currently: 2000 * 10 ~~+2000~~. Next few years: ~~12 *2000~~ + 3 * 4000 ~~-6000~~

155.69.0.0/16   12 *2000 +

15 < 2^4, 4 bits used for subnet ID. Thus, subnet mask = 16+4 = /20

$2^{12} -2 = 4094 > 4000$

24 - 20 = 4

4   15

0001 0000 ...0

1111 ...1

...

10|00000 ...0

CE3005: Computer Networks
CZ3006: Net Centric Computing

Subnet address of each school: 155.69.0.0
155.69.16.0/20, 155.69.32.0, ~~155.69.48.0,155.69.64.0,155.69.80.0,155.69.96.0,155.69.112.0,155.69.128.~~
~~0,155.69.144.0,155.69.160.0/20~~

Tutorial 2-1:
Network Layer - IP Addressing and Fragmentation

No need all to be /20,remaining 12 address blocks can be /21 since $2^{11} -2 =2046 >2000$
eg. 155.69.64.0/21: 155.69.64.0 - 155.69.71.255
155.69.72.0/21:155.69.72.0 - 155.69.79.255

1. A university has been allocated the 155.69.0.0/16 address block. As the network administrator of the university, you have been asked to subnet the network. There are presently 10 schools in the university, and it may increase to 15 over the next few years. Currently, each school has a maximum number of host stations of 2000, but three schools are growing and may have 4000 hosts in a couple of years later. Determine the subnet address/subnet mask for each school.

2. An organization is assigned a /16 IP address block. The organization has created several subnets for its network. It is known that one of the subnets is 145.32.128.0/255.255.224.0. What is the broadcast address for this subnet?

145.32.159.255 (see below)

3. Figure Q3 shows a network consisting of four subnets being interconnected by four routers. The integer on each link indicates the cost of that link. As a network engineer, you are allocated the IP address range 193.169.1.0/24 to support the network. Assign suitable IP address/subnet mask to each interface of the routers.

routers have 160-175

Host A
IP: 193.169.1.129

193.169.1.128-193.169.1.159 /27

Subnet A:
30 hosts

$2^5 = 32$

160-163
Router 1   Router 2

1   5   1

193.169.1.192 - 193.169.1.255 /26

Subnet C:
60 hosts $2^6 = 64$

2   1 164-167

168-171

Subnet B:
100 hosts

1   7   1

$2^7 =128$

Router 3   Router 4

172-175

193.169.1.176 - 193.169.1.191 /28

Subnet D:
10 hosts $2^4 = 16$

IP: 193.169.1.190
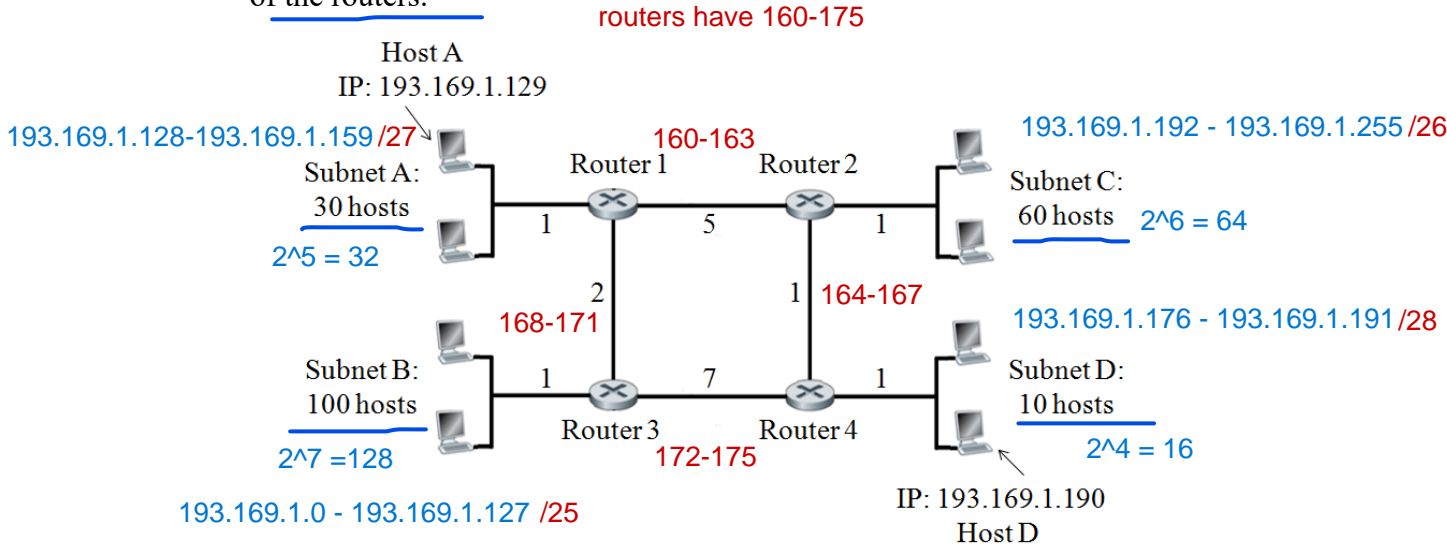Host D

193.169.1.0 - 193.169.1.127 /25

Figure Q3

4. Consider sending a 3000 byte datagram into a link that has an MTU of 500 bytes. Suppose the original datagram is stamped with the identification number 422. How many fragments are generated? What are their characteristics?

Q2.
mask: 255.255.224.0
binary mask: 255.255. 11100000 .0 => get /19
subnet address: 145.32.128.0/19 = 145.32.10000000.0
broadcast address: 145.32.10011111.11111 = 145.32.159.255/1⁹

host id all 1 for broadcast address

4.
datagram: 3000bytes, 20 bytes for header
=> 2980 bytes of data

MTU: 500 bytes,20 bytes for header =>
480 bytes of data

Number of fragments = datagram data/MTU data = 2980/480 ~= 7

-Identification of 11 bits is 422
-All MF bits are 1 except last fragment has 0
-All fragments have length 500 except last fragment with 120.
offset of fragments = MTU data/8 = 480/8 = 60
Offset of fragments starts from 0 and increments by 60 with each fragment