

Network Addressing

For each of the following, write down its class, network formula, network address, broadcast address, and default subnet mask. Save and submit when finished.

1. 192.56.31.7

2. 172.16.98.204

3. 101.51.1.1

4. 220.20.20.20

5. 10.10.10.10

Subnetting Practice

Question #1

Subnet the address **200.6.4.0** by borrowing **3 bits**. Find the following information:

1. What class is this address?
2. What is its Network/Host formula?
3. What is the Default Mask?
4. Formula to find the number of Usable subnets?
5. Formula to find the number of usable hosts?
6. Number of bits borrowed?
7. Possible number of subnets?
8. Possible number of hosts?
9. Usable number of hosts?
10. What is the subnet mask?
11. What is the increment?

Subnet #	Subnetwork Addresses (increment)	Usable Host from (subnet address +1)	Usable Host to (broadcast -1)	Broadcast Address (next subnet - 1)
SN0				
SN1				
SN2				
SN3				
SN4				
SN5				
SN6				
SN7				

Subnetting Practice

Question #2

Subnet the address **192.2.0.0** into **12 usable subnets** of **14 users**. Find the following information:

1. What class is this address?
2. What is its Network/Host formula?
3. What is the Default Mask?
4. Formula to find the number of Usable subnets?
5. Formula to find the number of usable hosts?
6. Number of bits borrowed?
7. Possible number of subnets?
8. Possible number of hosts?
9. Usable number of hosts?
10. What is the subnet mask?
11. What is the increment?

Subnet #	Subnetwork Addresses (increment)	Usable Host from (subnet address +1)	Usable Host to (broadcast -1)	Broadcast Address (next subnet - 1)
SN0				
SN1				
SN2				
SN3				
SN4				
SN5				
SN6				
SN7				
SN8				
SN9				
SN10				
SN11				
SN12				
SN13				
SN14				
SN15				

Subnetting Practice

Question #3

Subnet the address **222.22.2.0** into **25 usable subnets**. Find the following information:

1. What class is this address?
2. What is its Network/Host formula?
3. What is the Default Mask?
4. Formula to find the number of Usable subnets?
5. Formula to find the number of usable hosts?
6. Number of bits borrowed?
7. Possible number of subnets?
8. Possible number of hosts?
9. Usable number of hosts?
10. What is the subnet mask?
11. What is the increment?

Subnetting Practice

Subnet #	Subnetwork Addresses (increment)	Usable Host from (subnet address +1)	Usable Host to (broadcast -1)	Broadcast Address (next subnet - 1)
SN0				
SN1				
SN2				
SN3				
SN4				
SN5				
SN6				
SN7				
SN8				
SN9				
SN10				
SN11				
SN12				
SN13				
SN14				
SN15				
SN16				
SN17				
SN18				
SN19				
SN29				
SN21				
SN22				
SN23				
SN24				
SN25				
SN26				
SN27				
SN28				
SN29				
SN30				
SN31				

Subnetting Practice

Question #4

Subnet the address **192.168.53.0** into subnets with **60 usable hosts** per subnet.
Find the following information:

1. What class is this address?
2. What is its Network/Host formula?
3. What is the Default Mask?
4. Formula to find the number of Usable subnets?
5. Formula to find the number of usable hosts?
6. Number of bits borrowed?
7. Possible number of subnets?
8. Possible number of hosts?
9. Usable number of hosts?
10. What is the subnet mask?
11. What is the increment?

Subnet #	Subnetwork Addresses (increment)	Usable Host from (subnet address +1)	Usable Host to (broadcast -1)	Broadcast Address (next subnet - 1)
SN0				
SN1				
SN2				
SN3				

Subnet Mask and Increments

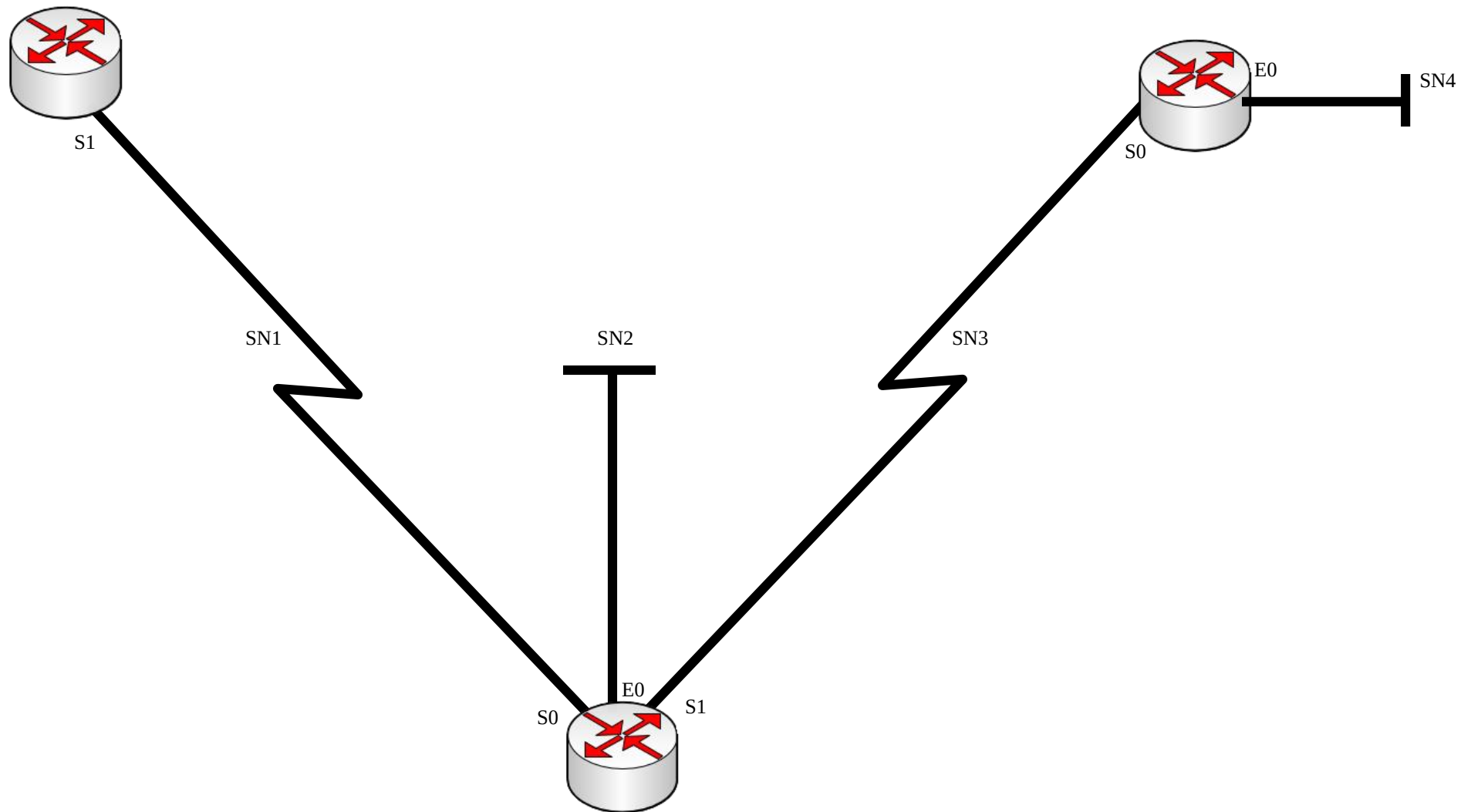
Supply a subnet mask and increment for each of these IP addresses:

1. 193.15.6.0/27
2. 206.59.33.0/29
3. 221.5.0.0/30
4. 197.164.193.0/28
5. 195.95.5.0/26
6. 190.50.0.0/22
7. 150.50.0.0/20
8. 166.72.0.0/24
9. 129.63.0.0/19
10. 97.0.0.0/15

Subnetting Practice

Solve this problem and include: subnet chart, wire address and interface IP address.

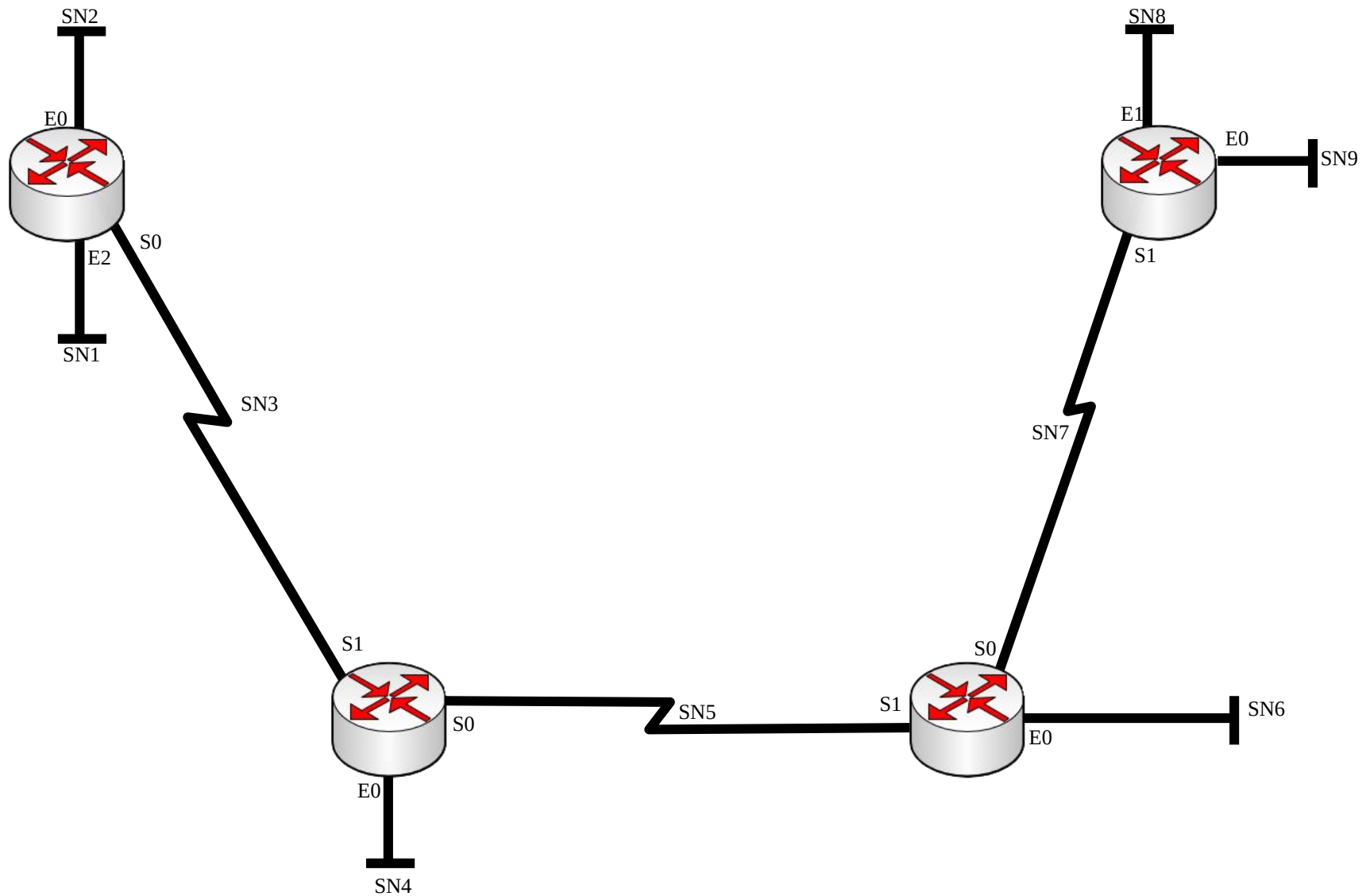
5. The IP address 193.24.5.0 and needs 5 subnets with 20 nodes per subnet.



Subnetting Practice

Solve this problem and include: subnet chart, wire address and interface IP address.

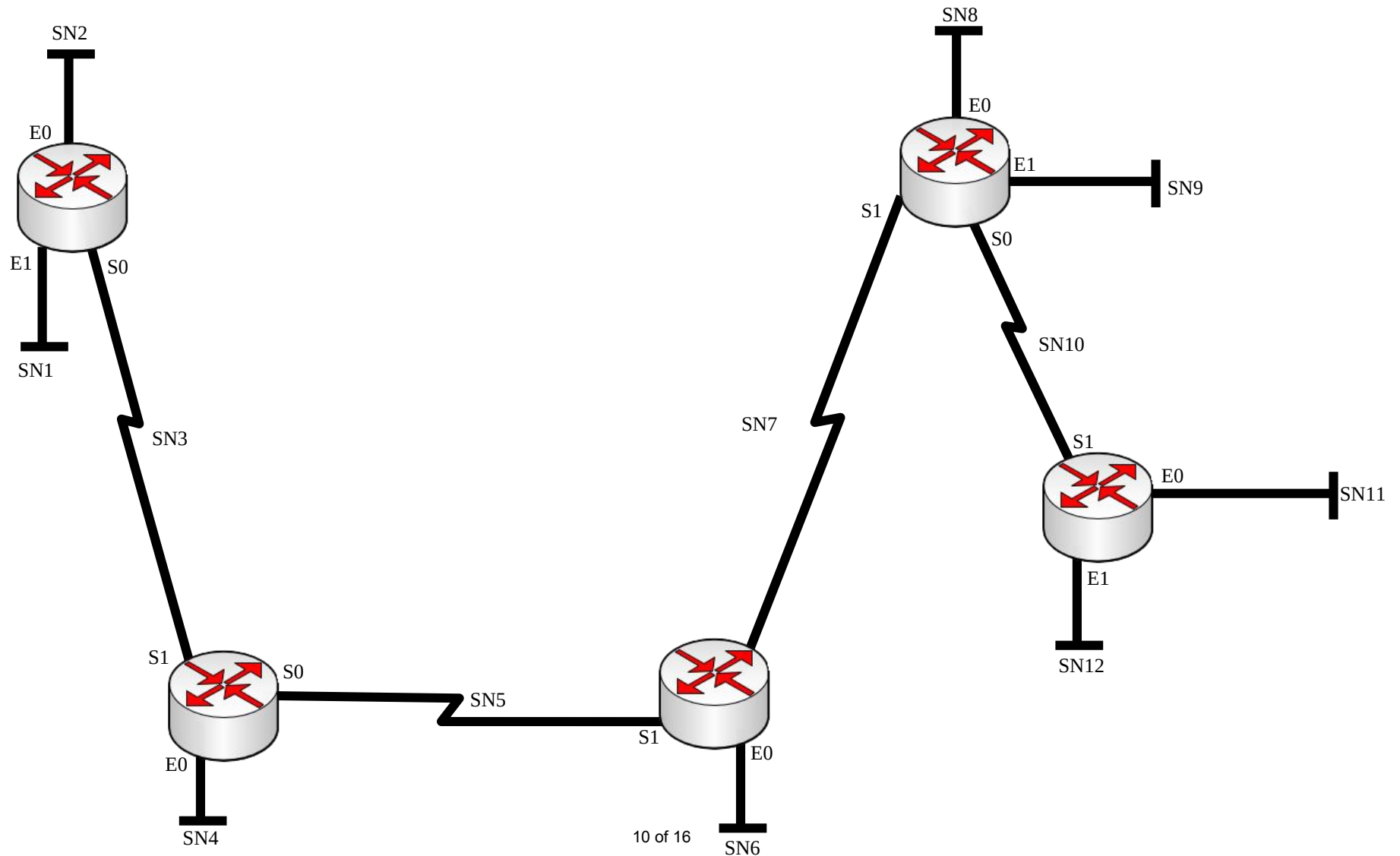
6. Use an IP address of 218.5.5.0 to configure this network allowing 10 users per



Subnetting Practice

Solve this problem and include: subnet chart, wire address and interface IP address.

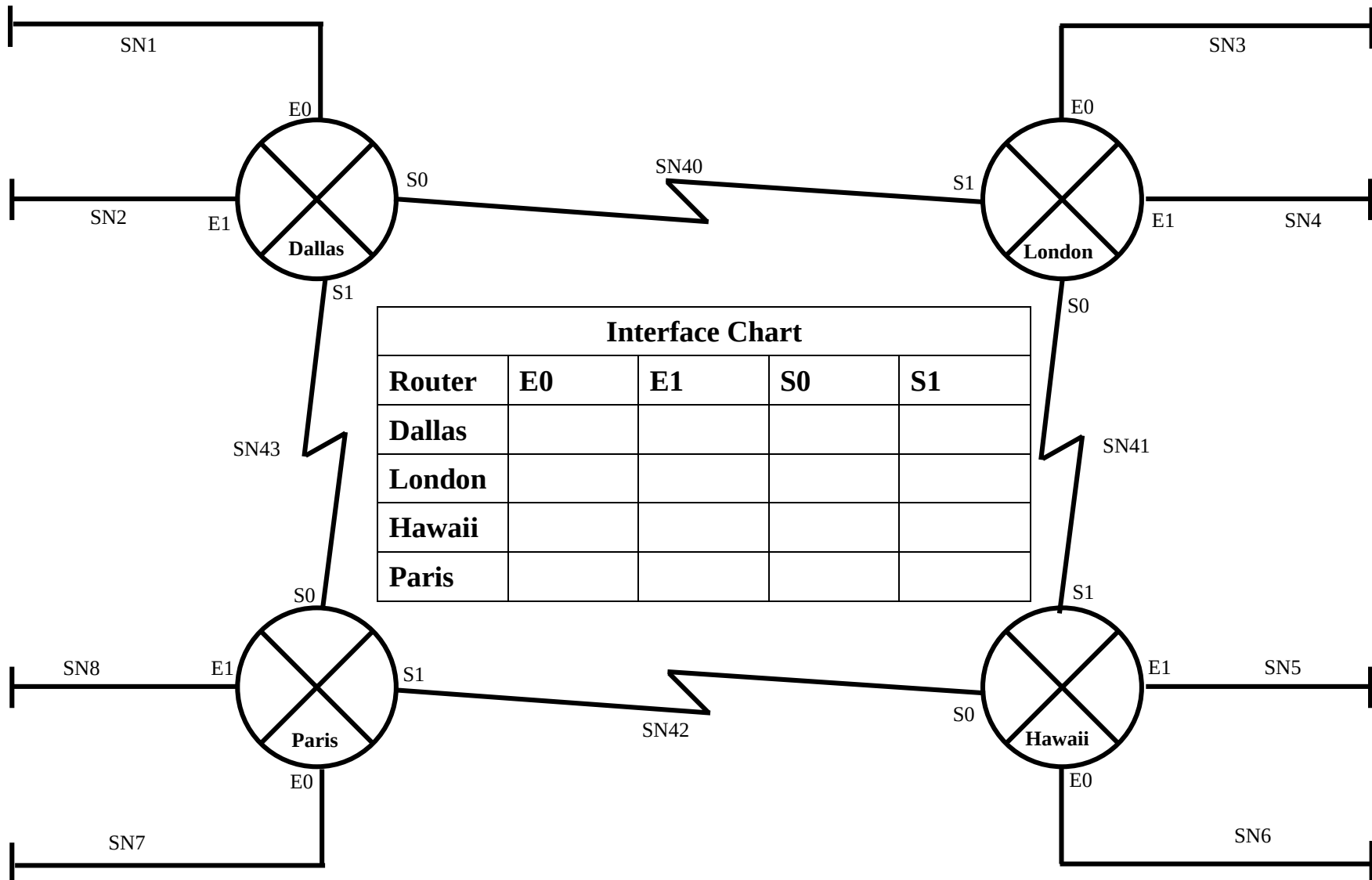
7. IP address of 208.5.5.0. There are currently 16 subnets with an estimated growth of 50% in the next ten years.



Subnetting Practice

Solve this problem and include: subnet chart, wire address, interface IP address, and Interface chart.

8. IP address of 201.2.4.0. Plan for 50 subnets.



Power Conversion Table

Power of 2's

Masking Bits

$2^0=1$	1 st octet	255
$2^1=2$		•
$2^2=4$		
$2^3=8$		
$2^4=16$		2 (/10)=192
$2^5=32$		3 (/11)=224
$2^6=64$		4 (/12)=240
$2^7=128$	2 nd octet	5 (/13)=248
$2^8=256$		6 (/14)=252
$2^9=512$		7 (/15)=254
$2^{10}=1,024$		8 (/16)=255
$2^{11}=2,048$		•
$2^{12}=4,096$		
$2^{13}=8,192$		
$2^{14}=16,384$		9 (/17)=128
$2^{15}=32,768$		10 (/18)=192
$2^{16}=65,536$		11 (/19)=224
$2^{17}=131,072$		12 (/20)=240
$2^{18}=262,144$	3 rd octet	13 (/21)=248
$2^{19}=524,288$		14 (/22)=252
$2^{20}=1,048,576$		15 (/23)=254
$2^{21}=2,097,152$		16 (/24)=255
$2^{22}=4,194,304$		•
$2^{23}=8,388,608$		
$2^{24}=16,777,216$		
		17 (/25)=128
		18 (/26)=192
		19 (/27)=224
		20 (/28)=240
	4 th octet	21 (/29)=248
		22 (/30)=252

Subnetting Fundamentals

Class	Range	Formula	Default Mask
A	1-126	N.H.H.H	255.0.0.0
B	128-191	N.N.H.H	255.255.0.0
C	192-223	N.N.N.H	255.255.255.0

1. Determine the Class of each given
2. Determine how many bits you must borrow (if applicable).
3. Determine the possible number and usable number of subnets.
 $2^{(B)} = \text{Usable Subnets}$
4. Determine how many possible number and usable number of hosts.
 $2^{(U)} - 2 = \text{Usable Hosts}$
5. Determine the Default Mask.
6. Determine the Subnet Mask.
7. Determine the increment. (Increment = Possible Number of Hosts)
8. Determine the network and broadcast address for each subnetwork.
9. Determine the usable range for each subnetwork.

IP Addressing Guide

Class A first octet range	1 – 126	(Network 127 is reserved for loopback and internal testing)	Leading bit pattern	0
Class B first octet range	128 – 191		Leading bit pattern	10
Class C first octet range	192 – 223		Leading bit pattern	110
Class D first octet range	224 – 239	(Reserved for multicast)	Leading bit pattern	1110
Class E first octet range	240 – 255	(Reserved for experimental, used for research)	Leading bit pattern	1111

Formulas to determine the number of subnets or hosts created by borrowing from the host portion of the address

B = The number of bits borrowed (Borrowed)

2^B = Usable # of subnets created

NOTE: You must leave at least 2 bits.

U = The number of bits remaining (Unused)

2^U = Possible # of host on each subnets (Increment)

$2^U - 2$ = Useable # of host on each subnet

Class A Network N.H.H.H					Class B Network N.N.H.H				
# of Bits Borrowed	Subnet Mask	Usable # Subnets	Possible # Hosts	Useable # Hosts	# of Bits Borrowed	Subnet Mask	Usable # Subnets	Possible # Hosts	Useable # Hosts
1 /9	255.128.0.0	2	8,388,608	8,388,606	1 /17	255.255.128.0	2	32,768	32,766
2 /10	255.192.0.0	4	4,194,304	4,194,302	2 /18	255.255.192.0	4	16,384	16,382
3 /11	255.224.0.0	8	2,097,152	2,097,150	3 /19	255.255.224.0	8	8,192	8,190
4 /13	255.240.0.0	16	1,048,576	1,048,574	4 /20	255.255.240.0	16	4,096	4,094
5 /13	255.248.0.0	32	524,288	524,286	5 /21	255.255.248.0	32	2,048	2,046
6 /14	255.252.0.0	64	262,144	262,142	6 /22	255.255.252.0	64	1,024	1,022
7 /15	255.254.0.0	128	131,072	131,070	7 /23	255.255.254.0	128	512	510
8 /16	255.255.0.0	256	65,536	65,534	8 /24	255.255.255.0	256	256	254
9 /17	255.255.128.0	512	32,768	32,766	9 /25	255.255.255.128	512	128	126
10 /18	255.255.192.0	1,024	16,384	16,382	10 /26	255.255.255.192	1,024	64	62
11 /19	255.255.224.0	2,048	8,192	8,190	11 /27	255.255.255.224	2,048	32	30
12 /20	255.255.240.0	4,096	4,096	4,094	12 /28	255.255.255.240	4,096	16	14
13 /21	255.255.248.0	8,192	2,048	2,046	13 /29	255.255.255.248	8,192	8	6
14 /22	255.255.252.0	16,384	1,024	1,022	14 /30	255.255.255.252	16,384	4	2
15 /23	255.255.254.0	32,768	512	510	Class C Network N.N.N.H				
16 /24	255.255.255.0	65,536	256	254	# of Bits Borrowed	Subnet Mask	Possible # Subnets	Possible # Hosts	Useable # Hosts
17 /25	255.255.255.128	131,072	128	126	1 /25	255.255.255.128	2	128	126
18 /26	255.255.255.192	262,144	64	62	2 /26	255.255.255.192	4	64	62
19 /27	255.255.255.224	524,288	32	30	3 /27	255.255.255.224	8	32	30
20 /28	255.255.255.240	1,048,576	16	14	4 /28	255.255.255.240	16	16	14
21 /29	255.255.255.248	2,097,152	8	6	5 /29	255.255.255.248	32	8	6
22 /30	255.255.255.252	4,194,304	4	2	6 /30	255.255.255.252	64	4	2

Class "C" Subnetting Key

Slash Notation	Subnet	Bits borrowed	Network Address	Usable Range	Broadcast Address	Subnet Mask
/25	0	1	x.x.x.0	x.x.x.1 - x.x.x. 126	x.x.x.127	255.255.255.128
/25	1	1	x.x.x.128	x.x.x.129 - x.x.x.x.254	x.x.x.255	255.255.255.129
/26	0	2	x.x.x.0	x.x.x.1 - x.x.x.62	x.x.x.63	255.255.255.192
/26	1	2	x.x.x.64	x.x.x.65 - x.x.x.126	x.x.x.127	255.255.255.192
/26	2	2	x.x.x.128	x.x.x.129 - x.x.x.190	x.x.x.191	255.255.255.192
/26	3	2	x.x.x.192	x.x.x.193 - x.x.x.254	x.x.x.255	255.255.255.192
/27	0	3	x.x.x.0	x.x.x.1 - x.x.x.30	x.x.x.31	255.255.255.224
/27	1	3	x.x.x.32	x.x.x.33 - x.x.x.62	x.x.x.63	255.255.255.224
/27	2	3	x.x.x.64	x.x.x.65 - x.x.x.94	x.x.x.95	255.255.255.224
/27	3	3	x.x.x.96	x.x.x.97 - x.x.x.126	x.x.x.127	255.255.255.224
/27	4	3	x.x.x.128	x.x.x.129 - x.x.x.158	x.x.x.159	255.255.255.224
/27	5	3	x.x.x.160	x.x.x.161 - x.x.x.190	x.x.x.191	255.255.255.224
/27	6	3	x.x.x.192	x.x.x.193 - x.x.x.222	x.x.x.223	255.255.255.224
/27	7	3	x.x.x.224	x.x.x.225 - x.x.x.254	x.x.x.255	255.255.255.224
/28	0	4	x.x.x.0	x.x.x.1 - x.x.x.14	x.x.x.15	255.255.255.240
/28	1	4	x.x.x.16	x.x.x.17 - x.x.x.30	x.x.x.31	255.255.255.240
/28	2	4	x.x.x.32	x.x.x.33 - x.x.x.46	x.x.x.47	255.255.255.240
/28	3	4	x.x.x.48	x.x.x.49 - x.x.x.62	x.x.x.63	255.255.255.240
/28	4	4	x.x.x.64	x.x.x.65 - x.x.x.78	x.x.x.79	255.255.255.240
/28	5	4	x.x.x.80	x.x.x.81 - x.x.x.94	x.x.x.95	255.255.255.240
/28	6	4	x.x.x.96	x.x.x.97 - x.x.x.110	x.x.x.111	255.255.255.240
/28	7	4	x.x.x.112	x.x.x.113 - x.x.x.126	x.x.x.127	255.255.255.240
/28	8	4	x.x.x.128	x.x.x.129 - x.x.x.142	x.x.x.143	255.255.255.240
/28	9	4	x.x.x.144	x.x.x.145 - x.x.x.158	x.x.x.159	255.255.255.240
/28	10	4	x.x.x.160	x.x.x.161 - x.x.x.174	x.x.x.175	255.255.255.240
/28	11	4	x.x.x.176	x.x.x.177 - x.x.x.190	x.x.x.191	255.255.255.240
/28	12	4	x.x.x.192	x.x.x.193 - x.x.x.206	x.x.x.207	255.255.255.240
/28	13	4	x.x.x.208	x.x.x.209 - x.x.x.222	x.x.x.223	255.255.255.240
/28	14	4	x.x.x.224	x.x.x.225 - x.x.x.238	x.x.x.239	255.255.255.240
/28	15	4	x.x.x.240	x.x.x.241 - x.x.x.254	x.x.x.255	255.255.255.240
/29	0	5	x.x.x.0	x.x.x.1 - x.x.x.6	x.x.x.7	255.255.255.248
/29	1	5	x.x.x.8	x.x.x.9 - x.x.x.14	x.x.x.15	255.255.255.248
/29	2	5	x.x.x.16	x.x.x.17 - x.x.x.22	x.x.x.23	255.255.255.248
/29	3	5	x.x.x.24	x.x.x.25- x.x.x.30	x.x.x.31	255.255.255.248
/29	4	5	x.x.x.32	x.x.x.233- x.x.x.38	x.x.x.39	255.255.255.248
/29	30	5	x.x.x.240	x.x.x.241 - x.x.x.246	x.x.x.247	255.255.255.248
/29	31	5	x.x.x.248	x.x.x.2419- x.x.x.254	x.x.x.255	255.255.255.248
/30	0	6	x.x.x.0	x.x.x.1 - x.x.x.2	x.x.x.3	255.255.255.252
/30	1	6	x.x.x.4	x.x.x.5 - x.x.x.6	x.x.x.7	255.255.255.252
/30	2	6	x.x.x.8	x.x.x.9 - x.x.x.10	x.x.x.11	255.255.255.252
/30	3	6	x.x.x.12	x.x.x.13 - x.x.x.14	x.x.x.15	255.255.255.252
/30	4	6	x.x.x.16	x.x.x.17 - x.x.x.18	x.x.x.19	255.255.255.252
/30	62	6	x.x.x.248	x.x.x.249 - x.x.x.250	x.x.x.251	255.255.255.252
/30	63	6	x.x.x.252	x.x.x.253 - x.x.x.254	x.x.x.255	255.255.255.252

Subnetmask 128 192 224 240 248 252 N/A N/A

Subnet	Network Address	Usable Range	Broadcast
SN0			
SN1			
SN2			
SN3			
SN4			
SN5			
SN6			
SN7			
SN8			
SN9			
SN10			
SN11			
SN12			
SN13			
SN14			
SN15			