R3. Consider a TCP connection between Host A and Host B. Suppose that the

TCP segments traveling from Host A to Host B have source port number x

and destination port number y. What are the source and destination port numbers

for the segments traveling from Host B to Host A?

答：在这种情况下，从主机B到主机A的段将有一个源端口号y和一个目的端口号x。

R7. Suppose a process in Host C has a UDP socket with port number 6789. Suppose both Host A and Host B each send a UDP segment to Host C with destination port number 6789. Will both of these segments be directed to the same

socket at Host C? If so, how will the process at Host C know that these two

segments originated from two different hosts?

答：

是的，这两个UDP段将被指向主机C的同一个套接字，因为它们有相同的目标端口号。

主机C的进程可以使用源IP地址和源端口号字段的组合来唯一地识别每个发件人并作出相应的反应。

R14. True or false?

a. Host A is sending Host B a large file over a TCP connection. Assume

Host B has no data to send Host A. Host B will not send acknowledgments

to Host A because Host B cannot piggyback the acknowledgments

on data.

False.

即使主机B没有数据要发送，只要它收到了主机A的数据，它仍然会向主机A发送确认。这是因为TCP使用了一个确认系统来确保数据的可靠传输。

b. The size of the TCP rwnd never changes throughout the duration of the

connection.

False.

TCP rwnd的大小可以随着连接的进行而改变。

c. Suppose Host A is sending Host B a large file over a TCP connection. The

number of unacknowledged bytes that A sends cannot exceed the size of

the receive buffer.

True.

为了避免接收器不堪重负，发送方必须将其发送的未确认数据量限制在接收器的缓冲区大小。

d. Suppose Host A is sending a large file to Host B over a TCP connection. If

the sequence number for a segment of this connection is m, then the

sequence number for the subsequent segment will necessarily be m + 1.

False.

一个段的序列号不一定是m+1。相反，它是前一个段的序列号与前一个段的数据长度之和。也就是说，后续段的序列号将取决于该段的数据长度和前一个段的序列号。

e. The TCP segment has a field in its header for rwnd.

True.

TCP段头有一个称为接收窗口（rwnd）的字段，用于流量控制。rwnd表示接收方缓冲区内的自由空间量，并被发送方用来限制其发送给接收方的未确认数据量。

f. Suppose that the last SampleRTT in a TCP connection is equal to 1 sec.

The current value of TimeoutInterval for the connection will necessarily

be ≥ 1 sec.

True.

TimeoutInterval = EstimatedRTT + 4 \* DevRTT

如果最后一个SampleRTT等于1秒，那么EstimatedRTT也可能接近1秒，连接的TimeoutInterval必然大于或等于1秒。

g. Suppose Host A sends one segment with sequence number 38 and 4 bytes

of data over a TCP connection to Host B. In this same segment the

acknowledgment number is necessarily 42.

False.

如果主机A通过TCP连接向主机B发送一个序列号为38的段和4个字节的数据，只有当主机B期望接下来收到42至45字节时，该段的确认号才是42。如果主机B期望接下来收到不同范围的字节，那么该段的确认号将是不同的。

R15. Suppose Host A sends two TCP segments back to back to Host B over a TCP

connection. The first segment has sequence number 90; the second has

sequence number 110.

1. How much data is in the first segment?

90 bytes

b. 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?

它将发送一个确认号为91的ACK，表明它已经收到了截至90的所有字节，并期待着收到下一个字节91。

P1. Suppose Client A initiates a Telnet session with Server S. At about the same

time, Client B also initiates a Telnet session with Server S. Provide possible

source and destination port numbers for

1. The segments sent from A to S.

从A发送至S的段的源端口号可以是任何可用的端口号（如49152-65535），而目的端口号将是Telnet端口号，即23。

1. The segments sent from B to S.

从B发送到S的段的源端口号可以是任何可用的端口号，目的端口号也是23。

1. The segments sent from S to A.

从S发往A的网段的源端口号是23，目的端口号是A在发给S的初始网段中使用的端口号。

1. The segments sent from S to B.

从S发往B的段的源端口号也是23，目的端口号是B在其发给S的初始段中使用的端口号。

e. If A and B are different hosts, is it possible that the source port number in

the segments from A to S is the same as that from B to S?

对，如果从A到S的网段中的源端口号与从B到S的网段中的源端口号是相同的，它们是从相同的端口号范围发起的，并且碰巧使用相同的端口号。

f. How about if they are the same host?

如果A和B是同一台主机，那么从A到S的网段中的源端口号就不可能与从B到S的网段相同，因为从主机到服务器的每个连接必须使用不同的源端口号。

P3. UDP and TCP use 1s complement for their checksums. Suppose you have the

following three 8-bit bytes: 01010011, 01100110, 01110100. What is the 1s

complement of the sum of these 8-bit bytes? (Note that although UDP and

TCP use 16-bit words in computing the checksum, for this problem you are

being asked to consider 8-bit sums.) Show all work.

三个8位字节的总和是：10101101

这个和的1s补数是：10101011

0101001011100110101011。是三个8位字节之和的1s补。

Why is it that UDP takes the 1s complement of the sum; that is, why not just use the sum?

UDP使用总和的1s补数来检测传输数据中的错误。取和的1s补码比单纯使用和本身提供了一种更稳健的错误检测方法。

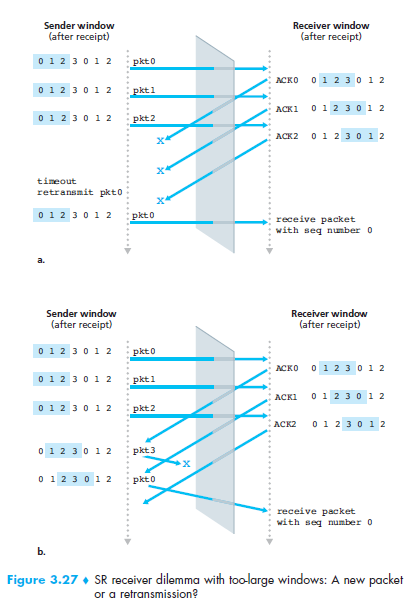
With the 1s complement scheme, how does the receiver detect errors? Is it possible that a 1-bit error will go undetected? How about a 2-bit error?

在1s补码方案下，1位的错误不会不被发现。这是因为1位错误将导致不同的校验和，这将被接收器检测到。然而，2位的错误有可能不被检测到。

P23. Consider the GBN and SR protocols. Suppose the sequence number space is

of size k. What is the largest allowable sender window that will avoid the

occurrence of problems such as that in Figure 3.27 for each of these protocols?



对于GBN协议，允许的最大发件人窗口是N <= min(k/2, B)。这确保了发送方不会发送超过接收方可以处理的数据包。

对于SR协议，允许的最大发件人窗口是N <= min(k, B)。这确保了发送方不会发送超过接收方可以处理的数据包，也确保了发送方可以利用协议的选择性确认功能，发送多达2N-1个数据包。

P24. Answer true or false to the following questions and briefly justify your

answer:

a. With the SR protocol, it is possible for the sender to receive an ACK for a

packet that falls outside of its current window.

True.

通过SR（选择性重复）协议，接收器可以不按顺序确认数据包。因此，发送方有可能收到一个不在其当前窗口内的数据包的ACK。

b. With GBN, it is possible for the sender to receive an ACK for a packet that

falls outside of its current window.

False.

在GBN（Go-Back-N）协议中，发送方只接受当前窗口中最古老数据包的确认。如果发送方收到一个在其当前窗口之外的数据包的确认，它将丢弃该确认。

c. The alternating-bit protocol is the same as the SR protocol with a sender

and receiver window size of 1.

False.

交替比特协议是一个简单的协议，它使用一个比特来表示一个数据包是否被正确接收。它不使用窗口法或选择性确认法。相反，SR协议使用窗口和选择性确认来提高数据传输的效率。

d. The alternating-bit protocol is the same as the GBN protocol with a sender

and receiver window size of 1.

False.

交替比特协议是一个简单的协议，它使用一个比特来表示一个数据包是否被正确接收。它不使用窗口法或选择性确认法。相反，GBN协议使用窗口法来提高数据传输的效率，在收到确认之前可以发送多个数据包。

P26. Consider transferring an enormous file of L bytes from Host A to Host B.

Assume an MSS of 536 bytes.

a. What is the maximum value of L such that TCP sequence numbers are not

exhausted? Recall that the TCP sequence number field has 4 bytes.

TCP序列号字段有4个字节，这意味着最大的序列号是2^32 - 1。每个段的MSS是536个字节，所以：

2^32 - 1 / 536 = 7,993,182（段）

在不耗尽序列号的情况下，可以传输的最大文件大小是：

L = 7,993,182 \* 536 = 4,289,405,152（字节）

因此，L的最大值约为4.29GB

b. For the L you obtain in (a), find how long it takes to transmit the file.

Assume that a total of 66 bytes of transport, network, and data-link header

are added to each segment before the resulting packet is sent out over a

155 Mbps link. Ignore flow control and congestion control so A can pump

out the segments back to back and continuously.

传输文件所需的总段数为：

l / mss = l / 536

传输、网络和数据链路头的总字节数为每段66字节。因此，文件中的总字节数，包括头文件，是：

(l / mss) \* (mss + 66) = (l / 536) \* 602

传输文件所需的时间是：

时间=（L/MSS）\*（MSS+66）/链接速度

假设链接速度为155Mbps，则传输文件所需的时间为：

时间=（L/MSS）\*（MSS+66）/（155\*10^6）秒

代入(a)部分中得到的L的值，我们得到：

时间 = (4,289,405,152 / 536) \* (536 + 66) / (155 \* 10^6) 秒= 220.47秒

因此，传输该文件大约需要220.47秒，即3分40秒。

P27. Host A and B are communicating over a TCP connection, and Host B has

already received from A all bytes up through byte 126. Suppose Host A then

sends two segments to Host B back-to-back. The first and second segments

contain 80 and 40 bytes of data, respectively. In the first segment, the

sequence number is 127, the source port number is 302, and the destination

port number is 80. Host B sends an acknowledgment whenever it receives a

segment from Host A.

a. In the second segment sent from Host A to B, what are the sequence number, source port number, and destination port number?

第二段的序列号是207，源端口号是302，目的端口号是80。由于第一段包含80字节的数据，第二段的序列号是第一段的序列号（127）和第一段的数据字节数（80）之和。

b. If the first segment arrives before the second segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number, the source port number, and the destination port number?

如果第一段在第二段之前到达，第一段到达的确认中的确认号是207，源端口号是80，目的端口号是302。该确认号是下一个预期的序列号，也就是第二段的序列号。

c. If the second segment arrives before the first segment, in the acknowledgment of the first arriving segment, what is the acknowledgment

number?

如果第二个网段先于第一个网段到达，在第一个到达的网段的确认中，确认号是127。这是因为主机B已经收到了到126字节的所有字节，所以下一个预期字节是127字节。

d. Suppose the two segments sent by A arrive in order at B. The first acknowledgment is lost and the second acknowledgment arrives after the first time-out interval. Draw a timing diagram, showing these segments and all other

segments and acknowledgments sent. (Assume there is no additional packet

loss.) For each segment in your figure, provide the sequence number and

the number of bytes of data; for each acknowledgment that you add, provide the acknowledgment number.

