CS 372 Introduction to Computer Networks
Self-Check Exercises: Lecture 26 **Solutions**

1) What reliability services does the IP network-layer protocol implement?
   Header Checksum! But no real reliability services.

2) What are the minimum and maximum sizes of the IP header, in bytes?
   Minimum: No options, Length = 5. 5x4 = 20 bytes.
   Maximum: Max options, Length = 15. 15x4 = 60 bytes.

3) Theoretically, what is the maximum number of bytes of "payload" (actual application data) that can be transmitted in an IP datagram carrying a TCP segment?
   65495 bytes.
   The "length" field of the IP datagram header is 16 bits, so the maximum datagram size is 65,535 bytes.
   The TCP header and the IP datagram header are each at least 20 bytes.
   65535 – 40 = 65495
   (It would not be practical to send a datagram of this size through the internet)

4) Why can't we use hardware addresses for our network address.
   IP addresses are hierarchically organized, allowing for streamlined routing throughout the internet. If we used hardware addresses, we would not be able to use longest-prefix matching. Indeed, some routers would have to keep lookup tables for every single hardware address connected to the internet. To make it worse, some hardware types use different addressing schemes than others.

5) Convert the following 32-bit binary number to a dotted-decimal IP address format.
   `10000000 11000001 00000100 01110000`
   128.193.4.112

   a. What do you find when you make an HTTP GET (port 80) request at this IP address?
      The oregonstate.edu main website!
   b. Convert the same address into hexadecimal format.
      80 C1 04 70

6) For the IP addresses as follows, how many bits are used for the network part, and how many bits are used for the host part?
    a. 128.145.22.44 / 28
       Network part: 28 bits (directly from above)
       Host part: 32 – 28 = 4 bits
    b. 142.33.54.71 / 26
       Network part: 26 bits (directly from above)
       Host part: 32 – 26 = 6 bits
    c. 193.111.54.4 / 16
       Network part: 16 bits (directly from above)
       Host part: 32 – 16 = 16 bits

7) What organization manages IP network addresses globally.
   Nominally, the IP address space is managed by ICANN:
   Internet Corporation for Assigned Names and Numbers