SSSSS

Subnetting Chart Tools for Quick Reference

Constructed by Tristan Mendoza

CIDR is the number of network bits used. 255.255.255.192 = 11111111.11111111.11111111.11000000 = /26 network bits, 32-26 = 6 host bits
Many teachers and some exams require you know the long way to do things- longhand calculation of usable hosts per subnet= 2^{H}-2 (H= host bits)
Usable subnets=2^{N} with N for network. If you know how to draw the number line of binary with bits up high enough, it's clear every bit after 4096 is just as before going to double the previous bit's number. It's easier to draw what you need like done in this sheet.
Block Sizes: Subtract subnet mask from 256 to get the bit position or "magic number." Mask of 192 (256-192=64) gives the network numbers of 0, 64, 128, and 192. So 255.255.255.192 has a /26 CIDR. Since 32-26= 6 host bits, we get 2^{6}-2=62 usable hosts per subnet.
Remembering mask numbers: Add bit value to it's bigger neighbor's mask like this: 128+64=192, 192+32=224, 224+16=240, etc.

Bit Value/ Position	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Power of Two for octet bit	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
Subnet Mask for Bit Position	128	192	224	240	248	252	254	255
Class C CIDR	/25	/26	/27	/28	/29	/30	/31	/32
Subnets	2	4	8	16	32	64	128	n/a
Hosts per Subnet (subtract 2)	128	64	32	16	8	4	2*	n/a
Class B CIDR (3rd Octet)	/17	/18	/19	/20	/21	/22	/23	/24
Subnets	2	4	8	16	32	64	128	256
Hosts per Subnet (subtract 2)	32768	16384	8192	4096	2048	1024	512	256
Class B CIDR (4th Octet)	/25	/26	/27	/28	/29	/30		
Subnets	512	1024	2048	4096	8192	16384		
Hosts per Subnet (subtract 2)	128	64	32	16	8	4		
Class A CIDR (2nd Octet)	/9	/10	/11	/12	/13	/14	/15	/16
Subnets	2	4	8	16	32	64	128	256
Hosts per Subnet (subtract 2)	8,388,608	4,194,304	2,097,152	1,048,576	524,288	262,144	131,072	65,536
Class A CIDR (3rd Octet)	/17	/18	/19	/20	/21	/22	/23	/24
Subnets	512	1024	2048	4096	8192	16,384	32,768	65,536
Hosts per Subnet (subtract 2)	32,768	16,384	8192	4096	2048	1024	512	256
Class A CIDR (4th Octet)	/25	/26	/27	/28	/29	/30		
Subnets	131,072	262,144	524,288	1,048,576	2,097,152	4,194,304		
Hosts per Subnet (subtract 2)	128	64	32	16	8	4		

Default Classful System

	Leading Bits		Starts At	Net Bits	Bits Left	# of Nets	Hosts per Net	Default Mask	Native CIDRs
Class A	0xxx, 1-126	-	0.0.0.1	8	24	128	16,777,216	255.0.0.0	/9 to /16
Class B	10xx, 128-191	-	128.0.0.0	16	16	16,384	65,534	255.255.0.0	/17 to /24
Class C	110x, 192-223	-	192.0.0.0	24	8	2,097,152	254	255.255.255.0	/25 to /32
Class D	1110, 224-239	Multicast	224.0.0.0	-	-	-	-	-	
Class E	1111, 240-254	Reserved	240.0.0.0	-	-	-	-	-	

Reserved and Private Addresses

Class A	*10.0.0.0 - 10.255.255.255*	*10.0.0.0/8*
Class B	*172.16.0.0 - 172.31.255.255*	*172.16.0.0/12*
Class C	*192.168.0.0 - 255.255*	*192.168.0.0/16*
Loopback	*127.x.x.x*	*127.0.0.0/8*
APIPA	*169.254.x.x*	*169.254.0.0/16*
Carrier NAT	*100.64.0.0 – 100.127.255.255*	*100.64.0.0/14*
Stress-testing	*198.18.0.0 – 199.19.255.255*	*198.18.0.0/15*

The main reason the chart above lists CIDR info for unusual-looking address space is to assist with imagining the "subnetting" of large chunks of private address space as is mostly the case in 10.0.0.0/8, but also 172.16.0.0/12 blocks. In those cases, for ease of reference mimicking the traditional routed addressing while adding a more human-recognizable patterns might help, (i.e., 10.1.x.x for eastern US, 10.2.x.x for central U.S., 10.3.x.x for western U.S., and so forth, as appropriate). An entire 10.0.0.0/8 has plenty of space for creativity.

Using the worksheet on the right hand side

Class B Subnetting - Subnetting for Hosts
We are given a Class B: 160.12.0.0, BC: 255.255.0.0. We are asked for 4080 hosts so add 2= 4082 Bits: where is the line drawn? 4096 ^ 2048 1024 512 256 128 64 32 16 8 4 2 1
So we need 12 bits- for hosts count from the RIGHT
160.12. 0 0 0 0 1
128 64 32 16 || 8 4 2 1 . 128 64 32 16 8 4 2 1
Subnet mask is 240 (128+64+32+16) "Magic number" is 16
160.12.16.0… 160.12.31.255
160.12.32.0, 160.12.48.0, 160.12.64.0, etc

Class C Subnetting - Subnetting for Networks
We are given 201.9.6.0 told to make 25 subnets- add 2 and it's 27.
27 = 5 bits - count from the left
201.9.6. 0 0 0 0 1
128 64 32 16 8 || 4 2 1
CIDR is /29 and 255.255.255.248 mask
Network IDs are 201.9.6.8, 201.9.6.16, 201.9.6.24, 201.9.6.32, 201.9.6.40 ... etc.

Class C Subnetting - Subnetting for Hosts - Review
We have 195.12.8.0 and need 40 hosts +2 = 42 = 6 bits to hold
This time count FROM THE RIGHT to place the divider:
195.12.8.
128 64 || 32 16 8 4 2 1
Subnet mask is 255.255.255.192 (128+64), CIDR is /26
Network IDs 195.12.8.64, 195.12.8.128. That's it since 192 is subnet for these subnets (and it's only a class C)

Subnetting for Networks What if...? - Subnet Masks and borrowing from another octet
We are given a Class B: 150.9.0.0, BC: 255.255.0.0 We need to borrow 10 bits How do we deal with the subnet mask?
150.9. 1 1 1 1 1 1 1 1 1 1 1 1
128 64 32 16 8 4 2 1 . 128 64 || 32 16 8 4 2 1
Use 64 (the 7th bit), 255.255.255.192 Since we are borrowing from the 4th octet it might look like a class C, but we can ultimately see by the first octet of the address (150) that this is Class B (128 to 191). (besides-CIDR is classless, remember?)

← # of nets by class type	← subnet mask	← Binary bit by octet	← Binary bit placement	← Power of 2	← # of hosts by position
2	128	128	24	2^{23}	8,388,608
4	192	64	23	2^{22}	4,194,304
8	224	32	22	2^{21}	2,097,152
16	240	16	21	2^{20}	1,048,576
32	248	8	20	2^{19}	524,288
64	252	4	19	2^{18}	262,144
128	254	2	18	2^{17}	131,072
255	255	1	17	2^{16}	65,536
			.		
2	128	128	16	2^{15}	32,768
4	192	64	15	2^{14}	16,384
8	224	32	14	2^{13}	8,192
16	240	16	13	2^{12}	4,096
32	248	8	12	2^{11}	2,048
64	252	4	11	2^{10}	1,024
128	254	2	10	2^{9}	512
255	255	1	9	2^{8}	256
			.		
2	128	128	8	2^{7}	128
4	192	64	7	2^{6}	64
8	224	32	6	2^{5}	32
16	240	16	5	2^{4}	16
32	248	8	4	2^{3}	8
64	252	4	3	2^{2}	4
128	254	2	2	2^{1}	2
255	255	1	1	2^{0}	1

SSSSS