are not valid, send last ACKed sequence.

Code:

```
B_input(packet) struct pkt packet;
{

    if ((validate_checksum(&packet)) && packet.seqnum == expectedseqnum)
    {
```

```
        printf("correct packet with sequence: %d recevied at B sending ack ", pac
ket.seqnum);
        print_packet(&packet);
        tolayer5(1, packet.payload);

        struct pkt ack = { 0, expectedseqnum, 0,{ 0 } };
        ack.checksum = check_sum(&ack);
        tolayer3(1, ack);

        expectedseqnum = (expectedseqnum + 1) % BUFFER_SIZE;
    }
    else
    {

        printf("corrupt or unexpected packet with sequence: %d recevied at B, sen
ding last acked sequence: %d ", packet.seqnum, expectedseqnum - 1);
        print_packet(&packet);
        struct pkt nack = { 0, (expectedseqnum - 1), 0,{ 0 } };
        nack.checksum = check_sum(&nack);
        tolayer3(1, nack);
    }
}
```

B_init():

This routine will be called once, before any of the other B-side routines are called. It is used for initialization.

Algorithm flow:

Initialize expected sequence number.

Code:

```
B_init()
{
        int expectedseqnum = 0;
}
```

Resend_window():

Function that is called when timer times out it resends packets from base to nextseqnum

Algorithm flow:

Loop over packets from base to nextseqnum and send them to the network one by one

Code:

```
void resend_window() {

   int i = buffer.base;

   while (i != buffer.nextseqnum) {
      printf("sending a packet with sequence: %d from A ", buffer.packets[i].seqnum);
      print_packet(&(buffer.packets[i]));

      tolayer3(0, buffer.packets[i]);
      i = (i + 1) % BUFFER_SIZE;
   }
}
```

Update_window():

A function that slides the window whenever base moves more than one packet place.

Algorithm flow:

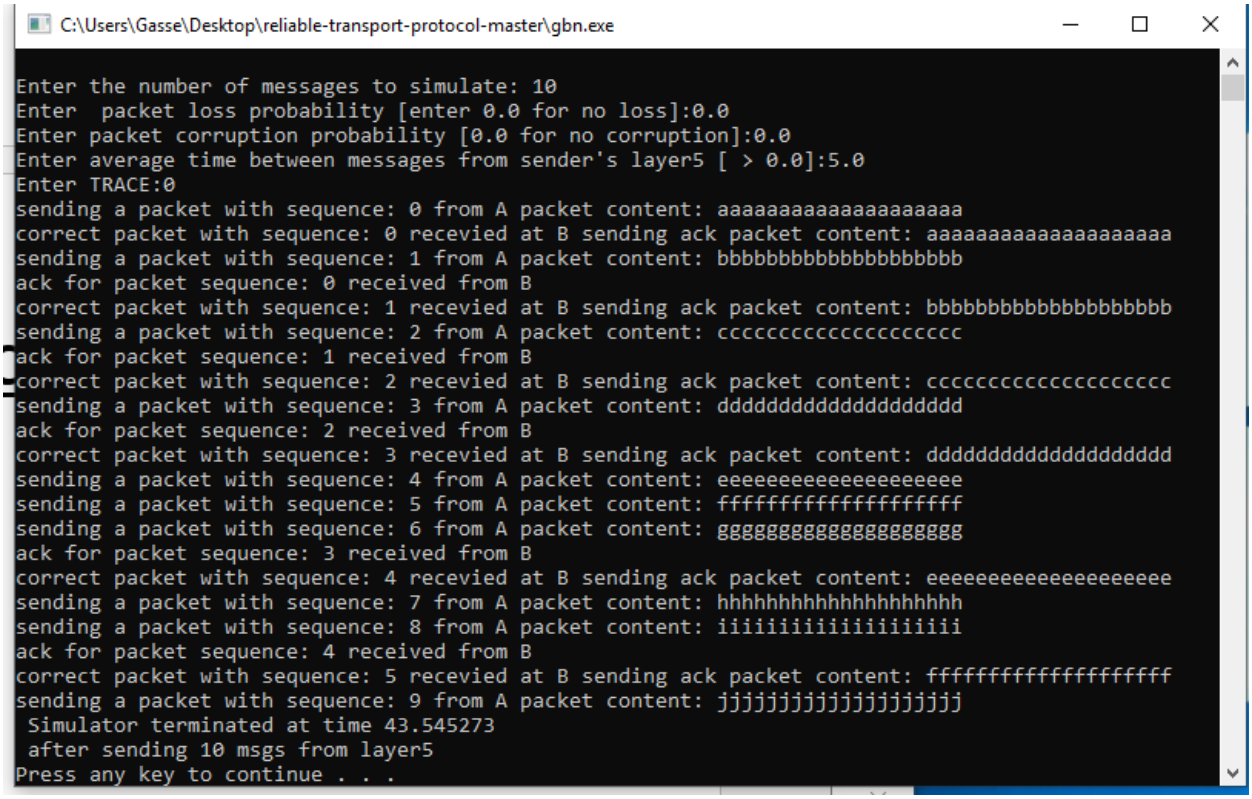
After updating base we check if buffered packets exceed the new window if they don't send all buffered packets if they exceed it, send packets till window limit

Code:

```
void update_window() {
   int i = buffer.nextseqnum;
   int j = (buffer.base + WINDOW_SIZE);
   int z = buffer.tail;

   if (buffer.tail < buffer.base)
      z += BUFFER_SIZE;

   int limit = (j < z) ? ((j + 1) % BUFFER_SIZE) : (buffer.tail%BUFFER_SIZE);

   while (i != limit) {
      printf("sending a packet with sequence: %d from A ", buffer.packets[i].seqnum);
      print_packet(&(buffer.packets[i]));

      tolayer3(0, buffer.packets[i]);
      i = (i + 1) % BUFFER_SIZE;
   }
   buffer.nextseqnum = i;
}
```

2.1 Test Cases

Test_Case_A:



Test_Case_B:

```
Enter the number of messages to simulate: 50
Enter  packet loss probability [enter 0.0 for no loss]:0.3
Enter packet corruption probability [0.0 for no corruption]:0.0
Enter average time between messages from sender's layer5 [ > 0.0]:10.0
Enter TRACE:0
sending a packet with sequence: 0 from A packet content: aaaaaaaaaaaaaaaaaaa
correct packet with sequence: 0 recevied at B sending ack packet content: aaaaaaaaaaaaaaaaaaa
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A packet content: bbbbbbbbbbbbbbbbbbb
correct packet with sequence: 1 recevied at B sending ack packet content: bbbbbbbbbbbbbbbbbbb
ack for packet sequence: 1 received from B
sending a packet with sequence: 2 from A packet content: ccccccccccccccccccc
correct packet with sequence: 2 recevied at B sending ack packet content: ccccccccccccccccccc
ack for packet sequence: 2 received from B
sending a packet with sequence: 3 from A packet content: ddddddddddddddddddd
correct packet with sequence: 3 recevied at B sending ack packet content: ddddddddddddddddddd
ack for packet sequence: 3 received from B
sending a packet with sequence: 4 from A packet content: eeeeeeeeeeeeeeeeeee
correct packet with sequence: 4 recevied at B sending ack packet content: eeeeeeeeeeeeeeeeeee
sending a packet with sequence: 5 from A packet content: fffffffffffffffffff
time out resending packet from base sequence: 4 to B
sending a packet with sequence: 4 from A packet content: eeeeeeeeeeeeeeeeeee
sending a packet with sequence: 5 from A packet content: fffffffffffffffffff
correct packet with sequence: 5 recevied at B sending ack packet content: fffffffffffffffffff
corrupt or unexpected packet with sequence: 5 recevied at B, sending last acked sequence: 5 packet content
: fffffffffffffffffff
sending a packet with sequence: 6 from A packet content: ggggggggggggggggggg
ack for packet sequence: 5 received from B
correct packet with sequence: 6 recevied at B sending ack packet content: ggggggggggggggggggg
ack for packet sequence: 5 received from B
```

```
ack for packet sequence: 5 received from B
correct packet with sequence: 6 recevied at B sending ack packet content: ggggggggggggggggggg
ack for packet sequence: 5 received from B
sending a packet with sequence: 7 from A packet content: hhhhhhhhhhhhhhhhhhh
correct packet with sequence: 7 recevied at B sending ack packet content: hhhhhhhhhhhhhhhhhhh
ack for packet sequence: 6 received from B
ack for packet sequence: 7 received from B
sending a packet with sequence: 8 from A packet content: iiiiiiiiiiiiiiiiiii
sending a packet with sequence: 9 from A packet content: jjjjjjjjjjjjjjjjjjj
correct packet with sequence: 8 recevied at B sending ack packet content: iiiiiiiiiiiiiiiiiii
sending a packet with sequence: 10 from A packet content: kkkkkkkkkkkkkkkkkkk
correct packet with sequence: 9 recevied at B sending ack packet content: jjjjjjjjjjjjjjjjjjj
time out resending packet from base sequence: 8 to B
sending a packet with sequence: 8 from A packet content: iiiiiiiiiiiiiiiiiii
sending a packet with sequence: 9 from A packet content: jjjjjjjjjjjjjjjjjjj
sending a packet with sequence: 10 from A packet content: kkkkkkkkkkkkkkkkkkk
ack for packet sequence: 8 received from B
sending a packet with sequence: 11 from A packet content: lllllllllllllllllll
ack for packet sequence: 9 received from B
sending a packet with sequence: 12 from A packet content: mmmmmmmmmmmmmmmmmmmm
corrupt or unexpected packet with sequence: 12 recevied at B, sending last acked sequence: 9 packet conte
t: mmmmmmmmmmmmmmmmmmmm
time out resending packet from base sequence: 10 to B
sending a packet with sequence: 10 from A packet content: kkkkkkkkkkkkkkkkkkk
sending a packet with sequence: 11 from A packet content: lllllllllllllllllll
sending a packet with sequence: 12 from A packet content: mmmmmmmmmmmmmmmmmmmm
sending a packet with sequence: 13 from A packet content: nnnnnnnnnnnnnnnnnnn
corrupt or unexpected packet with sequence: 11 recevied at B, sending last acked sequence: 9 packet conte
t: lllllllllllllllllll
ack for packet sequence: 9 received from B
```

```
ack for packet sequence: 9 received from B
sending a packet with sequence: 14 from A packet content: oooooooooooooooooo
sending a packet with sequence: 15 from A packet content: pppppppppppppppppppp
corrupt or unexpected packet with sequence: 13 recevied at B, sending last acked sequence: 9 packet conten
t: nnnnnnnnnnnnnnnnnn
ack for packet sequence: 9 received from B
corrupt or unexpected packet with sequence: 14 recevied at B, sending last acked sequence: 9 packet conten
t: oooooooooooooooooo
sending a packet with sequence: 16 from A packet content: qqqqqqqqqqqqqqqqqqqq
sending a packet with sequence: 17 from A packet content: rrrrrrrrrrrrrrrrrr
ack for packet sequence: 9 received from B
corrupt or unexpected packet with sequence: 16 recevied at B, sending last acked sequence: 9 packet conten
t: qqqqqqqqqqqqqqqqqqqq
corrupt or unexpected packet with sequence: 17 recevied at B, sending last acked sequence: 9 packet conten
t: rrrrrrrrrrrrrrrrrr
ack for packet sequence: 9 received from B
new message arrived but buffred because unacked packets exceed window
new message arrived but buffred because unacked packets exceed window
new message arrived but buffred because unacked packets exceed window
new message arrived but buffred because unacked packets exceed window
time out resending packet from base sequence: 10 to B
sending a packet with sequence: 10 from A packet content: kkkkkkkkkkkkkkkkkkkk
sending a packet with sequence: 11 from A packet content: lllllllllllllllllll
sending a packet with sequence: 12 from A packet content: mmmmmmmmmmmmmmmmmmmm
sending a packet with sequence: 13 from A packet content: nnnnnnnnnnnnnnnnnnn
sending a packet with sequence: 14 from A packet content: oooooooooooooooooo
sending a packet with sequence: 15 from A packet content: pppppppppppppppppppp
sending a packet with sequence: 16 from A packet content: qqqqqqqqqqqqqqqqqqqq
sending a packet with sequence: 17 from A packet content: rrrrrrrrrrrrrrrrrr
correct packet with sequence: 10 recevied at B sending ack packet content: kkkkkkkkkkkkkkkkkkkk
```

```
correct packet with sequence: 10 recevied at B sending ack packet content: kkkkkkkkkkkkkkkkkkkk
correct packet with sequence: 11 recevied at B sending ack packet content: lllllllllllllllllll
correct packet with sequence: 12 recevied at B sending ack packet content: mmmmmmmmmmmmmmmmmmmm
corrupt or unexpected packet with sequence: 14 recevied at B, sending last acked sequence: 12 packet conte
nt: oooooooooooooooooo
corrupt or unexpected packet with sequence: 15 recevied at B, sending last acked sequence: 12 packet conte
nt: pppppppppppppppppppp
ack for packet sequence: 10 received from B
sending a packet with sequence: 18 from A packet content: sssssssssssssssssss
sending a packet with sequence: 19 from A packet content: ttttttttttttttttttt
new message arrived but buffred because unacked packets exceed window
ack for packet sequence: 11 received from B
sending a packet with sequence: 20 from A packet content: uuuuuuuuuuuuuuuuuuuu
corrupt or unexpected packet with sequence: 16 recevied at B, sending last acked sequence: 12 packet conte
nt: qqqqqqqqqqqqqqqqqqqq
new message arrived but buffred because unacked packets exceed window
ack for packet sequence: 12 received from B
sending a packet with sequence: 21 from A packet content: vvvvvvvvvvvvvvvvvvv
corrupt or unexpected packet with sequence: 17 recevied at B, sending last acked sequence: 12 packet conte
nt: rrrrrrrrrrrrrrrrrr
ack for packet sequence: 12 received from B
ack for packet sequence: 12 received from B
corrupt or unexpected packet with sequence: 19 recevied at B, sending last acked sequence: 12 packet conte
nt: ttttttttttttttttttt
corrupt or unexpected packet with sequence: 21 recevied at B, sending last acked sequence: 12 packet conte
nt: vvvvvvvvvvvvvvvvvvv
new message arrived but buffred because unacked packets exceed window
ack for packet sequence: 12 received from B
new message arrived but buffred because unacked packets exceed window
ack for packet sequence: 12 received from B
```

```
ack for packet sequence: 12 received from B
new message arrived but buffred because unacked packets exceed window
time out resending packet from base sequence: 13 to B
sending a packet with sequence: 13 from A packet content: nnnnnnnnnnnnnnnnnnn
sending a packet with sequence: 14 from A packet content: oooooooooooooooooooo
sending a packet with sequence: 15 from A packet content: pppppppppppppppppppp
sending a packet with sequence: 16 from A packet content: qqqqqqqqqqqqqqqqqqqq
sending a packet with sequence: 17 from A packet content: rrrrrrrrrrrrrrrrrrrr
sending a packet with sequence: 18 from A packet content: ssssssssssssssssssss
sending a packet with sequence: 19 from A packet content: tttttttttttttttttttt
sending a packet with sequence: 20 from A packet content: uuuuuuuuuuuuuuuuuuuu
sending a packet with sequence: 21 from A packet content: vvvvvvvvvvvvvvvvvvvv
new message arrived but buffred because unacked packets exceed window
correct packet with sequence: 13 recevied at B sending ack packet content: nnnnnnnnnnnnnnnnnnn
corrupt or unexpected packet with sequence: 17 recevied at B, sending last acked sequence: 13 packet conte
nt: rrrrrrrrrrrrrrrrrrrr
time out resending packet from base sequence: 13 to B
sending a packet with sequence: 13 from A packet content: nnnnnnnnnnnnnnnnnnn
sending a packet with sequence: 14 from A packet content: oooooooooooooooooooo
sending a packet with sequence: 15 from A packet content: pppppppppppppppppppp
sending a packet with sequence: 16 from A packet content: qqqqqqqqqqqqqqqqqqqq
sending a packet with sequence: 17 from A packet content: rrrrrrrrrrrrrrrrrrrr
sending a packet with sequence: 18 from A packet content: ssssssssssssssssssss
sending a packet with sequence: 19 from A packet content: tttttttttttttttttttt
sending a packet with sequence: 20 from A packet content: uuuuuuuuuuuuuuuuuuuu
sending a packet with sequence: 21 from A packet content: vvvvvvvvvvvvvvvvvvvv
new message arrived but buffred because unacked packets exceed window
ack for packet sequence: 13 received from B
sending a packet with sequence: 22 from A packet content: wwwwwwwwwwwwwwwwwwww
corrupt or unexpected packet with sequence: 18 recevied at B, sending last acked sequence: 13 packet conte
```

```
ack for packet sequence: 12 received from B
new message arrived but buffred because unacked packets exceed window
time out resending packet from base sequence: 13 to B
sending a packet with sequence: 13 from A packet content: nnnnnnnnnnnnnnnnnnn
sending a packet with sequence: 14 from A packet content: oooooooooooooooooooo
sending a packet with sequence: 15 from A packet content: pppppppppppppppppppp
sending a packet with sequence: 16 from A packet content: qqqqqqqqqqqqqqqqqqqq
sending a packet with sequence: 17 from A packet content: rrrrrrrrrrrrrrrrrrrr
sending a packet with sequence: 18 from A packet content: ssssssssssssssssssss
sending a packet with sequence: 19 from A packet content: tttttttttttttttttttt
sending a packet with sequence: 20 from A packet content: uuuuuuuuuuuuuuuuuuuu
sending a packet with sequence: 21 from A packet content: vvvvvvvvvvvvvvvvvvvv
new message arrived but buffred because unacked packets exceed window
correct packet with sequence: 13 recevied at B sending ack packet content: nnnnnnnnnnnnnnnnnnn
corrupt or unexpected packet with sequence: 17 recevied at B, sending last acked sequence: 13 packet conte
nt: rrrrrrrrrrrrrrrrrrrr
time out resending packet from base sequence: 13 to B
sending a packet with sequence: 13 from A packet content: nnnnnnnnnnnnnnnnnnn
sending a packet with sequence: 14 from A packet content: oooooooooooooooooooo
sending a packet with sequence: 15 from A packet content: pppppppppppppppppppp
sending a packet with sequence: 16 from A packet content: qqqqqqqqqqqqqqqqqqqq
sending a packet with sequence: 17 from A packet content: rrrrrrrrrrrrrrrrrrrr
sending a packet with sequence: 18 from A packet content: ssssssssssssssssssss
sending a packet with sequence: 19 from A packet content: tttttttttttttttttttt
sending a packet with sequence: 20 from A packet content: uuuuuuuuuuuuuuuuuuuu
sending a packet with sequence: 21 from A packet content: vvvvvvvvvvvvvvvvvvvv
new message arrived but buffred because unacked packets exceed window
ack for packet sequence: 13 received from B
sending a packet with sequence: 22 from A packet content: wwwwwwwwwwwwwwwwwwww
corrupt or unexpected packet with sequence: 18 recevied at B, sending last acked sequence: 13 packet conte
```

```
corrupt or unexpected packet with sequence: 18 recevied at B, sending last acked sequence: 13 packet conte
nt: sssssssssssssssssss
ack for packet sequence: 13 received from B
corrupt or unexpected packet with sequence: 19 recevied at B, sending last acked sequence: 13 packet conte
nt: ttttttttttttttttttt
new message arrived but buffred because unacked packets exceed window
corrupt or unexpected packet with sequence: 20 recevied at B, sending last acked sequence: 13 packet conte
nt: uuuuuuuuuuuuuuuuuuu
ack for packet sequence: 13 received from B
corrupt or unexpected packet with sequence: 15 recevied at B, sending last acked sequence: 13 packet conte
nt: pppppppppppppppppppp
ack for packet sequence: 13 received from B
corrupt or unexpected packet with sequence: 17 recevied at B, sending last acked sequence: 13 packet conte
nt: rrrrrrrrrrrrrrrrrrr
new message arrived but buffred because unacked packets exceed window
corrupt or unexpected packet with sequence: 18 recevied at B, sending last acked sequence: 13 packet conte
nt: sssssssssssssssssss
ack for packet sequence: 13 received from B
corrupt or unexpected packet with sequence: 21 recevied at B, sending last acked sequence: 13 packet conte
nt: vvvvvvvvvvvvvvvvvvv
corrupt or unexpected packet with sequence: 22 recevied at B, sending last acked sequence: 13 packet conte
nt: wwwwwwwwwwwwwwwwwww
new message arrived but buffred because unacked packets exceed window
ack for packet sequence: 13 received from B
new message arrived but buffred because unacked packets exceed window
ack for packet sequence: 13 received from B
time out resending packet from base sequence: 14 to B
sending a packet with sequence: 14 from A packet content: oooooooooooooooooooo
sending a packet with sequence: 15 from A packet content: pppppppppppppppppppp
sending a packet with sequence: 16 from A packet content: qqqqqqqqqqqqqqqqqqqq
```

```
sending a packet with sequence: 16 from A packet content: qqqqqqqqqqqqqqqqqqqq
sending a packet with sequence: 17 from A packet content: rrrrrrrrrrrrrrrrrrr
sending a packet with sequence: 18 from A packet content: sssssssssssssssssss
sending a packet with sequence: 19 from A packet content: ttttttttttttttttttt
sending a packet with sequence: 20 from A packet content: uuuuuuuuuuuuuuuuuuu
sending a packet with sequence: 21 from A packet content: vvvvvvvvvvvvvvvvvvv
sending a packet with sequence: 22 from A packet content: wwwwwwwwwwwwwwwwwww
new message arrived but buffred because unacked packets exceed window
new message arrived but buffred because unacked packets exceed window
new message arrived but buffred because unacked packets exceed window
correct packet with sequence: 14 recevied at B sending ack packet content: oooooooooooooooooooo
new message arrived but buffred because unacked packets exceed window
ack for packet sequence: 14 received from B
sending a packet with sequence: 23 from A packet content: xxxxxxxxxxxxxxxxxxx
new message arrived but buffred because unacked packets exceed window
correct packet with sequence: 15 recevied at B sending ack packet content: pppppppppppppppppppp
correct packet with sequence: 16 recevied at B sending ack packet content: qqqqqqqqqqqqqqqqqqqq
time out resending packet from base sequence: 15 to B
sending a packet with sequence: 15 from A packet content: pppppppppppppppppppp
sending a packet with sequence: 16 from A packet content: qqqqqqqqqqqqqqqqqqqq
sending a packet with sequence: 17 from A packet content: rrrrrrrrrrrrrrrrrrr
sending a packet with sequence: 18 from A packet content: sssssssssssssssssss
sending a packet with sequence: 19 from A packet content: ttttttttttttttttttt
sending a packet with sequence: 20 from A packet content: uuuuuuuuuuuuuuuuuuu
sending a packet with sequence: 21 from A packet content: vvvvvvvvvvvvvvvvvvv
sending a packet with sequence: 22 from A packet content: wwwwwwwwwwwwwwwwwww
sending a packet with sequence: 23 from A packet content: xxxxxxxxxxxxxxxxxxx
ack for packet sequence: 15 received from B
sending a packet with sequence: 24 from A packet content: yyyyyyyyyyyyyyyyyyyy
new message arrived but buffred because unacked packets exceed window
```

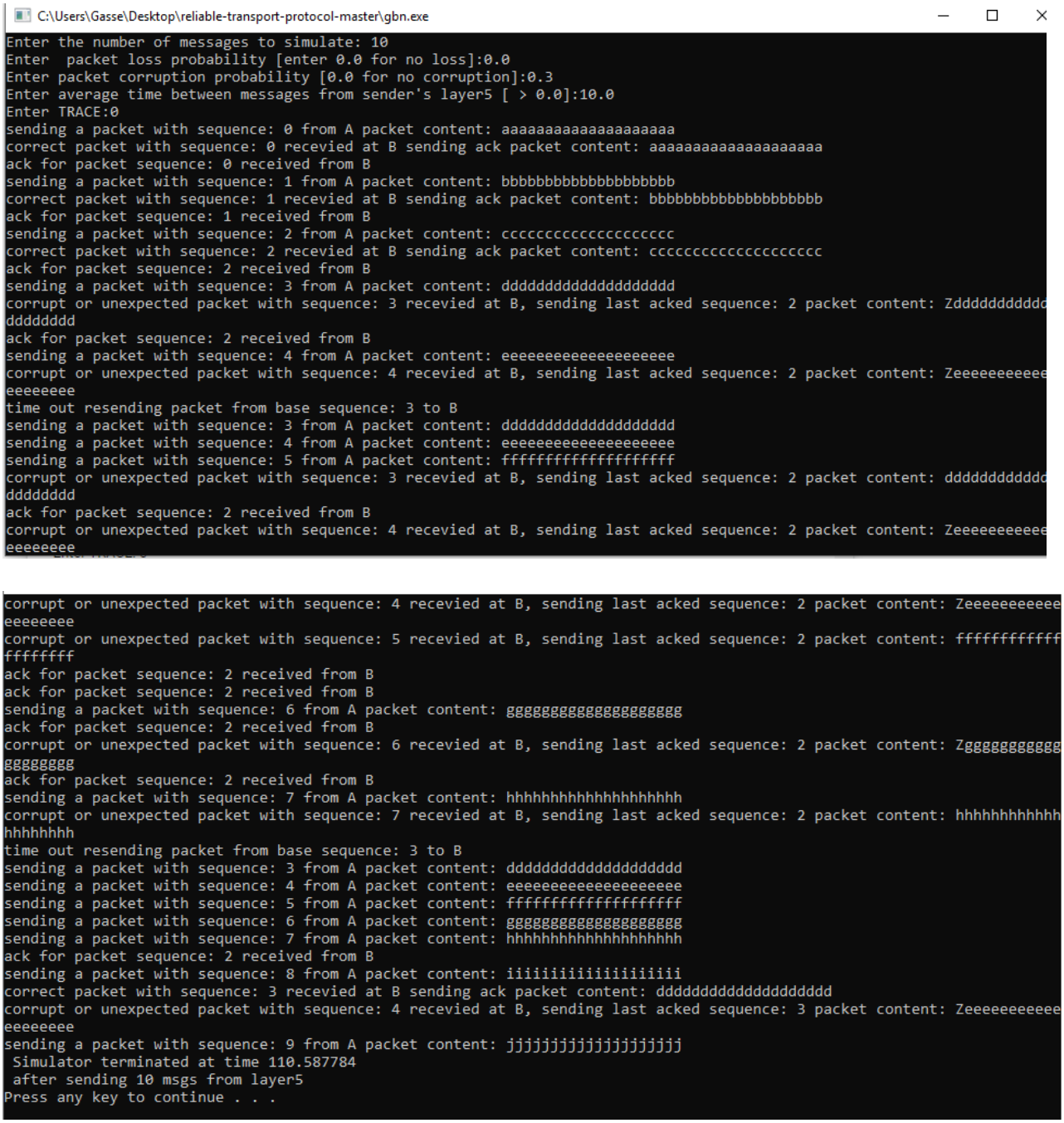
```
new message arrived but buffred because unacked packets exceed window
correct packet with sequence: 17 recevied at B sending ack packet content: rrrrrrrrrrrrrrrrrr
correct packet with sequence: 18 recevied at B sending ack packet content: sssssssssssssssssss
new message arrived but buffred because unacked packets exceed window
corrupt or unexpected packet with sequence: 20 recevied at B, sending last acked sequence: 18 packet conte
nt: uuuuuuuuuuuuuuuuuuuu
ack for packet sequence: 16 received from B
sending a packet with sequence: 25 from A packet content: zzzzzzzzzzzzzzzzzzz
new message arrived but buffred because unacked packets exceed window
ack for packet sequence: 18 received from B
sending a packet with sequence: 26 from A packet content: aaaaaaaaaaaaaaaaaaaa
sending a packet with sequence: 27 from A packet content: bbbbbbbbbbbbbbbbbbb
corrupt or unexpected packet with sequence: 21 recevied at B, sending last acked sequence: 18 packet conte
nt: vvvvvvvvvvvvvvvvvvv
ack for packet sequence: 18 received from B
corrupt or unexpected packet with sequence: 22 recevied at B, sending last acked sequence: 18 packet conte
nt: wwwwwwwwwwwwwwwwwwww
new message arrived but buffred because unacked packets exceed window
corrupt or unexpected packet with sequence: 23 recevied at B, sending last acked sequence: 18 packet conte
nt: xxxxxxxxxxxxxxxxxxx
ack for packet sequence: 18 received from B
corrupt or unexpected packet with sequence: 15 recevied at B, sending last acked sequence: 18 packet conte
nt: pppppppppppppppppppp
corrupt or unexpected packet with sequence: 16 recevied at B, sending last acked sequence: 18 packet conte
nt: qqqqqqqqqqqqqqqqqqqq
ack for packet sequence: 18 received from B
corrupt or unexpected packet with sequence: 17 recevied at B, sending last acked sequence: 18 packet conte
nt: rrrrrrrrrrrrrrrrrr
ack for packet sequence: 18 received from B
correct packet with sequence: 19 recevied at B sending ack packet content: ttttttttttttttttttt
```

```
correct packet with sequence: 19 recevied at B sending ack packet content: ttttttttttttttttttt
new message arrived but buffred because unacked packets exceed window
new message arrived but buffred because unacked packets exceed window
correct packet with sequence: 20 recevied at B sending ack packet content: uuuuuuuuuuuuuuuuuuuu
ack for packet sequence: 18 received from B
ack for packet sequence: 18 received from B
correct packet with sequence: 21 recevied at B sending ack packet content: vvvvvvvvvvvvvvvvvvv
new message arrived but buffred because unacked packets exceed window
correct packet with sequence: 22 recevied at B sending ack packet content: wwwwwwwwwwwwwwwwwwww
correct packet with sequence: 23 recevied at B sending ack packet content: xxxxxxxxxxxxxxxxxxx
time out resending packet from base sequence: 19 to B
sending a packet with sequence: 19 from A packet content: ttttttttttttttttttt
sending a packet with sequence: 20 from A packet content: uuuuuuuuuuuuuuuuuuuu
sending a packet with sequence: 21 from A packet content: vvvvvvvvvvvvvvvvvvv
sending a packet with sequence: 22 from A packet content: wwwwwwwwwwwwwwwwwwww
sending a packet with sequence: 23 from A packet content: xxxxxxxxxxxxxxxxxxx
sending a packet with sequence: 24 from A packet content: yyyyyyyyyyyyyyyyyyyy
sending a packet with sequence: 25 from A packet content: zzzzzzzzzzzzzzzzzzz
sending a packet with sequence: 26 from A packet content: aaaaaaaaaaaaaaaaaaaa
sending a packet with sequence: 27 from A packet content: bbbbbbbbbbbbbbbbbbb
correct packet with sequence: 24 recevied at B sending ack packet content: yyyyyyyyyyyyyyyyyyyy
new message arrived but buffred because unacked packets exceed window
correct packet with sequence: 25 recevied at B sending ack packet content: zzzzzzzzzzzzzzzzzzz
time out resending packet from base sequence: 19 to B
sending a packet with sequence: 19 from A packet content: ttttttttttttttttttt
sending a packet with sequence: 20 from A packet content: uuuuuuuuuuuuuuuuuuuu
sending a packet with sequence: 21 from A packet content: vvvvvvvvvvvvvvvvvvv
sending a packet with sequence: 22 from A packet content: wwwwwwwwwwwwwwwwwwww
sending a packet with sequence: 23 from A packet content: xxxxxxxxxxxxxxxxxxx
sending a packet with sequence: 24 from A packet content: yyyyyyyyyyyyyyyyyyyy
```

```
sending a packet with sequence: 24 from A packet content: yyyyyyyyyyyyyyyyyyy
sending a packet with sequence: 25 from A packet content: zzzzzzzzzzzzzzzzzzz
sending a packet with sequence: 26 from A packet content: aaaaaaaaaaaaaaaaaaa
sending a packet with sequence: 27 from A packet content: bbbbbbbbbbbbbbbbbbb
ack for packet sequence: 25 received from B
sending a packet with sequence: 28 from A packet content: ccccccccccccccccccc
sending a packet with sequence: 29 from A packet content: ddddddddddddddddddd
sending a packet with sequence: 30 from A packet content: eeeeeeeeeeeeeeeeeee
sending a packet with sequence: 31 from A packet content: fffffffffffffffffff
sending a packet with sequence: 32 from A packet content: ggggggggggggggggggg
sending a packet with sequence: 33 from A packet content: hhhhhhhhhhhhhhhhhhh
sending a packet with sequence: 34 from A packet content: iiiiiiiiiiiiiiiiiii
corrupt or unexpected packet with sequence: 27 recevied at B, sending last acked sequence: 25 packet conte
nt: bbbbbbbbbbbbbbbbbbb
corrupt or unexpected packet with sequence: 21 recevied at B, sending last acked sequence: 25 packet conte
nt: vvvvvvvvvvvvvvvvvvv
new message arrived but buffred because unacked packets exceed window
ack for packet sequence: 25 received from B
new message arrived but buffred because unacked packets exceed window
corrupt or unexpected packet with sequence: 22 recevied at B, sending last acked sequence: 25 packet conte
nt: wwwwwwwwwwwwwwwwwww
corrupt or unexpected packet with sequence: 23 recevied at B, sending last acked sequence: 25 packet conte
nt: xxxxxxxxxxxxxxxxxxx
ack for packet sequence: 25 received from B
corrupt or unexpected packet with sequence: 24 recevied at B, sending last acked sequence: 25 packet conte
nt: yyyyyyyyyyyyyyyyyyy
corrupt or unexpected packet with sequence: 25 recevied at B, sending last acked sequence: 25 packet conte
nt: zzzzzzzzzzzzzzzzzzz
new message arrived but buffred because unacked packets exceed window
time out resending packet from base sequence: 26 to B
```

```
nt: zzzzzzzzzzzzzzzzzzz
new message arrived but buffred because unacked packets exceed window
time out resending packet from base sequence: 26 to B
sending a packet with sequence: 26 from A packet content: aaaaaaaaaaaaaaaaaaa
sending a packet with sequence: 27 from A packet content: bbbbbbbbbbbbbbbbbbb
sending a packet with sequence: 28 from A packet content: ccccccccccccccccccc
sending a packet with sequence: 29 from A packet content: ddddddddddddddddddd
sending a packet with sequence: 30 from A packet content: eeeeeeeeeeeeeeeeeee
sending a packet with sequence: 31 from A packet content: fffffffffffffffffff
sending a packet with sequence: 32 from A packet content: ggggggggggggggggggg
sending a packet with sequence: 33 from A packet content: hhhhhhhhhhhhhhhhhhh
sending a packet with sequence: 34 from A packet content: iiiiiiiiiiiiiiiiiii
corrupt or unexpected packet with sequence: 27 recevied at B, sending last acked sequence: 25 packet cor
nt: bbbbbbbbbbbbbbbbbbb
new message arrived but buffred because unacked packets exceed window
 Simulator terminated at time 464.109558
 after sending 50 msgs from layer5
Press any key to continue . . .
```

Test_Case_C:


C:\Users\Gasse\Desktop\reliable-transport-protocol-master\gbn.exe
Enter the number of messages to simulate: 10
Enter packet loss probability [enter 0.0 for no loss]:0.0
Enter packet corruption probability [0.0 for no corruption]:0.3
Enter average time between messages from sender's layer5 [> 0.0]:10.0
Enter TRACE:0
sending a packet with sequence: 0 from A packet content: aaaaaaaaaaaaaaaaaaa
correct packet with sequence: 0 recevied at B sending ack packet content: aaaaaaaaaaaaaaaaaaa
ack for packet sequence: 0 received from B
sending a packet with sequence: 1 from A packet content: bbbbbbbbbbbbbbbbbbb
correct packet with sequence: 1 recevied at B sending ack packet content: bbbbbbbbbbbbbbbbbbb
ack for packet sequence: 1 received from B
sending a packet with sequence: 2 from A packet content: ccccccccccccccccccc
correct packet with sequence: 2 recevied at B sending ack packet content: ccccccccccccccccccc
ack for packet sequence: 2 received from B
sending a packet with sequence: 3 from A packet content: ddddddddddddddddddd
corrupt or unexpected packet with sequence: 3 recevied at B, sending last acked sequence: 2 packet content: Zddddddddddd
dddddddd
ack for packet sequence: 2 received from B
sending a packet with sequence: 4 from A packet content: eeeeeeeeeeeeeeeeeee
corrupt or unexpected packet with sequence: 4 recevied at B, sending last acked sequence: 2 packet content: Zeeeeeeeeeee
eeeeeeee
time out resending packet from base sequence: 3 to B
sending a packet with sequence: 3 from A packet content: ddddddddddddddddddd
sending a packet with sequence: 4 from A packet content: eeeeeeeeeeeeeeeeeee
sending a packet with sequence: 5 from A packet content: fffffffffffffffffff
corrupt or unexpected packet with sequence: 3 recevied at B, sending last acked sequence: 2 packet content: ddddddddddd
dddddddd
ack for packet sequence: 2 received from B
corrupt or unexpected packet with sequence: 4 recevied at B, sending last acked sequence: 2 packet content: Zeeeeeeeeeee
eeeeeeee
corrupt or unexpected packet with sequence: 4 recevied at B, sending last acked sequence: 2 packet content: Zeeeeeeeeeee
eeeeeeee
corrupt or unexpected packet with sequence: 5 recevied at B, sending last acked sequence: 2 packet content: fffffffffff
ffffffff
ack for packet sequence: 2 received from B
ack for packet sequence: 2 received from B
sending a packet with sequence: 6 from A packet content: gggggggggggggggggg
ack for packet sequence: 2 received from B
corrupt or unexpected packet with sequence: 6 recevied at B, sending last acked sequence: 2 packet content: Zgggggggggg
gggggggg
ack for packet sequence: 2 received from B
sending a packet with sequence: 7 from A packet content: hhhhhhhhhhhhhhhhhhh
corrupt or unexpected packet with sequence: 7 recevied at B, sending last acked sequence: 2 packet content: hhhhhhhhhhh
hhhhhhhh
time out resending packet from base sequence: 3 to B
sending a packet with sequence: 3 from A packet content: ddddddddddddddddddd
sending a packet with sequence: 4 from A packet content: eeeeeeeeeeeeeeeeeee
sending a packet with sequence: 5 from A packet content: fffffffffffffffffff
sending a packet with sequence: 6 from A packet content: gggggggggggggggggg
sending a packet with sequence: 7 from A packet content: hhhhhhhhhhhhhhhhhhh
ack for packet sequence: 2 received from B
sending a packet with sequence: 8 from A packet content: iiiiiiiiiiiiiiiiiii
correct packet with sequence: 3 recevied at B sending ack packet content: ddddddddddddddddddd
corrupt or unexpected packet with sequence: 4 recevied at B, sending last acked sequence: 3 packet content: Zeeeeeeeeeee
eeeeeeee
sending a packet with sequence: 9 from A packet content: jjjjjjjjjjjjjjjjjjj
 Simulator terminated at time 110.587784
 after sending 10 msgs from layer5
Press any key to continue . . .