**CNT 4104 Software Project Computer Networks - Assignment 2**

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*This assignment encompasses material from in-lecture presentations, online resources, and the textbook. It encompasses topics covered in the initial three weeks. Kindly transcribe the answers and consolidate the content into* ***a single file****, which could be in either Word or PDF format. You can use typing, handwriting, or a writing pad for this purpose. Total: 100 points + 20 extra points*

**Question 1**: Suppose Host A sends two TCP segments back to back to Host B over a TCP connection. The first segment has sequence number 60; the second has sequence number 100.

1. How much data is in the first segment? (5 points)

So to find the first data we subtract the second sequence so

100-60 = 40

40 bytes

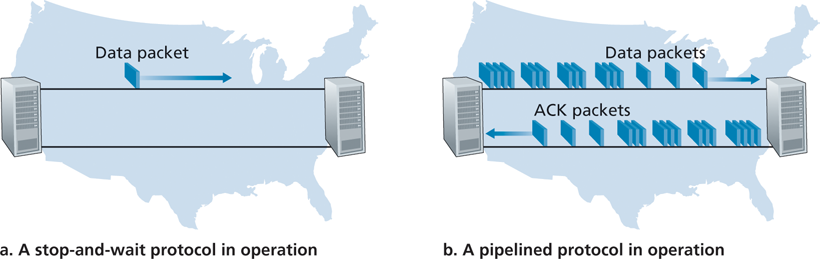
1. Suppose that the first segment is lost but the second segment arrives at B. In the acknowledgment that Host B sends to Host A, what will be the acknowledgment number? (10 points)

The second sequence number will be the ACK so 100

**Question 2**: Suppose that the UDP receiver computes the Internet checksum for the received UDP segment and finds that it matches the value carried in the checksum field. Can the receiver be absolutely certain that no bit errors have occurred? Explain. (15 points)

We cannot be absolutely certain that no bit errors have occurred. Despite UDP providing a decent level of error detection it is still not perfect and this is for multiple reasons. One of them being the way that the internet checksum is calculated. This is due to UDP checksum being more a simple checksum mostly being able to detect common errors. This is most efficient but there are some blind spots that can happen in the process. Another notable reason why we can't be certain is also due to security, because UDP checksum is primarily made for detecting common errors that it doesn't have the security to be tampered with by hackers and malicious actors.

**Question 3**: Consider the cross-country example shown in figure below. How big would the window size have to be for the channel utilization to be greater than 98 percent? Suppose that the size of a packet is 1,500 bytes, including both header fields and data. (15 points)



So we start with the transmission time. We take a look at the textbook it takes RTT = 30 ms ad transmission rate in 10^9

Size of data packet (L) = 1500 bytes = 1500\*5 bits

So we solve for L/R = 1500\*8 bits/10^9 bits/second= 12ms = 0.012 µs

So we solve for 98%

98/100 = N \* 0.012 µs/30ms+ .012 = .98\*30.012 = N\*0.012=

N = 29.41176/.012

N = 2450.98

So it would need a window size of 2451 packets

**Question 4**: Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support at least 60 interfaces, Subnet 2 is to support at least 90 interfaces, and Subnet 3 is to support at least 12 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints. Explain your answers. (15 points)

Subnet 1: so for this one we need a /26 subnet because this has 64 addresses and 62 hosts which is more than the required 60. The address would be 223.1.17.0/26 with a range (223.1.17.0 to 223.1.17.63) get the range because we add the addresses to the first address

Subnet 2: For this one we will use a /25 subnet mask because this has 128 addresses and 126 hosts which is the closet one to the required 90. The address would be 223.1.17.128/25 with a range 223.1.17.128-223.1.17.255.

Subnet 3: This one will use a /28 subnet mask because it has 16 addresses and 14 host making it the closest to the required 12. The address will be 223.1.17.192/28 and the range 223.1.17.192 to 223.1.17.207.

**Question 5**: Consider a subnet with prefix 128.119.40.128/26. Give an example of one IP address (of form xxx.xxx.xxx.xxx) that can be assigned to this network. Suppose an ISP owns the block of addresses of the form 128.119.40.64/26. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form a.b.c.d/x) for the four subnets? Explain your answers. (20 points)

Because it has a submask of /26 as previously stated, it can have an address of 255.255.255.192

The next part is where the ISP owns a block of addresses of form 128.119.40.64/26. Creating 4 new subnets from this block. Because we need 4 subnets to find the hosts per subnet we divide the form of the block of address by 4 which is 64/4 = 16 so we keep increasing by 16 to find each subnet. For the subnet mask of the four subsets, we need to have it as /28 subnet for each subnet

First Subnet: 128.119.40.64/28, The subnet will range from 28.119.40.64 to 128.119.40.79

Second Subnet 128.119.40.80/28. The range will be 128.119.40.80 to 128.119.40.95 (64+16)

Third subnet 128.119.40.96/28. The range will be 128.119.40.96 to 128.119.40.111 (80 + 16)

Fourth subnet 128.119.40.112/28 the range will be 128.119.40.112 to 128.119.40.127 (96 +16)

**Question 6**: Suppose datagrams are limited to 1,500 bytes (including header) between source Host A and destination Host B. Assuming a 20-byte IP header, how many datagrams would be required to send an MP3 consisting of 5 million bytes? Explain how you computed your answer. (20 points)

So the formula for how to get the number of diagrams requirement you need to use this formula

Diagrams required = total data/ (max datagram size/ header size)

So the total data size = 5\*10^6 bytes, max diagram size = 1,500 bytes, and the header is 20 bytes.

So to solve:

5106(1500-20)=510614803,378.38

So the total number of datagrams to send a 5 million byte MP3 file from Host A to Host B is 3,378.

**Question 7 (extra credits)**: Consider the topology shown below (Ignore the IP address that already signed on each node). Denote the three subnets with hosts (starting clockwise at 12:00) as Networks A, B, and C. Denote the subnets without hosts as Networks D, E, and F.

1. Assign network addresses to each of these six subnets, with the following constraints: All addresses must be allocated from 214.97.254/23; Subnet A should have enough addresses to support 250 interfaces; Subnet B should have enough addresses to support 120 interfaces; and Subnet C should have enough addresses to support 120 interfaces. Of course, subnets D, E and F should each be able to support two interfaces. For each subnet, the assignment should take the form a.b.c.d/x or a.b.c.d/x – e.f.g.h/y. (10 points)

Subnet A with 250 interfaces is submask /24 and the address 214.97.254.0/24

Subnet B with 120 interfaces has submask /25 and address 214.97.254.128/25

Subnet C with 120 interfaces has submasl /25 and max address 214.97.254.0/25

Subnet D with 2 interfaces has submask /30 and max address 214.97.254.192/30

Subnet E with 2 interfaces has submask /30 and max address 214.97.254.196/30

Subnet F with 2 interfaces has submask /30 and max address 214.97.254.200/30

b. Using your answer to part (a), provide the forwarding tables (using longest prefix matching, in binary) for each of the three routers (R1, R2 and R3). (10 points)

