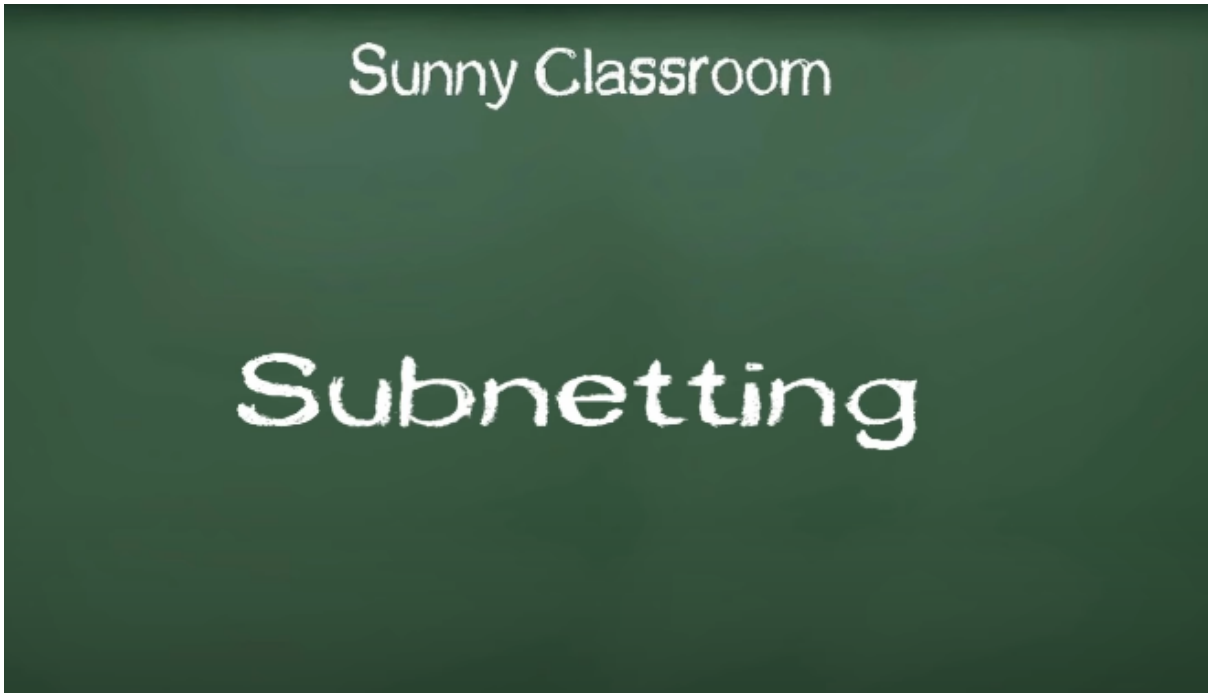
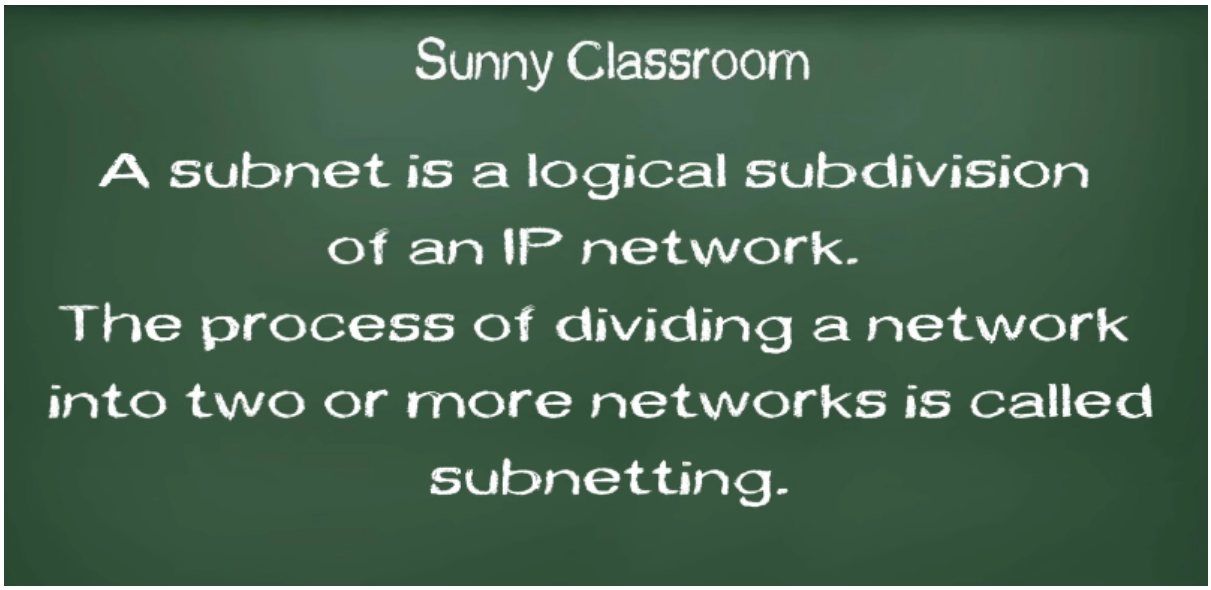
SUNNY - Subnetting





The main purpose of subnetting is to help relieve network congestion, and improve network performance. Security is another benefit of subnetting.

To understand subnetting, we do need some basic knowledge,

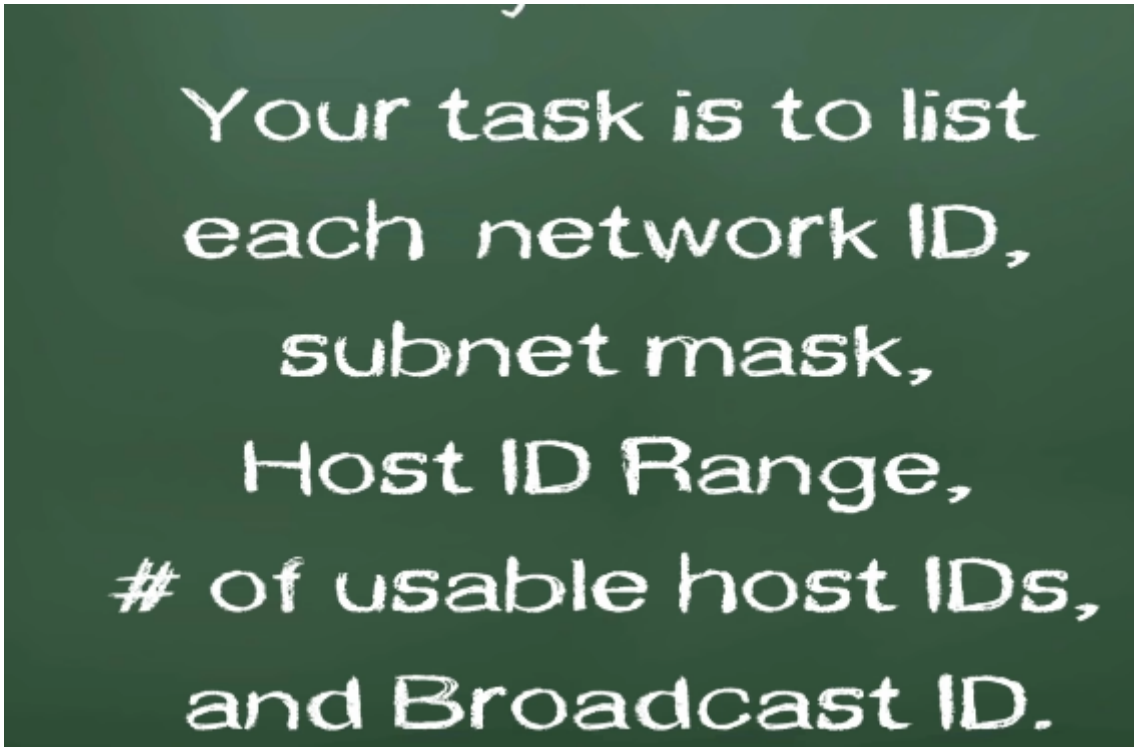
such as subnet mask, network ID, host ID, and broadcast ID.

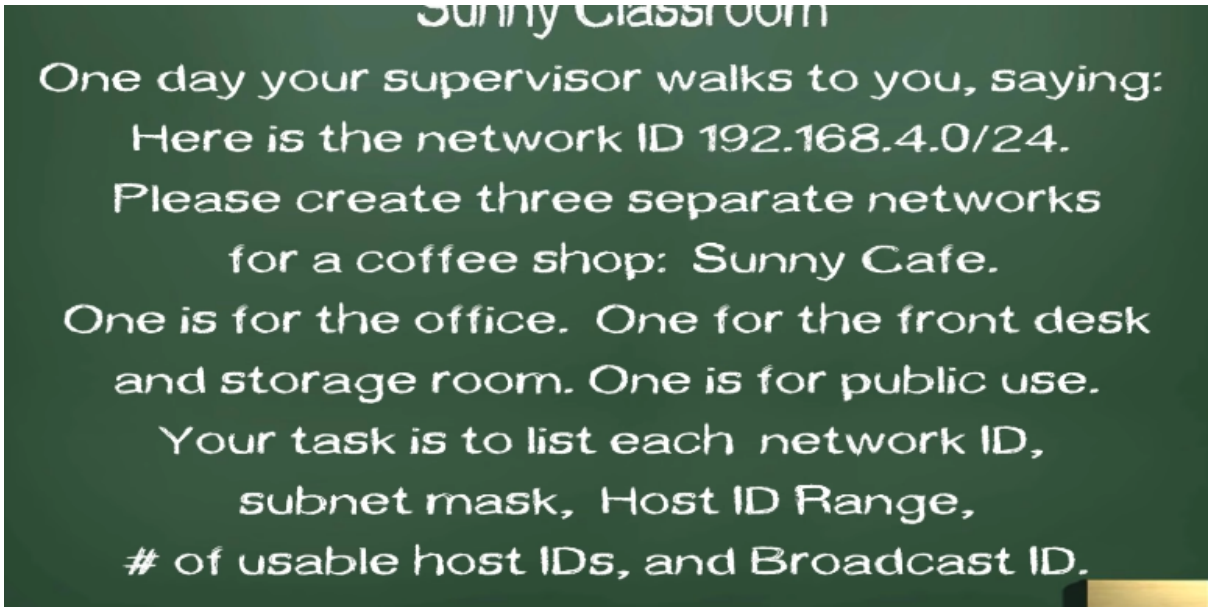
Subnetting Example

One day your supervisor walks to you, saying: Here is the network ID 192.168.4.0/24.

Please create three separate networks or subnets for a coffee shop: Sunny Cafe.

One subnet is for the office. One is for the front desk and storage room. One is for public use.


Your task is to list
each network ID,
subnet mask,
Host ID Range,
# of usable host IDs,
and Broadcast ID.


Sunny Classroom
One day your supervisor walks to you, saying:
Here is the network ID 192.168.4.0/24.
Please create three separate networks
for a coffee shop: Sunny Cafe.
One is for the office. One for the front desk
and storage room. One is for public use.
Your task is to list each network ID,
subnet mask, Host ID Range,
# of usable host IDs, and Broadcast ID.

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

This table is the most critical,

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

You are given a network ID:
192.168.4.0/24.

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

because once we build it,
we can easily solve most subnetting questions.

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

You are required to get three subnets.

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

ignoring all other columns
because we can get our answers

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

4 means 4 subnets.

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

64 means each subnet
will have 64 total host IDs

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

including network ID and broadcast ID.

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

/26 is the new subnet mask
for these 4 subnets.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID

Let's find the first new network ID.

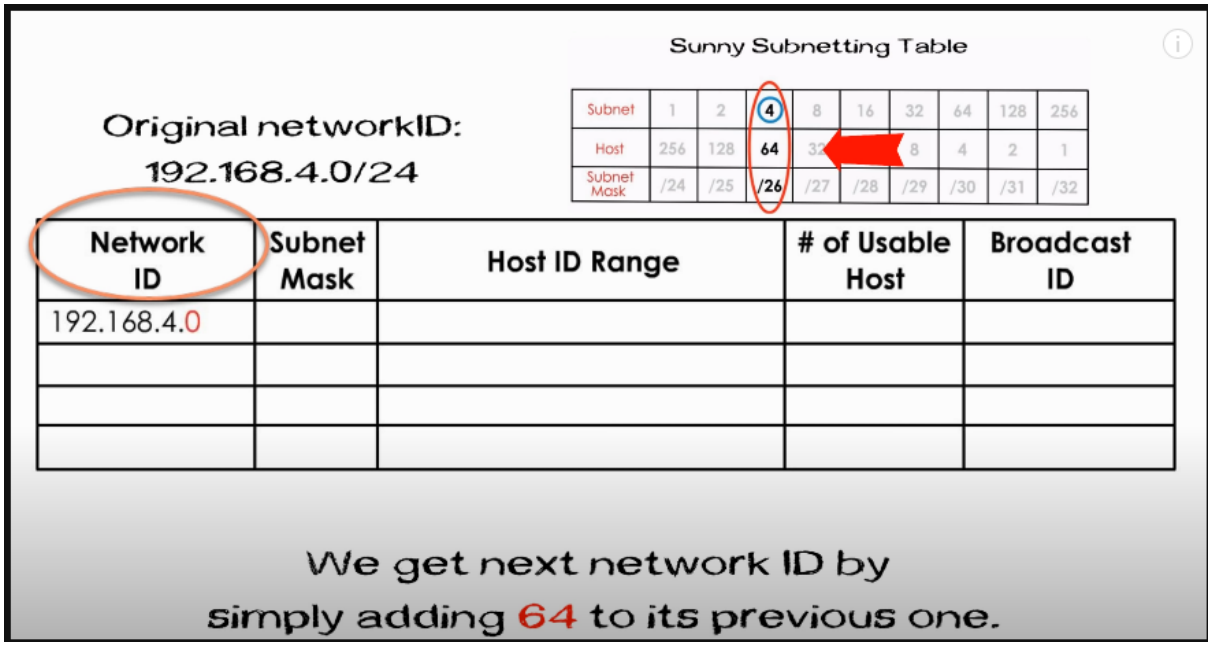
Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID

The first network ID is
always the original network ID,



Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0				
192.168.4.64				

Therefore, the second network ID would be 0+ 64, which is 64.

Show apps

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0				
192.168.4.64				

The third network ID would be 64+ 64, which is 128.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0				
192.168.4.64				
192.168.4.128				
192.168.4.				

The fourth network ID is
128+ 64, which is 192

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0				
192.168.4.64				
192.168.4.128				
192.168.4.192				

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26			
192.168.4.64	/26			
192.168.4.128	/26			
192.168.4.192	/26			

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26			
192.168.4.64	/26			
192.168.4.128	/26			
192.168.4.192	/26			

64 is the total number of host IDs
for each network.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26			
192.168.4.64	/26			
192.168.4.128	/26			
192.168.4.192	/26			

But the first host ID is reserved for network ID,
and last host ID is reserved for broadcast ID.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26			
192.168.4.64	/26			
192.168.4.128	/26			
192.168.4.192	/26			

Thus, the number of usable host ID
is 64 minus 2, which is 62.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26		62	
192.168.4.64	/26		62	
192.168.4.128	/26		62	
192.168.4.192	/26		62	

Thus, we write down 62 for all four subnets.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26		62	
192.168.4.64	/26		62	
192.168.4.128	/26		62	
192.168.4.192	/26		62	

Now let us look at the broadcast ID
for each subnet.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26		62	
192.168.4.64	/26		62	
192.168.4.128	/26		62	
192.168.4.192	/26		62	

Keep in mind, the last host ID
is reserved for its broadcast ID.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26		62	192.168.4.63
192.168.4.64	/26		62	
192.168.4.128	/26		62	
192.168.4.192	/26		62	

Therefore, broadcast ID for
the first subnet is 63.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26		62	192.168.4.63
192.168.4.64	/26		62	192.168.4.127
192.168.4.128	/26		62	
192.168.4.192	/26		62	

Next broadcast ID is 127.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26		62	192.168.4.63
192.168.4.64	/26		62	192.168.4.127
192.168.4.128	/26		62	192.168.4.191
192.168.4.192	/26		62	

next one is 191

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26		62	192.168.4.63
192.168.4.64	/26		62	192.168.4.127
192.168.4.128	/26		62	192.168.4.191
192.168.4.192	/26		62	192.168.4.255

We can see the broadcast ID equals
next subnet's network ID minus 1.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26		62	192.168.4.63
192.168.4.64	/26		62	192.168.4.127
192.168.4.128	/26		62	192.168.4.191
192.168.4.192	/26		62	192.168.4.255

once you know the first broadcast ID, 63,
you simply add 64 to get the second broadcast ID,

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26		62	192.168.4.63
192.168.4.64	/26		62	192.168.4.127
192.168.4.128	/26		62	192.168.4.191
192.168.4.192	/26		62	192.168.4.255

and then increase by 64 again to
get the fourth broadcast ID, which is 255.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26		62	192.168.4.63
192.168.4.64	/26		62	192.168.4.127
192.168.4.128	/26		62	192.168.4.191
192.168.4.192	/26		62	192.168.4.255

A subnet's Host ID range is any IDs
between its network ID and broadcast ID.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26		62	192.168.4.63
192.168.4.64	/26		62	192.168.4.127
192.168.4.128	/26		62	192.168.4.191
192.168.4.192	/26		62	192.168.4.255

For the first subnet, 1-62 is between network ID 0 and broadcast ID, 63.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26	192.168.4.1-192.168.4.62	62	192.168.4.63
192.168.4.64	/26		62	192.168.4.127
192.168.4.128	/26		62	192.168.4.191
192.168.4.192	/26		62	192.168.4.255

The second host ID range: 65-126 is between 64 and 127.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26	192.168.4.1-192.168.4.62	62	192.168.4.63
192.168.4.64	/26	192.168.4.65-192.168.4.126	62	192.168.4.127
192.168.4.128	/26	192.168.4.129-192.168.4.190	62	192.168.4.191
192.168.4.192	/26		62	192.168.4.255

The third host ID range 129-190
is between 128 and 191.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26	192.168.4.1-192.168.4.62	62	192.168.4.63
192.168.4.64	/26	192.168.4.65-192.168.4.126	62	192.168.4.127
192.168.4.128	/26	192.168.4.129-192.168.4.190	62	192.168.4.191
192.168.4.192	/26	192.168.4.193-192.168.4.254	62	192.168.4.255

The fourth host ID range is between
192 and 255, which is 193 to 254.

Original networkID:
192.168.4.0/24

Sunny Subnetting Table

Subnet	1	2	4	8	16	32	64	128	256
Host	256	128	64	32	16	8	4	2	1
Subnet Mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26	192.168.4.1-192.168.4.62	62	192.168.4.63
192.168.4.64	/26	192.168.4.65-192.168.4.126	62	192.168.4.127
192.168.4.128	/26	192.168.4.129-192.168.4.190	62	192.168.4.191
192.168.4.192	/26	192.168.4.193-192.168.4.254	62	192.168.4.255

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26	192.168.4.1-192.168.4.62	62	192.168.4.63
192.168.4.64	/26	192.168.4.65-192.168.4.126	62	192.168.4.127
192.168.4.128	/26	192.168.4.129-192.168.4.190	62	192.168.4.191
192.168.4.192	/26	192.168.4.193-192.168.4.254	62	192.168.4.255

You can assign any three out of four subnets for Sunny Café. One subnet is wasted of course.

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26	192.168.4.1-192.168.4.62	62	192.168.4.63
192.168.4.64	/26	192.168.4.65-192.168.4.126	62	192.168.4.127
192.168.4.128	/26	192.168.4.129-192.168.4.190	62	192.168.4.191
192.168.4.192	/26	192.168.4.193-192.168.4.254	62	192.168.4.255

That is the downside of subnetting, no biggy.

Network ID	Subnet Mask	Host ID Range	# of Usable Host	Broadcast ID
192.168.4.0	/26	192.168.4.1-192.168.4.62	62	192.168.4.63
192.168.4.64	/26	192.168.4.65-192.168.4.126	62	192.168.4.127
192.168.4.128	/26	192.168.4.129-192.168.4.190	62	192.168.4.191
192.168.4.192	/26	192.168.4.193-192.168.4.254	62	192.168.4.255

I put one similar question below for your practice.
I also provide the answer below for your reference.

Subnetting Practice

With the same network ID: 192.168.4.0/24, you are required to get 6 subnets. List each of new network ID, subnet mask, host ID range, # of usable hosts, and broadcast ID. One last question: how many subnets are wasted after subnetting?

Answer for your reference:

We will have 8 subnets. subnet mask is /27 for all 8 subnets. The number of usable host IDs is 30 for all 8 subnets. I list below 8 subnets' network ID,host ID range, and broadcast ID in the order.
#1: 192.168.4.0, 192.168.4.1-192.168.4.30, 192.168.4.31
#2: 192.168.4.32, 192.168.4.33-192.168.4.62, 192.168.4.63
#3: 192.168.4.64, 192.168.4.65-192.168.4.94, 192.168.4.95
#4: 192.168.4.96, 192.168.4.97-192.168.4. 126, 192.168.4.127
#5: 192.168.4.128, 192.168.4.129-192.168.4. 158, 192.168.4.159
#6: 192.168.4.160 , 192.168.4.161-192.168.4. 190, 192.168.4.191
#7: 192.168.4.192, 192.168.4.193-192.168.4. 222, 192.168.4.223
#8: 192.168.4.224, 192.168.4.225-192.168.4. 254, 192.168.4.255

reference:

subnetting is simple

Class B ID - Subnetting https://www.youtube.com/watch?v=wuldYxaV46Y&t=10sSubnetting a subnethttps://www.youtube.com/watch?

https://www.youtube.com/watch?v=ecCuyq-Wprc

Prefix size	Network mask	Usable hosts per subnet
/1	128.0.0.0	2,147,483,646
/2	192.0.0.0	1,073,741,822
/3	224.0.0.0	536,870,910
/4	240.0.0.0	268,435,454
/5	248.0.0.0	134,217,726
/6	252.0.0.0	67,108,862
/7	254.0.0.0	33,554,430
Class A		
/8	255.0.0.0	16,777,214
/9	255.128.0.0	8,388,606
/10	255.192.0.0	4,194,302
/11	255.224.0.0	2,097,150
/12	255.240.0.0	1,048,574
/13	255.248.0.0	524,286
/14	255.252.0.0	262,142
/15	255.254.0.0	131,070
Class B		
/16	255.255.0.0	65,534
/17	255.255.128.0	32,766
/18	255.255.192.0	16,382
/19	255.255.224.0	8,190
/20	255.255.240.0	4,094
/21	255.255.248.0	2,046
/22	255.255.252.0	1,022
/23	255.255.254.0	510
Class C		
/24	255.255.255.0	254
/25	255.255.255.128	126
/26	255.255.255.192	62
/27	255.255.255.224	30
/28	255.255.255.240	14
/29	255.255.255.248	6
/30	255.255.255.252	2
/31	255.255.255.254	0
/32	255.255.255.255	0