### **/x notation and subnet masks**

1. Give the subnet masks and network addresses corresponding to the following:
   1. 130.102.0.0 / 19
   2. 10.192.168.0 / 9
   3. 11.11.0.0 / 24
2. Which of the following (if any) are invalid subnet masks:
   1. 255.255.0.0
   2. 255.255.252.0
   3. 255.127.0.0
   4. 128.0.0.0

Network addresses are just a known address bitwise AND with subnet mask.

This site might be helpful <https://kthx.at/subnetmask/>

1. A. Network address = 130.102.0.0, subnet mask = 255.255.224.0  
   B. Network address = 10.128.0.0, subnet mask = 255.128.0.0  
   C. Network address = 11.11.0.0, subnet mask = 255.255.255.0

In binary form subnet masks need to be consecutive 1’s, 255.127.0.0, is

11111111 01111111 000000000 00000000, thus invalid.

1. C is invalid, the others are valid.

### **Broadcast addresses**

1. What is the broadcast address for the networks with the following address and netmask pairs belong to?
   1. 192.168.14.0 - (netmask=255.255.254.0)
   2. 192.168.14.0 - (netmask=255.255.192.0)
   3. 192.168.14.0 - (netmask=255.254.0.0)

To find the broadcast address you need to bitwise OR the network address

and the bitwise negation of the subnet mask. Any address within the subnet range will work though.

1. A. 0.0.1.255 | 192.168.14.0 = 192.168.15.255  
   B. 0.0.63.255 | 192.168.14.0 = 191.168.63.255  
   C. 0.1.255.255 | 192.168.14.0 = 126.169.255.255

### **minimal sized networks**

1. What is the network address and subnet mask for the smallest network (in terms of possible hosts) which contains the first two addresses of each set but not the third address:
   1. 192.168.0.17, 192.168.0.31, 192.168.0.32
   2. 192.168.12.1, 192.168.13,95, 192.169.15.1
   3. 10.0.0.1, 12.12.12.12, 16,0,0,64
2. **A.** Is a bad question according to Mitchell Krome as the second host (192.168.0.31) has the same address as the network's broadcast address.  
   Second host == 192.168.0.31   
   Broadcast address is the highest host address on the network.   
   Broadcast address == (network address) | ~(subnet mask)  
   == 192.168.0.16 | 0.0.0.15 == 192.158.0.31   
   Second host == broadcast address - that’s invalid!  
   Calculations:   
   Subnet Mask = 255.255.255.224,   
   First two IP addresses should be on network address = 192.168.0.16  
   Third IP address should be on network address = 192.168.0.32  
   **B.** Subnet Mask = 255.255.0.0,  
   First two IP addresses should be on network address = 192.168.0.0,  
   Third IP address should be on network address = 192.169.0.0  
   Broadcast address =   
   **C.** Subnet Mask = 248.0.0.0  
   First two IP addresses should be on network address = 8.0.0.0   
   Third IP address should be on network address = 16.0.0.0
3. For each of the following list of IP addresses, determine the smallest network which contains them all and specify the network address, broadcast address, subnet mask, and the maximum number of hosts.
   1. 163.54.81.95, 163.52.13.71, 163.52.250.1, 163.53.16.73
   2. 5.2.17.171, 5.2.17.182, 5.2.17.169
4. A. Subnet Mask = 255.252.0.0, Network address = 163.52.0.0  
   Network 163.52.0.0/14  
   Broadcast 163.5.255.255  
   Hosts/Net 262142

B. 255.255.255.224  
 Network: 5.2.17.160/27  
 Broadcast: 5.2.17.191  
 Hosts/Net: 30

### **TCP/IP Stack Questions**

1. On what layer would the address of the form a2:16:32:4c:e3:19 be used?

Link layer (It’s a mac address)

1. Why do Transport layer protocols use 'ports' in addition to IP addresses?

To deliver the information to the correct application?  
 Allows multiple independent channels per IP address

1. What does the Link Layer do with the headers from the Network Layer?

If receiving, passes the header and information up to the network layer after reading the

link layer’s header. If sending the link layer adds its own header on top of the network layer’s header.

1. Which of the following IPv4 addresses are valid (based only on the IPv4 address format):
   * 130.102.72.7
   * 255.255.254.255
   * 255.256.255.255
   * 300.10.1.128
   * 127.0.0.1

All but the 3rd and the 4th. Because they cross the octet bounds (max values of 255)

1. Given that the transfer of an IP packet over the network to another host only requires knowing the destination host's address, why does the IP packet header contain both the destination and source addresses?

So that the receiver of the packet can respond to the sender.