

# ITS323 – Quiz 7

Introduction to Data Communications, Semester 1, 2011

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## Question 1 [6 marks]

Write the last 8 digits of your ID in the spaces below *backwards*. (E.g. if my ID is 5222123456, then I would write 6 5 4 3 2 1 2 2).

\_\_\_\_ . \_\_\_\_ . \_\_\_\_ . \_\_\_\_

Above is the IP address of your computer. Use it to answer the following questions.

- (a) If your IP address has subnet mask [ /8 | /16 | /24 | /24 | /8 | /16], then what is the [ network | network | network | directed broadcast | directed broadcast | directed broadcast] address for the subnet your computer is attached to? [2 marks]

**Answer.** *In the answers the example ID of 5222123456 will be used. Hence the IP address is 65.43.21.22. The subnet mask indicates where the IP address is split between the network and host portions. The two special case addresses, network and directed broadcast, are found by using the same network portion of the IP address and setting the host portion to all 0's and all 1's, respectively. The subnet masks in the question indicate the split is either after the 8th bit, 16th bit or 24th bit (/8, /16, /24). In dotted decimal notation these correspond to the first dot, second dot and third dot, respectively. The answers are:*

Mask	Network	Directed Broadcast
/8	65.0.0.0	65.255.255.255
/16	65.43.0.0	65.43.255.255
/24	65.43.21.0	65.43.21.255

- (b) Assume your computer is initially the only IP host in the subnet. Then a router with an IP address with subnet mask [ 255.255.192.0 | 255.255.255.128 | 255.255.255.224 | 255.255.128.0 | 255.255.224.0 | 255.255.255.192] is attached to the same subnet. Now how many more IP devices can be attached to the subnet? [2 marks]

**Answer.** *The subnet mask indicates how many bits are allocated for the network and host portions. The number of bits for the host portion limits the number of IP devices that can be attached to the subnet. With  $n$  bits in the host portion there are  $2^n$  possible values. Two of these values are reserved for special addresses (all 0's and all 1's in host portion) and therefore cannot be used for IP devices. Hence there are  $2^n - 2$  possible IP addresses for devices, two of which are in use (your computer and router). Hence  $2^n - 4$  more devices can be attached.*

*$n$  is found from the subnet mask by converting the mask to binary and counting the number of 0 bits. The answers are:*

Mask	Mask (/)	Host bits	Other devices
255.255.224.0	/19	13	$2^{13} - 4 = 8188$
255.255.192.0	/18	14	$2^{14} - 4 = 16380$
255.255.128.0	/17	15	$2^{15} - 4 = 32764$
255.255.255.128	/25	7	$2^7 - 4 = 124$
255.255.255.192	/26	6	$2^6 - 4 = 60$
255.255.255.224	/27	5	$2^5 - 4 = 28$

- (c) Write an IP address that is a [ local broadcast | local broadcast | local broadcast | loopback | loopback | loopback] address *and* explain what happens if your computer sends an IP datagram to that address. [2 marks]

**Answer.** *The local broadcast address is 255.255.255.255. Sending a datagram to it means every IP device on your currently attached subnet will received a copy of the datagram.*

*A loopback address is 127.0.0.1 (or any address starting with 127, but not including 127.0.0.0 or 127.255.255.255). Sending a datagram to it your computer will receive the datagram, i.e. send to yourself.*

## Question 2 [4 marks]

Draw a diagram that illustrates the TCP connection establishment process, assuming a client selects an initial sequence number of [ 6432 | 9877 | 102 | | ], and the server selects [ 4323 | 901 | 3376 | | ]. For each TCP segment, clearly indicate the value of the Sequence Number field, the Acknowledgement Number field (if relevant) and the flags that are set to 1.

**Answer.** *Assuming the ISN chosen by the client is denoted as “ISNclient” and by the server is “ISNserver” then the connection establishment is the following three messages:*

*Segment 1 (client to server): SYN flag set, SeqNum = ISNclient*

*Segment 2 (server to client): SYN flag set, SeqNum = ISNserver, ACK flag set, AckNum = ISNclient + 1*

*Segment 3 (client to server): ACK flag set, AckNum = ISNserver + 1*

*For example, if ISNclient is 6432, then Segment 1 contains Sequence number 6432, Segment 2 contains Sequence number 4323 and Ack number 6433, and Segment 3 contains Ack number 4324.*

*Note that both Sequence Number and Acknowledgement number have a value in all segments. The above only shows there value if the value is of use to the receiver (i.e. if the value is not shown then the receiver doesn't care about the value).*

## Question 3 [4 marks]

Draw a diagram that illustrates the TCP connection establishment process, assuming a client selects an initial sequence number of [ 6432 | 9877 | 102 | | ], and the server selects [ 4323 | 901 | 3376 | | ]. For each TCP segment, clearly indicate the value of the

Sequence Number field, the Acknowledgement Number field (if relevant) and the flags that are set to 1.

**Answer.** Assuming the ISN chosen by the client is denoted as “ISNclient” and by the server is “ISNserver” then the connection establishment is the following three messages:

Segment 1 (client to server): SYN flag set, SeqNum = ISNclient

Segment 2 (server to client): SYN flag set, SeqNum = ISNserver, ACK flag set, AckNum = ISNclient + 1

Segment 3 (client to server): ACK flag set, AckNum = ISNserver + 1

For example, if ISNclient is 6432, then Segment 1 contains Sequence number 6432, Segment 2 contains Sequence number 4323 and Ack number 6433, and Segment 3 contains Ack number 4324.

Note that both Sequence Number and Acknowledgement number have a value in all segments. The above only shows their value if the value is of use to the receiver (i.e. if the value is not shown then the receiver doesn't care about the value).

## Question 4 [4 marks]

Assume host A has established a TCP connection to host B. Host A chose initial sequence number of [ | | | 521 | 679 | 800]. No data has been sent yet.

- (a) Host A sends 500 Bytes of data in one segment to B. B responds with an acknowledgement, but with no data. What flags are set in the segment sent by B? [1 mark]

**Answer.** Only the ACK flag. (Other flags could potentially be set, such as PSH, but there is no mention in the question that urgent delivery is required).

- (b) In part (a), what is the sequence number in the segment sent by A? [1 mark]

**Answer.** The sequence number is the initial sequence number plus 1, e.g. 522 or 680 or 801.

- (c) Host B sends 2000 Bytes of data in one segment to A. And then B sends another [ | | | 3000 | 2000 | 4000] Bytes in a segment to A. A then acknowledges all data received by sending a single segment with ACK number [ | | | 8043 | 12345 | 9647]. What was the initial sequence number chosen by B? [2 marks]

**Answer.** The ACK number will be the initial sequence number plus 1 plus the data size. So if 5000 Bytes of data has been received and A sends ACK number 8043, then the initial sequence number must have been 3042. (Alternative answers are 8344 and 3646.)

**Question 5** [4 marks]

Assume host A has established a TCP connection to host B. Host A chose initial sequence number of [ | | | 521 | 679 | 800]. No data has been sent yet.

- (a) Host A sends 500 Bytes of data in one segment to B. B responds with an acknowledgement, but with no data. What flags are set in the segment sent by B? [1 mark]

**Answer.** *Only the ACK flag. (Other flags could potentially be set, such as PSH, but there is no mention in the question that urgent delivery is required).*

- (b) In part (a), what is the sequence number in the segment sent by A? [1 mark]

**Answer.** *The sequence number is the initial sequence number plus 1, e.g. 522 or 680 or 801.*

- (c) Host B sends 2000 Bytes of data in one segment to A. And then B sends another [ | | | 3000 | 2000 | 4000] Bytes in a segment to A. A then acknowledges all data received by sending a single segment with ACK number [ | | | 8043 | 12345 | 9647]. What was the initial sequence number chosen by B? [2 marks]

**Answer.** *The ACK number will be the initial sequence number plus 1 plus the data size. So if 5000 Bytes of data has been received and A sends ACK number 8043, then the initial sequence number must have been 3042. (Alternative answers are 8344 and 3646.)*