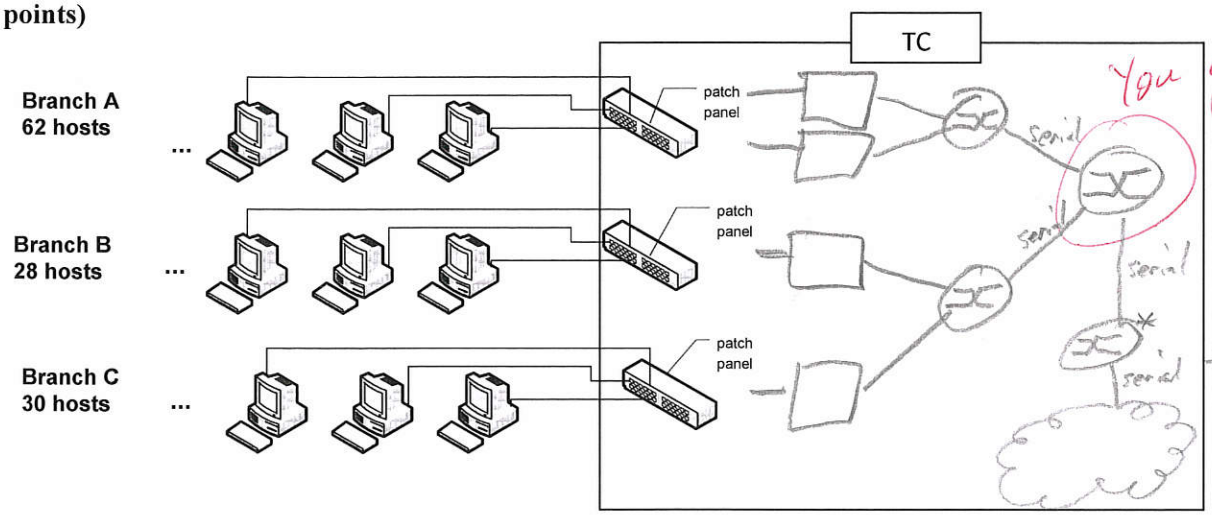
Name: Jonathan Harrod Total points: ~~85~~ 90 - 5

Problem 1: Subnettting, IP Addressing, and Network Components

Below is a diagram depicting a partially completed network architecture that needs to support a total of 124 office computers across three different branches. The network needs to be configured in such a way that traffic within an office does not propagate to other offices within the company. This means that if network packages are exchanged between hosts in branch A, they will not be forwarded to branches B or C. Branch A must support 62 computers, branch B 28 computers, branch C 30 computers.

1. Complete the diagram by using the correct network devices (use circles for routers and squares for switches). Assume that you have 48 port switches and routers with two Ethernet ports and a serial port and one router with two serial ports available. **(10 points)**

2. Attach a wide-area connection to your network that allows the company to connect to the Internet. **(5 points)**



-1 You don't have such a router in your network & won't work

* note: need this router to connect to Internet router/ISP. If not, omit this router

3. The entire LAN is given the following network address with mask: 193.66.88.128/25. Assign each subnet, its range of IP addresses along with subnet mask information. **(9 points)**

Branches	Network Address	IP Address range	Subnet Mask
A (62 hosts)	193.66.88.192 ✓	193.66.88.193 (.255 broadcast) - 193.66.88.254 ✓	255.255.255.192 ✓
B (28 hosts)	193.66.88.128 ✓	193.66.88.129 (.159 broadcast) - 193.66.88.158 ✓	255.255.255.224 ✓
C (30 hosts)	193.66.88.160 ✓	193.66.88.161 (.191 broadcast) - 193.66.88.190 ✓	255.255.255.224 ✓

1 193.66.88.1|000 0000 A 193.66.88.1|00 0000 B 193.66.88.1|01 0000 C

-1

4. Assume that offices from the branches B and C merge along with their corresponding networks. Briefly describe the changes in the network configuration including network addressing, network topology, etc. that needs to occur to make this happen. **(5 points)**

You gain 2 IP addresses from 1 broadcast + 1 network. Router configuration would need to be changed to 1 subnet.
network: 193.66.88.128
mask: 255.255.255.224
broadcast: 193.66.88.191
range: 193.66.88.129 - 193.66.88.190

No other changes.

this must change

-1

-3.5

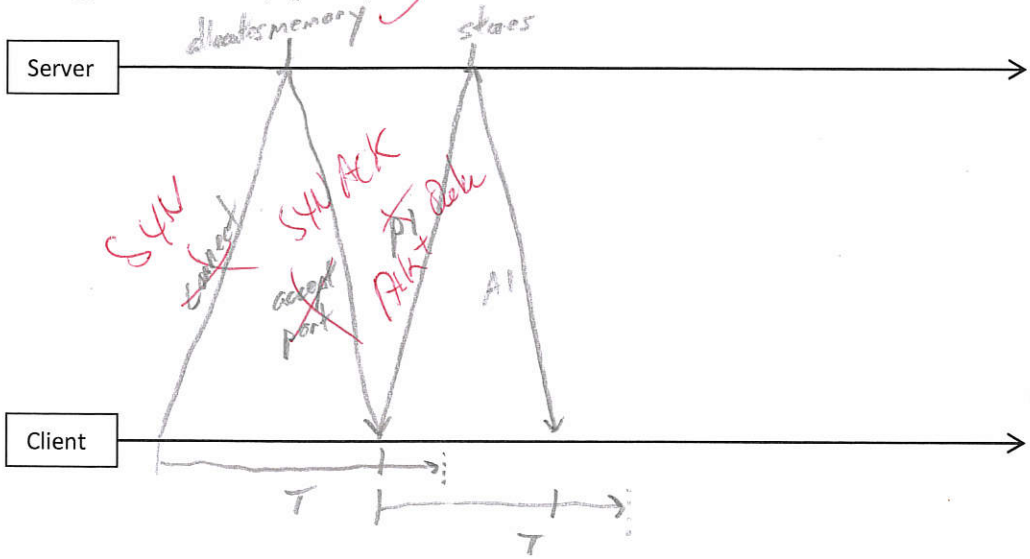
Problem 2: Transport Services

1. Compare differences between TCP and Selective-Repeat and Go-Back-N: **(6 points)**

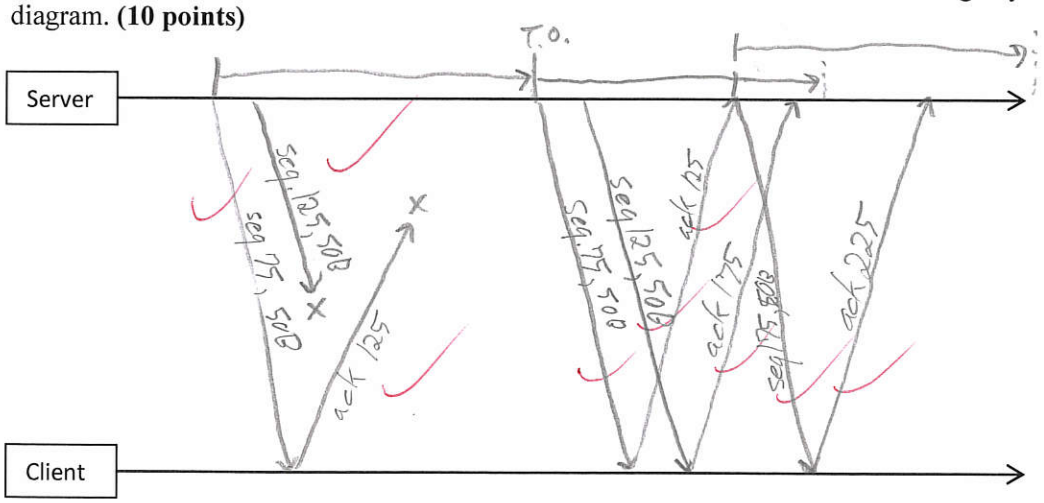
Criteria	Go-Back-N	Selective Repeat	TCP
Acks	cumulative acks ✓	individual acks ✓	cumulative acks ✓
Timer	oldest unacked packet ✓	1 timer per packet ✗	oldest packet ✗
Timeout Action	retransmission of oldest + all unacked packets ✓	resends that packet ✗	if T.O. before ack, packets resent ✗
Sequence number	0 - n packets ✗	0 - n packets ✗	packet size ✗

-4.5

2. Draw a time-space diagram to illustrate message exchanges between a client and a server when the client establishes a new connection with a server. You must include timers in your illustration and annotate the diagram with information to show when the server sets up the memory buffers for storing received data. **(5 points)**

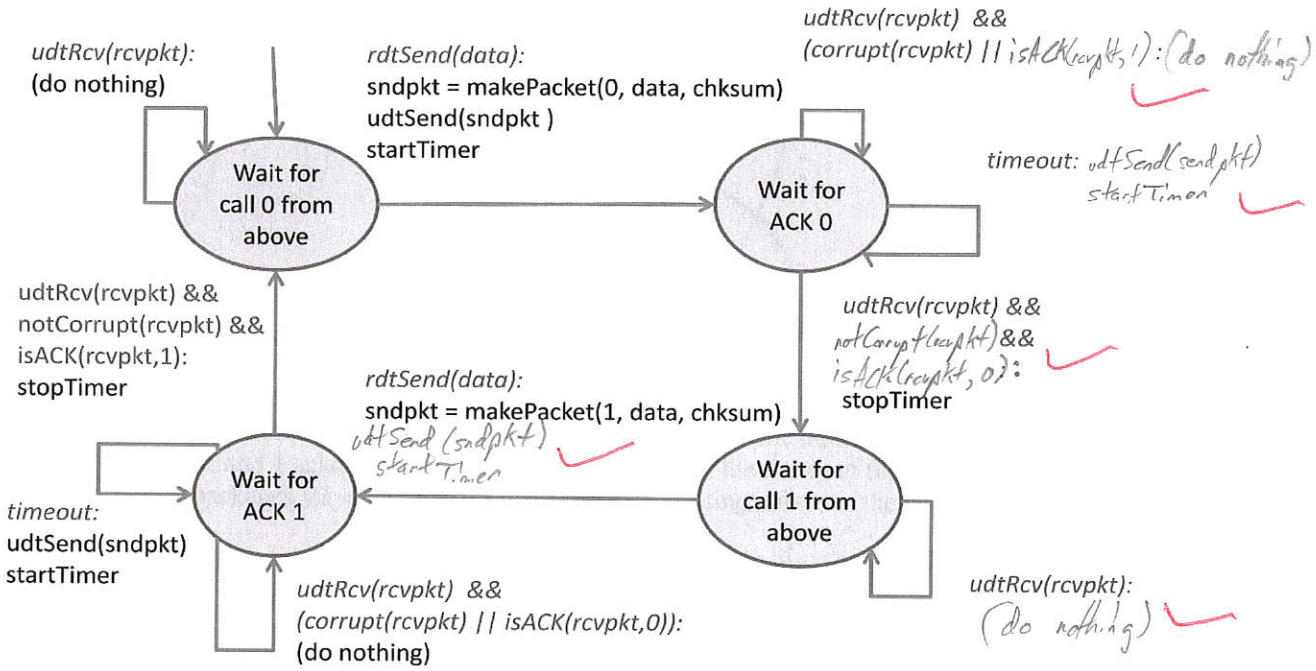


3. In a communication between a server and a client over TCP, the server sends a message of 150 bytes to the client. Assume that the segment size is 50 bytes for the payload. Furthermore, assume that the initial sequence number for the sender is 75, the sender's window size is 2, and that the second segment and the first acknowledgment are lost. Draw a time-space diagram that illustrates the communication between sender and receiver to transmit the entire message. You must clearly label TCP sequence numbers and acknowledgments as well as all events that are occurring in your diagram. **(10 points)**

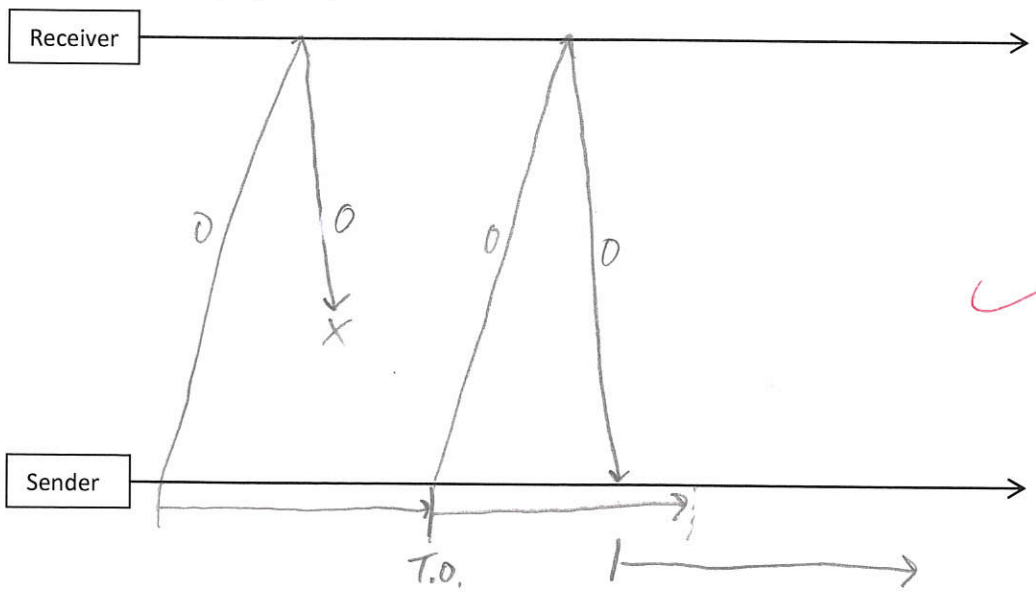


4. Consider the transmission protocol rdt3.0 for reliable transfer over channel with loss & bit error. This protocol alternates between two different sequence and acknowledgment numbers of 0 and 1, meaning if the sender transmits packet 0, the next packet that the sender transmits will be packet 1, and so forth.

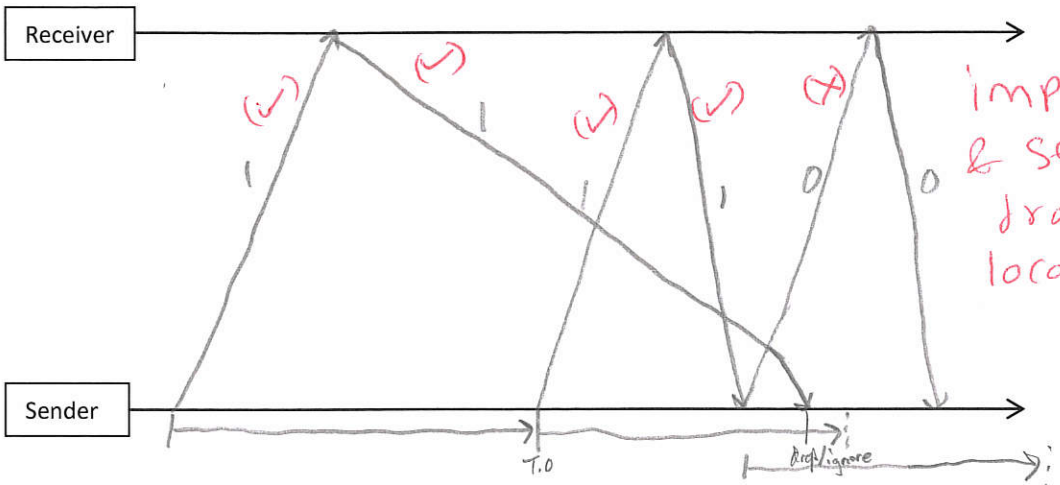
A. Complete the state machine for the sender below. **(10 points)**



B. Draw a space-time diagram illustrating the sequence of the following events: The sender transmits the first segment and it is received. The receiver responds by sending the ACK which is lost. The sender retransmits the segment which is received. The receiver responds by sending the ACK which the sender receives. **(10 points)**



C. Extend the diagram with one more message exchanges between sender and receiver to show how sender and receiver will recover from a delayed ACK. **(5 points)**



improper labeling & seq 0 starts from wrong location (-2)

5. How long does it take to send a 1.5 MB file from host A to host B over a network if the sender transmits at a rate of 500Kbps? Assume a stop-and-wait protocol and a segment size of 2 KB. Furthermore, assume that RTT is fixed at 150ms (milliseconds) for the duration of the transmission and that 5 segments and 1 acknowledgment is lost. Assume that the time-out for lost or unacknowledged packages stays fixed at 160ms. Ignore processing delays at the hosts and routers.

   a. Compute the time it takes without any loss of data packets on the network. **(5 points)**

$1.5MB = 1536KB \cdot \frac{8b}{1B} \Rightarrow 12288Kb$

$\Rightarrow 2KB \cdot \frac{8b}{1B} = 16Kb \Rightarrow \frac{12,288Kb}{16Kb} = 768 \text{ segments}$

$\frac{16Kb}{500Kbps} = 0.032 \text{ sec} = 32ms$

$150(768) + 32(768) = 139,776ms \Rightarrow 139.7 \text{ sec}$

   b. Compute the time it takes with the specified loss of data packets on the network. **(5 points)**

768 segments

32ms delay

77
41
794 segs

→ those add delay

$150(794) + 32(794) + 6(160) = 141,825ms \Rightarrow 141.8 \text{ sec}$

(-2)

c. How will the time changes if the stop-and-wait protocol is replaced with a pipelined protocol such as go-back-N that uses a constant window size of 5, assuming an ideal situation with no loss or error of data segments and acknowledgments. **(5 points)**

$\frac{768}{5}$ segments = 153.6 ≈ 154 seeds

32 ms delay

150(154) + 32(154) = 28,028 ms ⇒ 28 sec

-2

not quite.

Problem 4: All Layer Services

-2

Fill in the gabs **(1 points)**:

1. Routers operate at layers network (3) & below, switches operate at layers link (2) & below, and hubs operate at layers physical (1).
2. How many queries are generated to resolve ssh1.cs.uwf.edu using the iterative model: 4 Assume DNS servers do not cache root server information and that Computer Science runs its own DNS server.
3. The PDU that is encapsulated in a datagram is a packet. X
4. The TCP/IP stack consists of 5 different network layers.
5. Circuit switched networks use multiplexing for sharing a data link to sending data over a network.
6. The network layer uses an IP address to identify a host, the application layer uses a port to identify a process.
7. Assume an MTU of 600 bytes for a data link between two routers. The router receives a datagram of 1500 bytes in size with a 24 byte header size. The router generates 3 fragments to transport data. For the second fragmented datagram, it must set the offset to 72.
8. A TCP server supporting *n* simultaneous connection each from a different host machine has n+1 sockets including the server socket bound to n+1 ports. A client connecting to the server has 1 sockets bound to 1 ports.

-4

Zach Douglass 3/15/2011 100-42 ⇒ 58

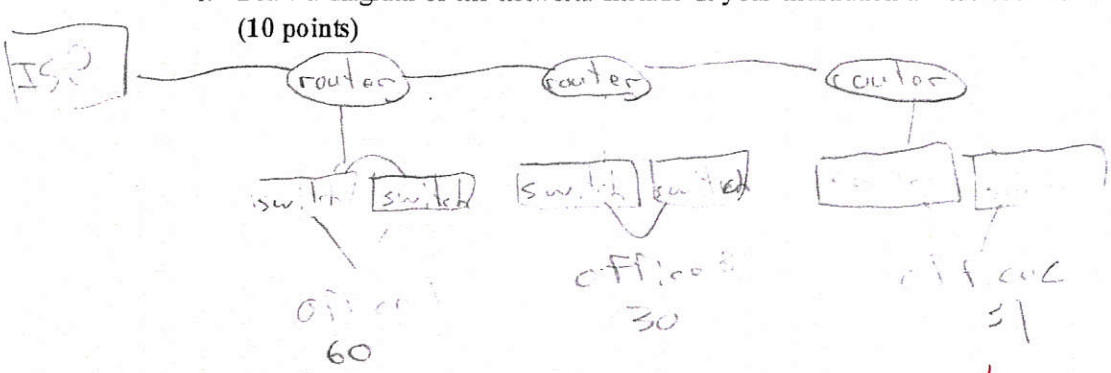
Spring 2012 System & Networks II Midterm Exam

Problem 1: Subnettting, IP Addressing, and Network Components

A LAN needs to be created connecting computers from multiple offices in a building. Office A has 60 computers, Office B has 30 computers, and Office C has 31 computers.

Create a LAN consisting of routers and 24-port switches that supports communication among computers. The network needs to be built so that traffic between computers within each office does not propagate to computers from a different office.

1. Draw a diagram of the network. Include in your illustration a wide-area connection to the Internet. **(10 points)**



each office has separate network and address range

2. The entire LAN is given the following network address: 193.66.88.128. Assign each subnet its range of IP addresses along with subnet mask information **(5 points)**

- incorrect masks
- incorrect range of addr.

-5

3. Assume that Office B and Office C merge along with their corresponding networks. Briefly describe the changes in the network configuration including network addressing, network topology, etc. **(5 points)**

Well first there is no need for a router for the 3rd office. Both combined would still a 3rd switch. Office B/C computers. The topology will change because office B/C can see part of...

Could create a single subnet

- address range changes
- subnet mask changes

-3

1

-8

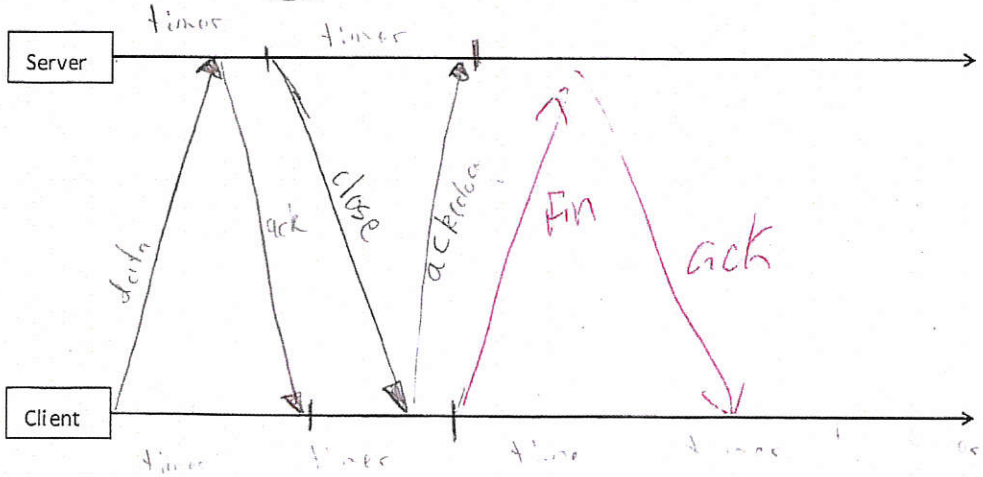
Problem 2: Transport Services

1. Consider TCP compare differences between TCP and Selective-Repeat and Go-Back-N respectively: **(5 points)**

Criteria	Go-Back-N	Selective Repeat	TCP
ACKs	Cumulative Acks ✓	Individual acks ✓	Individual Acks ✗ cumm acks
	for oldest packet ... ✓	resends all within the window ✓	... ✓
	... RECV = 1	Sender receiving window RECV > 1	... window RECV > 1

+C.5

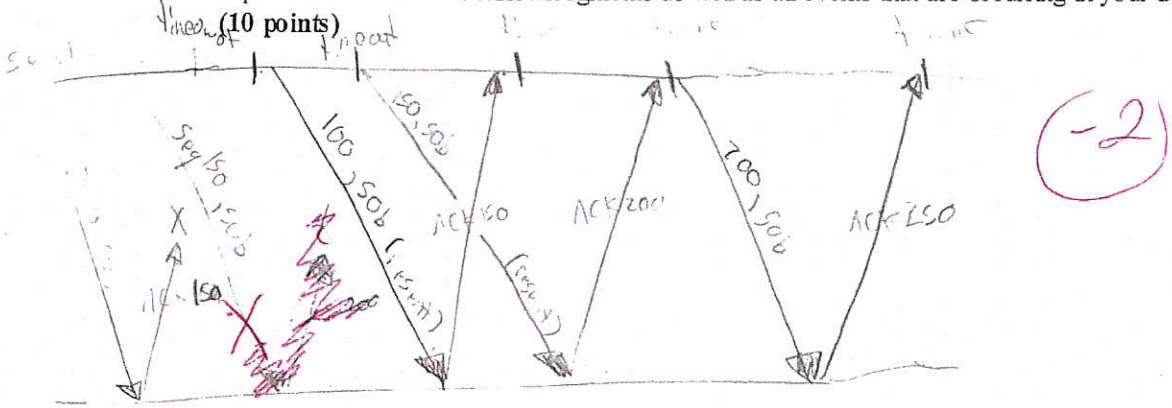
2. Draw a time-space diagram to illustrate message exchanges between a client and a server when the server closes the connection. Be sure to include timers in your illustration. **(5 points)**



-2

-2.5

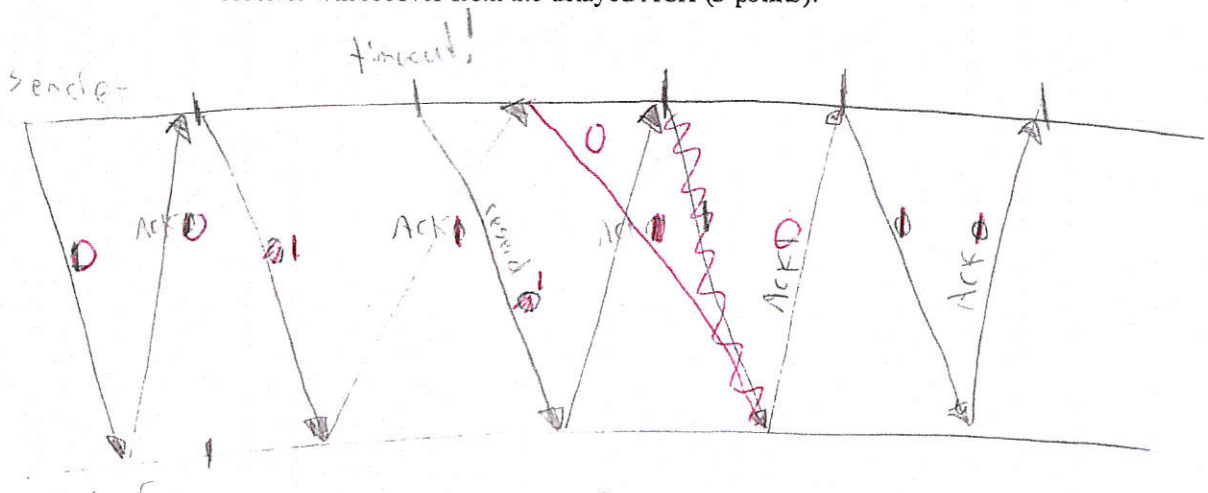
3. In a communication between a server and a client over TCP, the server sends a message of 150 bytes to the client. Assume that the segment size is 50 bytes for the payload. Furthermore, assume that the initial sequence number for the sender is 100, the sender's window size is 2, and that the second segment and the first acknowledgment are lost. Draw a time-space diagram that illustrates the communication between sender and receiver to transmit the entire message. You must clearly label sequence numbers and acknowledgments as well as all events that are occurring in your diagram. **(10 points)**



-2

4. Consider the transmission protocol rdt3.0 for reliable transfer over channel with loss & bit error. This protocol alternates between two different sequence and acknowledgment numbers of 0 and 1, meaning if the sender transmits packet 0, the next packet that the sender transmits will be packet 1, and so forth. Now consider the following sequence of events. The sender transmits a message and it is received. The receiver responds by sending the ACK which is also received by the sender. The sender then sends another packet, which is also received by the receiver. The receiver responds by sending another ACK that will be delayed beyond the time limit allocated by the sender.

   A. Draw a space-time diagram illustrating the sequence of events described above. Then extend the diagram with two more message exchanges between sender and receiver to show how sender and receiver will recover from the delayed ACK **(5 points)**.



start at 0
later delayed ack comes, send packet

-2

-4

rdt 3.0

How ?

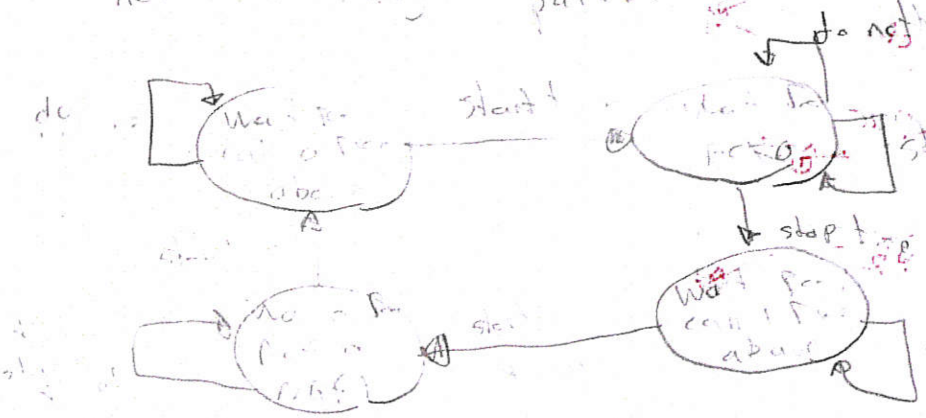
B. Describe a situation in which the protocol may fail to deliver data reliably – data will not be completely received on the receiver side – because of the delayed ACK. Hint: make the delay very long and setup a situation where the delayed ACK causes a lost packet to be accidentally acknowledged **(10 points)**.

-5

If the timer is set too short, and there's a slow connection there may not be enough time for the ACK to come back thus causing it to be resent. If a packet is accidentally acked the ... could be ... the same packet with ... 0 was sent ... then a delayed ack with Ack 0 ... would ACK ... packet

?

We are looking at one sender + receiver not between sender + receivers



5. How long does it take to send a 3 MB file from host A to host B over a network if the sender transmits at a rate of 500Kbps? Assume a stop-and-wait protocol and a segment size of 2 KB. Furthermore, assume that RTT is fixed at 150ms (milliseconds) for the duration of the transmission and that two segments and 1 acknowledgment is lost. Assume that the time-out for lost or unacknowledged packages is set to 300ms. Ignore processing delays at the hosts. Show intermediate steps of your solution for partial credit. **(5 points)**

$\frac{3 \times 10^6}{2 \times 10^3} = 1500$ segments, +2 lost, +1 un ACK → 1503

2·1024·8 / R: 2 KB * 8 / 500k bps = 32 ms → 32.768 ms (-1)

Timeouts, Trans Delay, propagation

3(300 ms) + 1500(32 ms) + 1500(150 ms) = 50.4 sec

You need to add RTT! (-1)

-7

Problem 3: True – False and Fill-in the Blank

That's not exc!

For the three questions below, mark all answers that apply. If necessary, describe any assumptions you made in arriving at your answers **(5 points each)**.

1) Which of the following protocols/services are not needed to compute a trace route for a host A on the Internet from a computer in UWF's System & Security lab using the destination host's IP address?
   a) Transmission Control Protocol
   b) Internet Control Message Protocol
   c) Dynamic Host Configuration Protocol
   d) Domain Name System
   e) Network Address Translation

A C (-2)

2) Which of the following are true statements about routers and switches?
   a) Routers operate at layer 1-2 in the protocol stack.
   b) A switch examines the MAC address in a frame to determine the output port on the switch for sending the frame.
   c) A router connects networks with the same network Ids.
   d) Switches may broadcast or forward PDUs to its output ports.
   e) Routers use a forwarding table to direct PDUs to its output ports.

B C E ✓

3) Which of the following are true statements about packet-switched networks?
   a) They offer connection-oriented services that set up a limited number of dedicated connections at a constant bit rate.
   b) Data for a single connection are routed on the same path through a network.
   c) Packet-switched networks are extremely reliable for data transmission.
   d) Packet-switched networks use TDM for sending packets over a network link.
   e) They are used predominantly in today's Internet for transmitting data.

A D E (-2)

Fill in the gabs **(1 points)**:

1. RIP uses the Distance Vector algorithm and OSPF uses the link state algorithm for computing a router's forwarding table.
2. The PDU that is encapsulated in a datagram is a ~~Unit~~ segment (-1)
3. The TCP/IP stack consists of 5 different network layers.
4. The network layer uses ~~Port~~ IP address (-1) as addresses (identifiers), the application layer uses Data Port (-1) as addresses (identifiers), and the data link layer uses ~~Frame~~ MAC (-1) as addresses (identifiers).
5. Assume an MTU of 600 bytes for a data link between two routers. The router receives a datagram of 1500 bytes in size with a 16 byte header size. The router generates 23 fragments to transport data. For the second fragmented datagram, it must set the offset to ~~885~~ 73 (-2).

-10

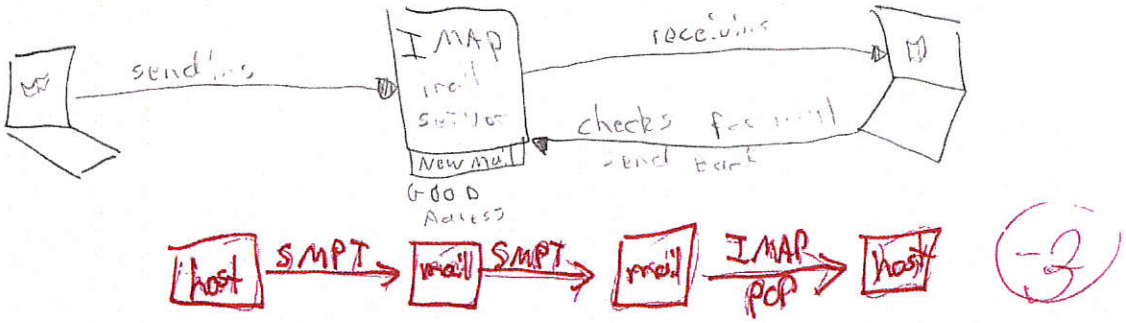
6. IPv6 tunneling avoids ~~loss/corruption~~ Protocol Translation (-1) when transmitting datagrams between IPv4 and IPv6 network routers in the Internet.

7. The router can act as a ~~switch~~ relay agent (-1) to send DHCP messages across two different networks, to enable a single DHCP server to assign IP address to machines from both networks.

8. A TCP server supporting *n* simultaneous connection each from a different host machine has (-1) ~~TCP~~ n+1 sockets including the server socket bound to n+1 (-0.5) ports. A client connecting to the server has ~~TCP~~ 1 (-1) sockets bound to ~~n~~ 1 (-1) ports. (-3.5 total)

Problem 4: Application Layer Services

1. In a diagram, illustrate how SMTP and IMAP transport email messages between two hosts in a wide-area network. **(5 points)**.



(-3)

2. Draw a query chain to describe the steps that a DNS server at UWF performs to lookup an IP address for a host with the host name ssh1.ihmc.us. Assume that the IP address for host and domains are not cached. Use the recursive model for DNS resolution as discussed in class **(5 points)**.

(-10.5)