Florida Institute of Technology

Comprehensive Examination

Fall 2014

Computer Networks

Read Carefully: Resolve each of the following problems without any reference material (closed books and closed notes). **Calculators are allowed**. Please **fully explain** your response, and address the questions asked. If additional space is needed please attach a blank page and add your name.

Student ID: ________________________

Date: ________________________

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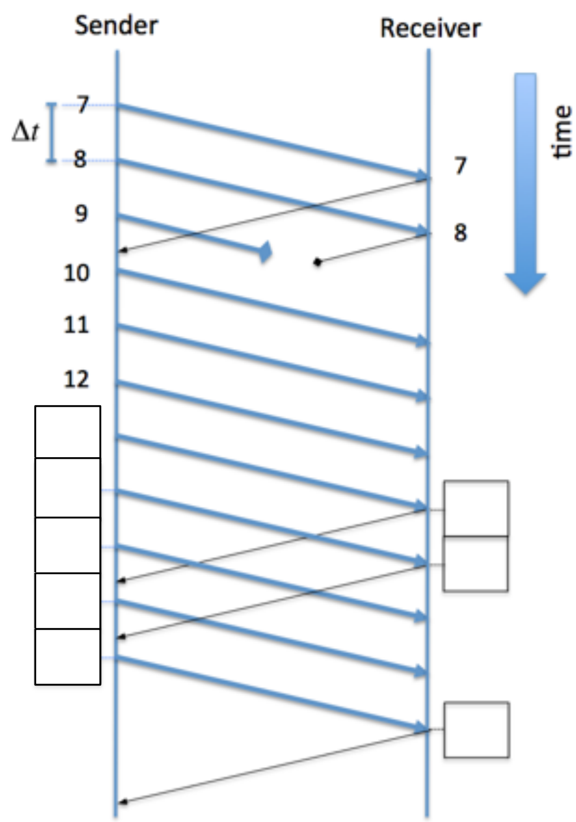
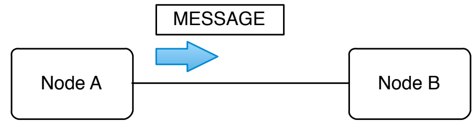
Question 1 (20 points) In the diagram below, a simple sliding window algorithm is illustrated between a sender (left side) and a receiver (right side). As illustrated in the diagram, the sender transmits a new frame each Δt seconds, and the timeout interval is five times Δt (i.e. $timeout = 5 \cdot \Delta t$). So, if the sender does not receive an acknowledgement from a frame it sent after $5 \cdot \Delta t$, it retransmits the frame. Following the diagram, please fill-out the empty boxes showing the ID (or sequence number) of each frame sent by the sender, and acknowledgement sent (left side) by the receiver (right side). Consider that the interrupted lines (i.e. incomplete arrows) are packet losses, the sender and receiver window sizes are 20 frames, and that there are no limits for the sequence number (i.e. it can grow indefinitely, in this example).



Question 2 (20 points) Consider that following 24-bit message for the scenario illustrated in the figure.

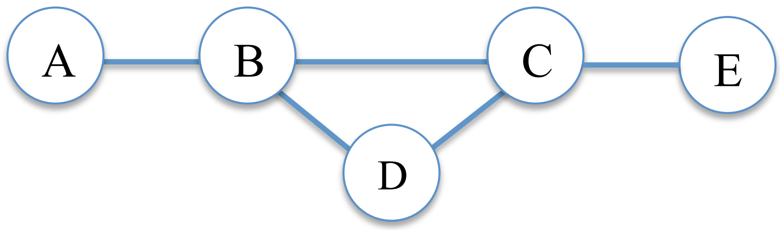
`Message: 101101101010110011010110`



a) Assuming that both the transmitter and the receiver will use CRC for error checking, and that they share the polynomial $\left(x^3+1\right)$ as a common generator, please calculate the complete message (i.e. payload + CRC) that will be transmitted from node A to node B

b) Assuming now that the transmitter and the receiver will use a one's complement 8-bit checksum for error checking, please calculate the complete message (i.e. payload + Checksum) that will be transmitted from node A to node B.

Question 3 (20 points) Consider the topology illustrated in the figure below.



In order to construct their internal routing tables, each node will share some information with its peers. The information shared and the way in which it is shared depends on the type of routing algorithm used. Considering a **Distance Vector algorithm**, and assuming that each node is able to detect its immediate neighbors, please fill out the tables below. The tables represent the internal routing tables of each of the node at each time step through the routing algorithm.

Time 0

Node A		Node B		Node C		Node D		Node E	
TO	Next Hop	TO	Next Hop	TO	Next Hop	TO	Next Hop	TO	Next Hop
A	A	A		A		A		A	
B		B	B	B		B		B	
C		C		C	C	C		C	
D		D		D		D	D	D	
E		E		E		E		E	E

Time 1

Node A		Node B		Node C		Node D		Node E	
TO	Next Hop	TO	Next Hop	TO	Next Hop	TO	Next Hop	TO	Next Hop
A	A	A		A		A		A	
B		B	B	B		B		B	
C		C		C	C	C		C	
D		D		D		D	D	D	
E		E		E		E		E	E

Time 2

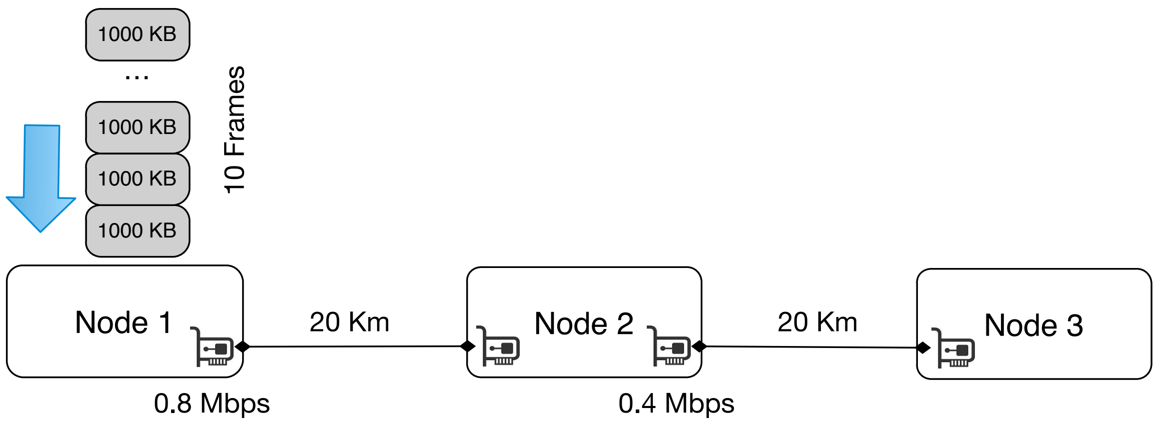
Node A		Node B		Node C		Node D		Node E	
TO	Next Hop	TO	Next Hop	TO	Next Hop	TO	Next Hop	TO	Next Hop
A	A	A		A		A		A	
B		B	B	B		B		B	
C		C		C	C	C		C	
D		D		D		D	D	D	
E		E		E		E		E	E

Time 3

Node A		Node B		Node C		Node D		Node E	
TO	Next Hop	TO	Next Hop	TO	Next Hop	TO	Next Hop	TO	Next Hop
A	A	A		A		A		A	
B		B	B	B		B		B	
C		C		C	C	C		C	
D		D		D		D	D	D	
E		E		E		E		E	E

Question 4 (20 points)

In the scenario illustrated in the figure below, node A has 10 frames to transmit to node B, each frame is 1000KB in size. There are no acknowledgments ore errors in the link, the propagation speed in all links is $2 \cdot 10^8 m/s$, and the length of each link is shown in the figure.



a) Calculate how long it will take for all 10 frames to arrive at node 3.

b) Calculate the average queue size (in frames) on nodes 1 and 2.

Question 5 (20 points)

TCP normally relies on a sequence of specially marked packets exchanged between sender and receiver to establish and tear down connections. In **just a few sentences**, please identify how many packets are exchanged in each of the processes described below, and explain how the process works.

a) TCP establishment:

b) TCP Tear Down: