Solutions to Assignment 5

Question 1

If the PC received an IP address, netmask and name server it would enable the interface. But without a default route it would only have a route to the network the interface was on. It's unlikely the web server's network would be on the same network and thus the computer would not have a route for it.

An ICMP "Destination Unreachable" (Type 3) with Code 0 ("Network Unreachable") message would most likely be generated although it might not be seen as an actual packet since there is no need to to sent it to another host.

Question 2

A UDP header is a sequence of four unsigned 16-bit integers (source and destination ports, length and checksum) in big-endian order. The decimal values given in the question are 5179, 53, 36, and 0. In hex notation this would be:

```
14 3B 00 35 00 24 00 00
```

The UDP length field includes the UDP header. It's possible to interpret the "payload" length mentioned in the question as not including the header. In this case the length field in the UDP header would be larger by 8, or `0x2c`.

Question 3

The RFC 793 TCP specification' state transition diagram does not show any frames with both the FIN and ACK bits set[1]. However, after sending a frame with the FIN bit set the TCP state machine moves to state:

- **LAST ACK** (if receive a FIN), or

---
[1]In practice this happens when the TCP state machine transitions directly from the **ESTAB** to the **LAST ACK** states by sending a frame with both FIN and ACK set.

- **FIN WAIT-1** (if the application calls CLOSE).

From either state we would expect to receive a frame with the ACK bit set.

The state transition diagram shows that after sending a frame with only the SYN bit set the TCP state machine moves to the **SYN SENT** state. In this state it is possible to receive frames with either just the SYN or both the SYN and ACK bits set.

Question 4

If the Sequence value is set to 105 and the Length value is zero then 105 bytes have been sent thus far in the direction the frame was sent.

If the Acknowledge value was 3235 then 3235 bytes will have been received the other direction.

These answers assume the simplified description in the lecture notes. The Sequence and Acknowledge values actually start at random values and the Acknowledgement values are incremented by 1 to acknowledge receipt of the SYN and FIN frames. There is also an ambiguity as to whether the word "last" in this question means "most recent" or "final." Because of this, values that are 1 less than the above values will also be marked as correct.

Question 5

To compute the 1's complement checksum we take each pair of bytes as a 16-bit unsigned number and add them up:

```
111   <- carries
9258
0120
0001
0363
6f6d
0000
----
10649
```

The sum is 0x10649 (you could also use a calculator with hex arithmetic). The we add the MS 16 bits (1) to the LS 16 bits to give 0x064A. In binary this is 0000 0110 0100 1010. Inverting all the bits gives us 1111 1001 1011 0101 or 0xF9B5 (with a calculator you can XOR with 0xFFFF). This is the checksum.

Question 6

(a) The graph of the network is:
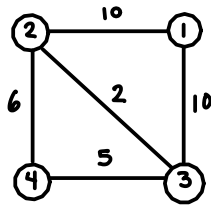
(b) From router 1, the shortest paths to each router are as follows:

To Router	Shortest Path	Cost
2	2	10
3	3	10
4	3, 4	15

This leads to the following "routing table" for router 1 where the first column would be the destination network(s) directly connected to the specified router and the second column specifies that the interface to be used is the one connected to the specified router:

Destination Network	Use Interface
2	2
3	3
4	3

From router 4, the the shortest paths to each router are as follows:

To Router	Shortest Path	Cost
1	3, 1	15
2	2	6
3	3	5

Destination Network	Use Interface
1	3
2	2
3	3

Question 7

Wireshark's HTTP protocol display of the the initial request is:

```
⊟ Hypertext Transfer Protocol
  ⊞ GET / HTTP/1.1\r\n
    Host: www.bcit.ca\r\n
    User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64; rv:28.0) Gecko/20100101 Firefox/28.0\r\n
    Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8\r\n
    Accept-Language: en-US,en;q=0.5\r\n
    Accept-Encoding: gzip, deflate\r\n
    DNT: 1\r\n
    Connection: keep-alive\r\n
    \r\n
    [Full request URI: http://www.bcit.ca/]
    [HTTP request 1/5]
    [Response in frame: 17]
    [Next request in frame: 19]
```

from which:

(a) version 1.1 of HTTP is used

(b) the request is for host www.bcit.ca

(c) the client software is Mozilla/5.0 ldots Firefox/28.0

The initial response is:

```
⊟ Hypertext Transfer Protocol
  ⊞ HTTP/1.1 200 OK\r\n
    Server: nginx\r\n
    Date: Thu, 08 May 2014 02:14:04 GMT\r\n
    Content-Type: text/html\r\n
    Transfer-Encoding: chunked\r\n
    Connection: keep-alive\r\n
    Content-Encoding: gzip\r\n
    \r\n
    [HTTP response 1/5]
    [Time since request: 0.140269000 seconds]
    [Request in frame: 9]
    [Next request in frame: 19]
    [Next response in frame: 33]
```

from which:

(a) the server software is nginx

(b) the content-type is text/html; yes is it one of the types specified in the request

(c) the content-encoding is gzip; yes is it one of the types specified in the request

Question 8

The HTML file would contain the following:

```
I go <a href="http://www.bcit.ca/">here</a>.
```

and one possible rendering by a browser would be:

I go here.