IP

→ Classful

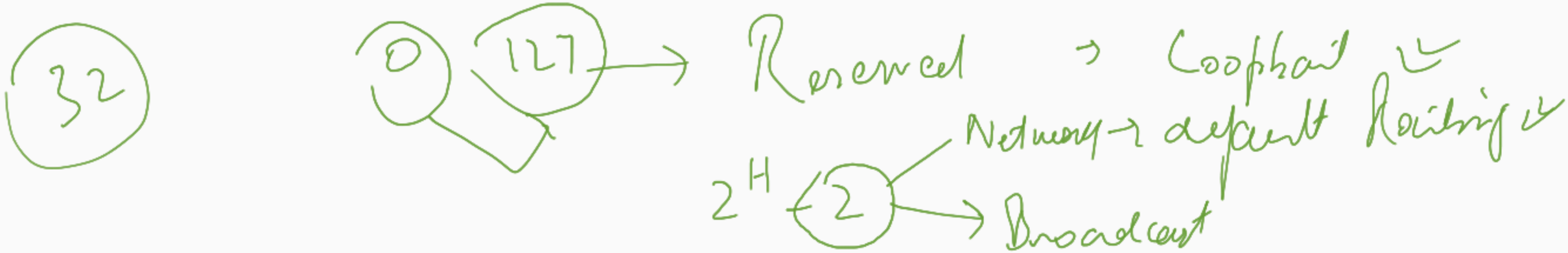
→ Classless

192.168.0.1 C

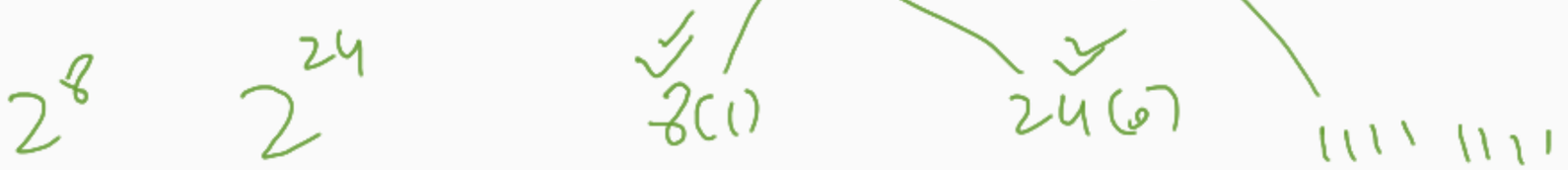
10.0.0.1 A

Class	First Octet Values	Purpose
A	1–126	Unicast (large networks)
B	128–191	Unicast (medium-sized networks)
C	192–223	Unicast (small networks)
D	224–239	Multicast
E	240–255	Reserved (formerly experimental)

200.1.1.1



	Class A	Class B	Class C
First octet range	1–126	128–191	192–223
Valid network numbers	1.0.0.0–126.0.0.0	128.0.0.0–191.255.0.0	192.0.0.0–223.255.255.0
Total networks	$2^7 - 2 = 126$	$2^{14} = 16{,}384$	$2^{21} = 2{,}097{,}152$
Hosts per network	$2^{24} - 2$	$2^{16} - 2$	$2^8 - 2$
Octets (bits) in network part	1 (8)	2 (16)	3 (24)
Octets (bits) in host part	3 (24)	2 (16)	1 (8)
Default mask	255.0.0.0	255.255.0.0	255.255.255.0



- *n* indicates a bit used for the network ID.
- *H* indicates a bit used for the host ID.
- X indicates a bit without a specified purpose.

```
Class A
  0.   0.   0.   0 = 00000000.00000000.00000000.00000000
127.255.255.255 = 01111111.11111111.11111111.11111111
                  0nnnnnnn.HHHHHHHH.HHHHHHHH.HHHHHHHH

Class B
128.   0.   0.   0 = 10000000.00000000.00000000.00000000
191.255.255.255 = 10111111.11111111.11111111.11111111
                  10nnnnnn.nnnnnnnn.HHHHHHHH.HHHHHHHH

Class C
192.   0.   0.   0 = 11000000.00000000.00000000.00000000
223.255.255.255 = 11011111.11111111.11111111.11111111
                  110nnnnn.nnnnnnnn.nnnnnnnn.HHHHHHHH

Class D
224.   0.   0.   0 = 11100000.00000000.00000000.00000000
239.255.255.255 = 11101111.11111111.11111111.11111111
                  1110XXXX.XXXXXXXX.XXXXXXXX.XXXXXXXX

Class E
240.   0.   0.   0 = 11110000.00000000.00000000.00000000
255.255.255.255 = 11111111.11111111.11111111.11111111
                  1111XXXX.XXXXXXXX.XXXXXXXX.XXXXXXXX
```

0 - 127 => MSB => 0

128 - 191 => MSB = 10

192 - 223 => MSB = 110

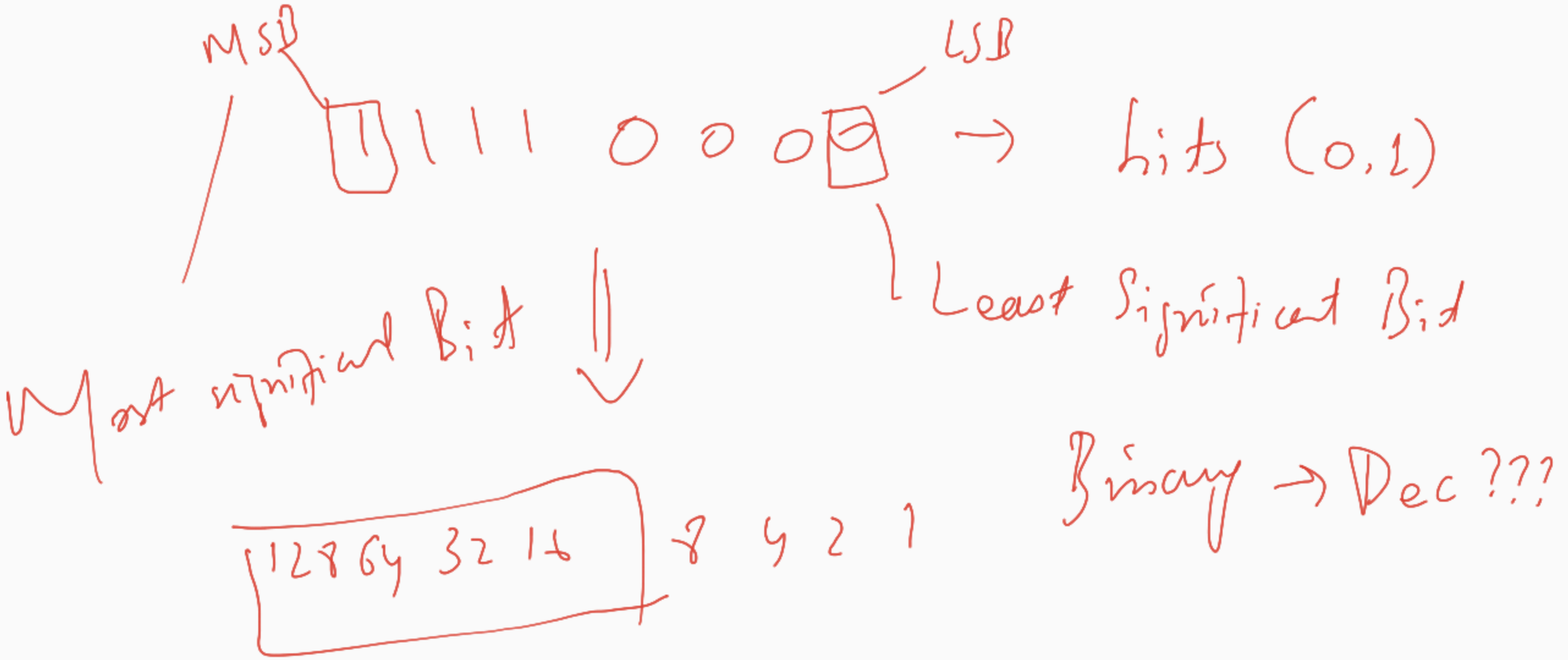
224 - 239 => MSB = 1110

240 - 255 => MSB = 1111

2^7

2^{14}

2^{21}


MSB
LSB
1 1 1 1 0 0 0 0
→ bits (0,1)
Most significant Bit
Least Significant Bit
128 64 32 16 8 4 2 1
Binary → Dec ???

$\boxed{\text{Class A}}$ ⇒ MSB ⇒ 0

→ 128

1 0 0 0 0 0 0 0

$\boxed{0}$ 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0

⇒ $\boxed{0}$.0.0.0

$\boxed{1}$ 1 1 1 1 1 1   1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1

1

$\boxed{127}$.255.255.255

Host = 2^{24}

$\boxed{10}$ 1 1 1 1 1 1

⇓

191

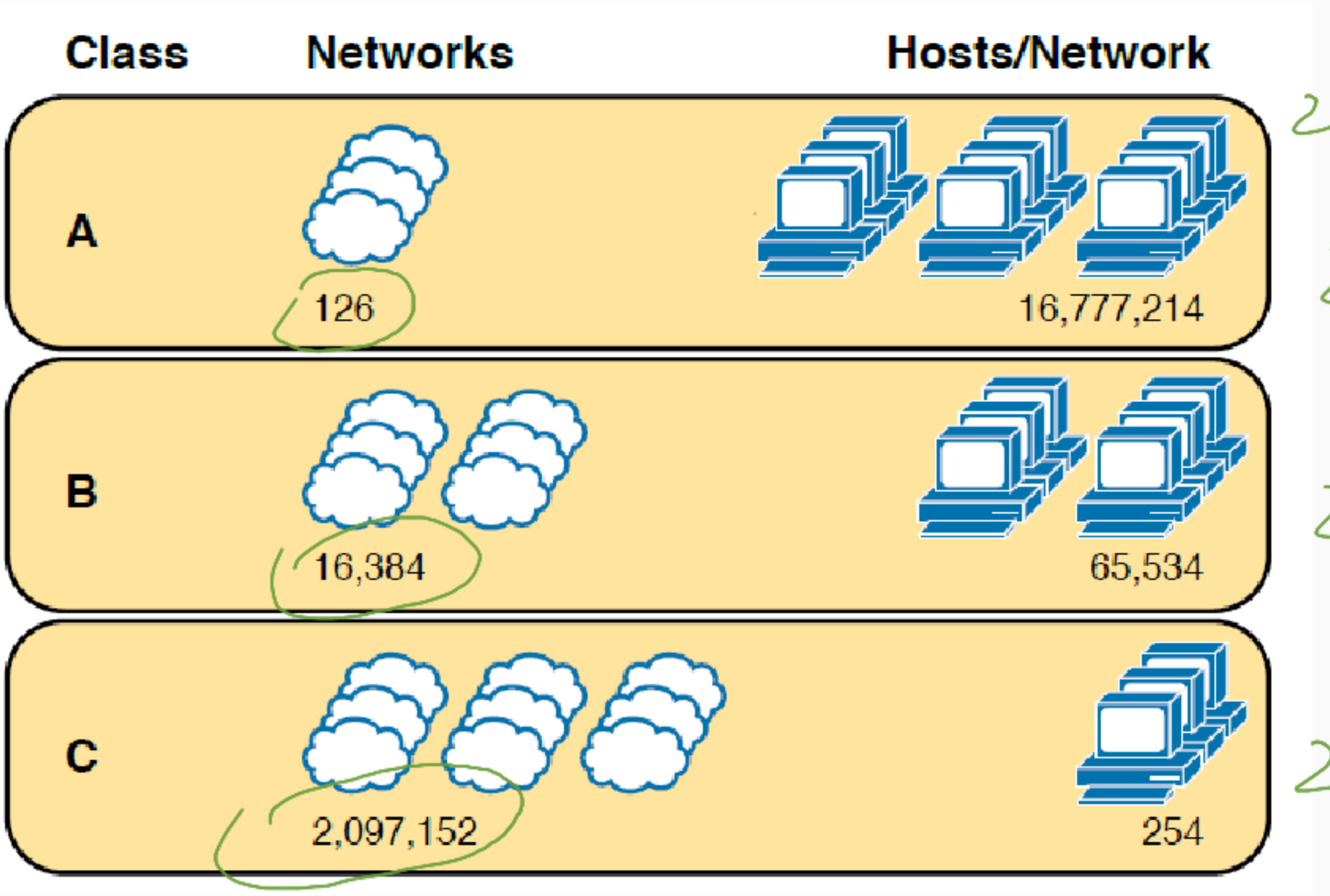
2^{15} ⇒ ~~0~~ – ~~127~~

2^{14} =

Network

$\boxed{1-126}$

$2^7 - 2$


Class
Networks
Hosts/Network
A
126
16,777,214
B
16,384
65,534
C
2,097,152
254

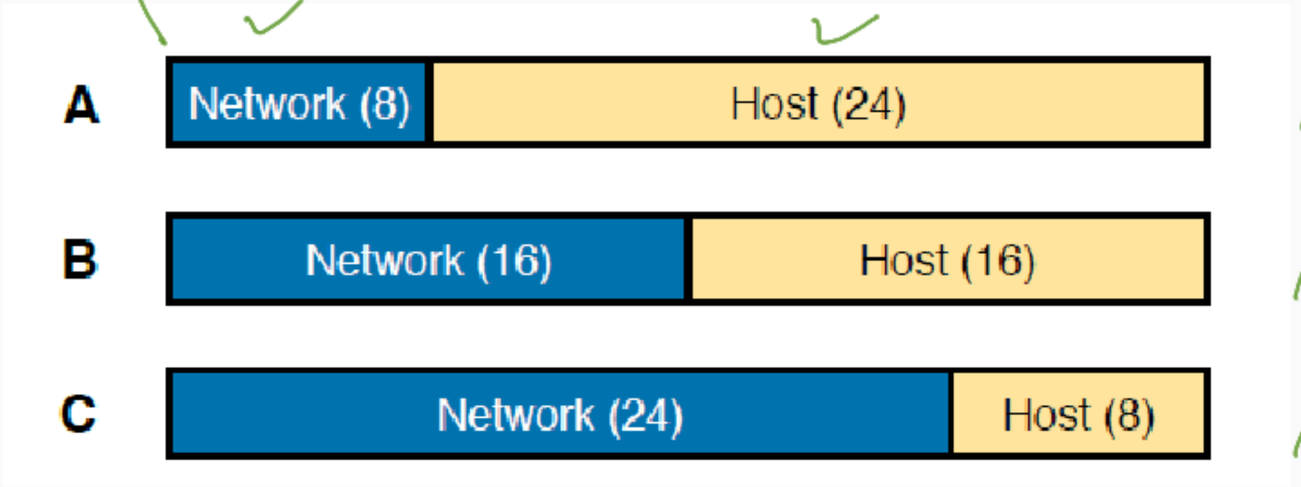
32 → IP

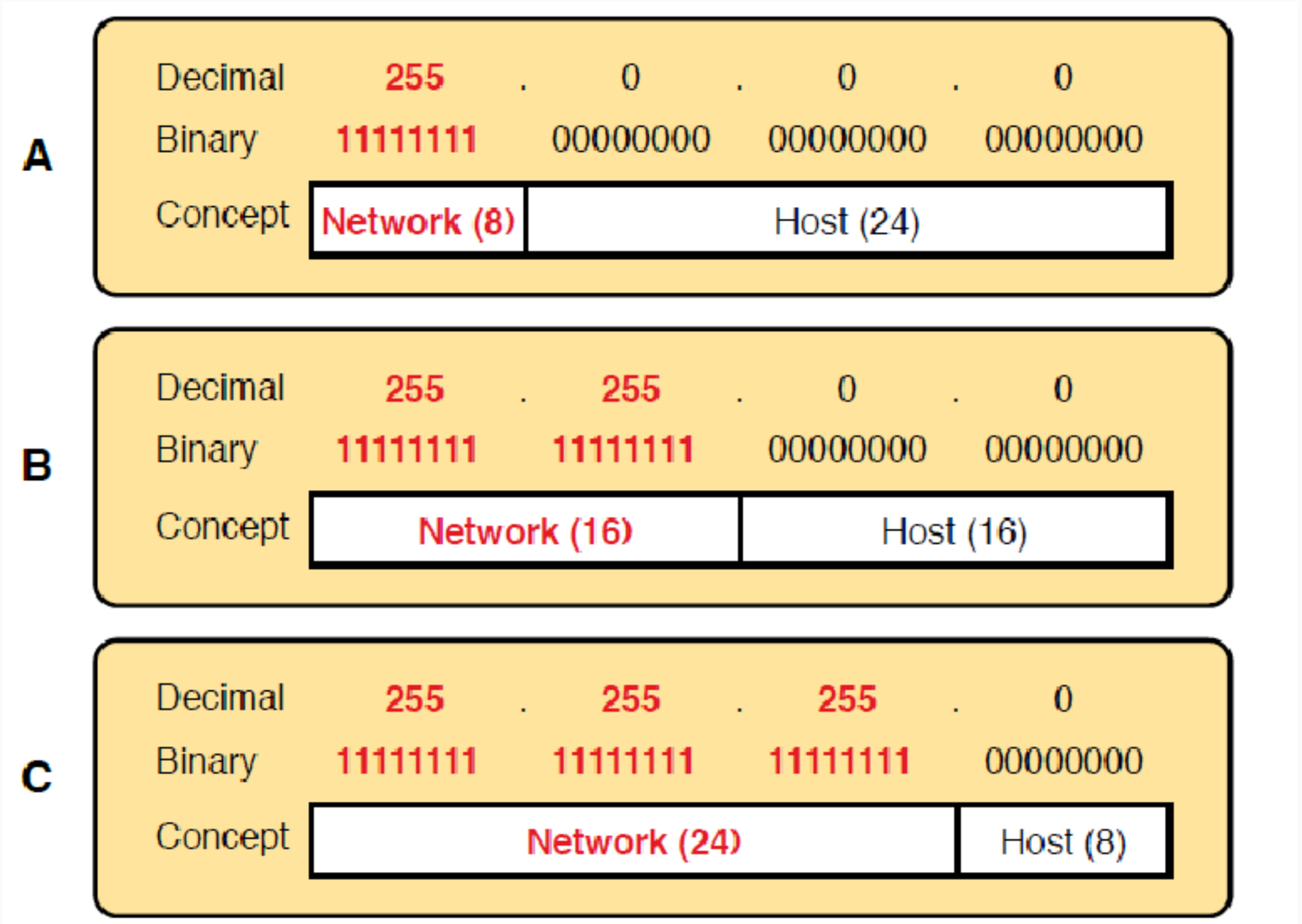
Classful IP →

A B C

Prefix

Network + Host





1–126

128 →

Default Mask?

C

255.255.25.0

192.168.1.0

C?

10.0.0.1
10.255.255.254

$2^H - 2$

N | H

10 | 17 . 18 . 21

10 | 0 . 0 . 0 — NIP

+1

(A) class !!!

Mask ?

255.0.0.0

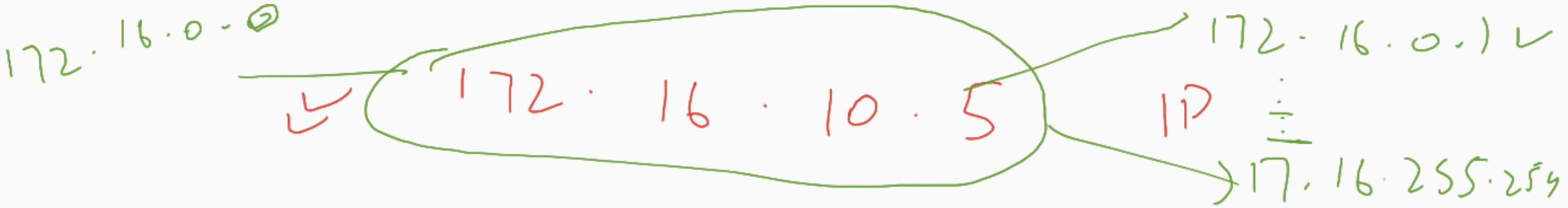
10 | 0 . 0 . 1

Network ID ??? X

10 | 255 . 255 . 255 — BC

1st Usable IP ?

10 | 255 . 255 . 254



Mask ? 255.255.0.0 / 16 → Prefix

N.ID ? 172.16.0.0

B.ID ? 172.16.255.255

F.ID 172.16.0.1

2.IP 172.16.255.254

D.D.D 192.168.1.15

class C 255.255.255.0

192.168.1.0

192.168.1.255

192.168.1.1

192.168.1.254

192.168.0.1.1

classful IP → A, B, C

~~classless IP~~ →

10.1.1.0

Mask

1. 255.0.0.0 (DDN) — /8
2. 255.255.0.0 (DDN) — /16
3. 255.255.255.0 (DDN) — /24

100100

111000

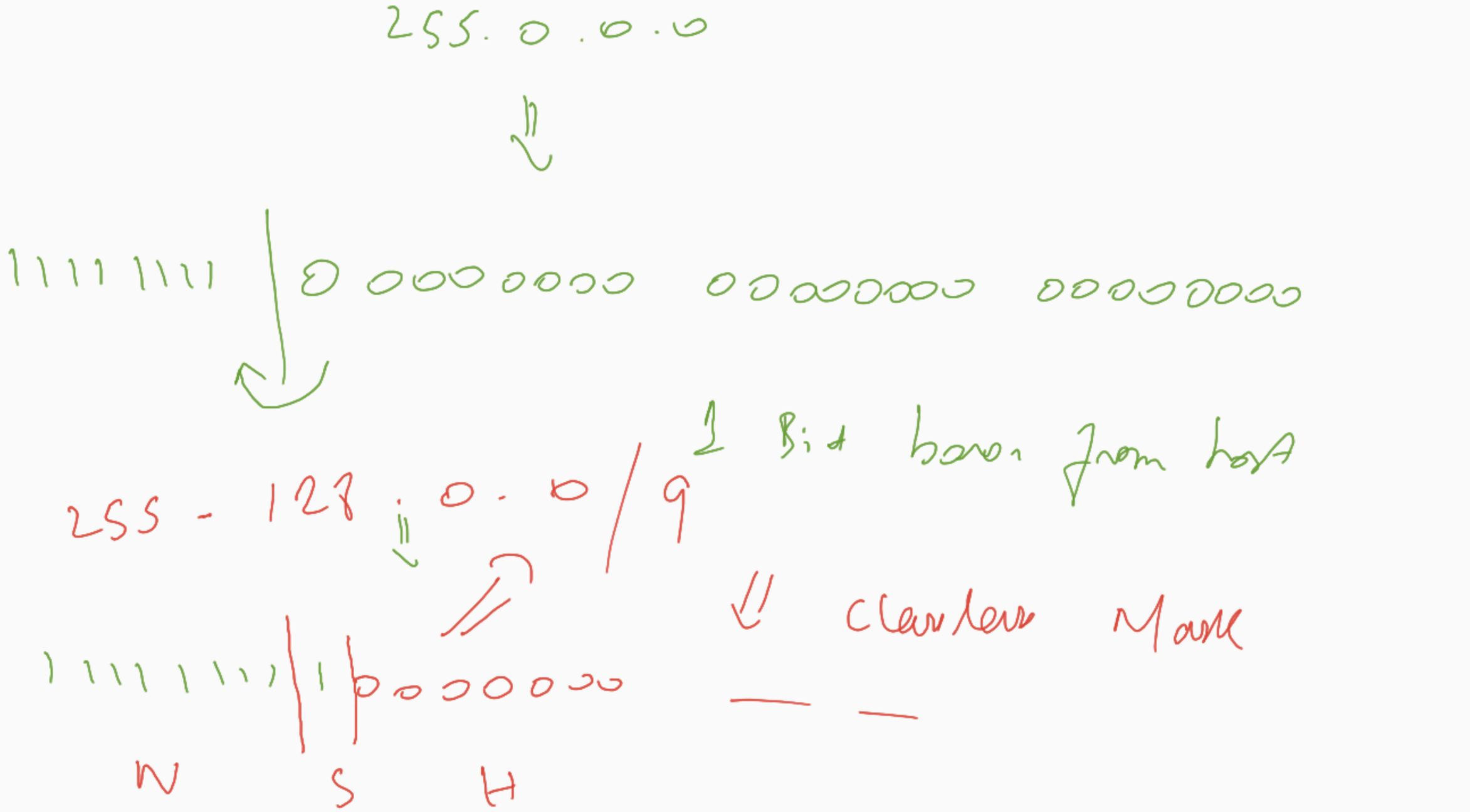
✓ 18 ⇒ 11111110 - -

19 ⇒ 11111111 10 ——

115 ⇒ $\xrightarrow[15]{}$ $\underset{0}{\underline{\quad}}$

DDN ⟷ Binary ⟷ Prefix

—— ⟵ 18


255.0.0.0
11111111 | 00000000 00000000 00000000
255 - 128 : 0.0/9
1 Bit borrow from host
Classless Mask
11111111 | 10000000
N
S
H

255.25.0.0

128 64 32

11111111 . 00000000 . 00000000 . 00000000

11111111 - 11100000 - - - - .

255 . 224 . 0 . 0 / 11

225 . 0 . 0 ✓

255 . 25 . - - ✓

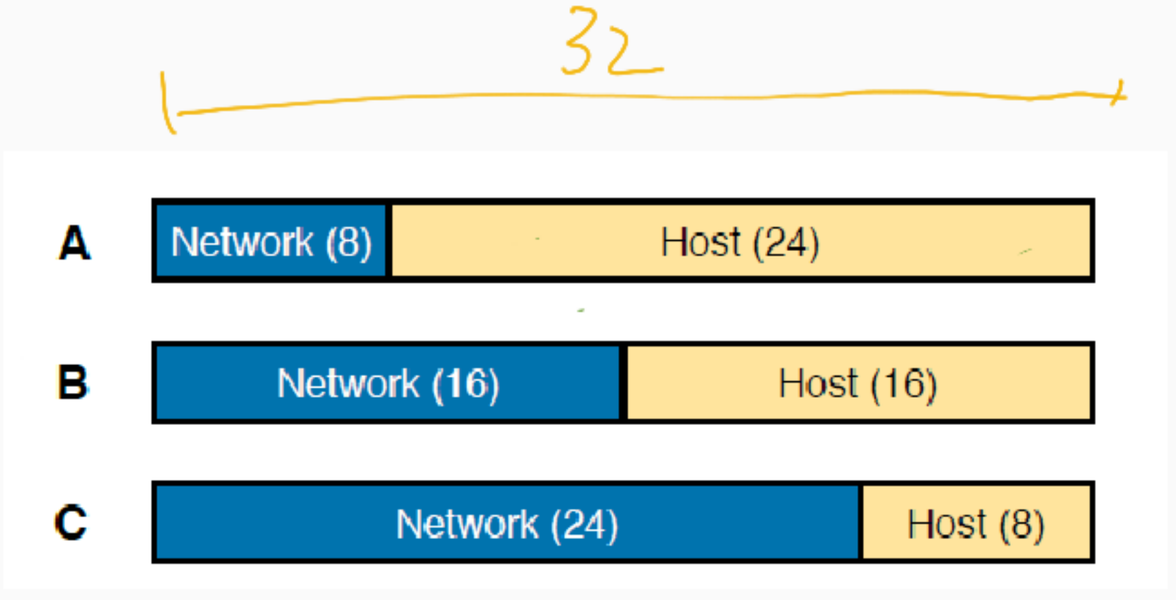
25 . 9 . - - . ✓

Binary Mask Octet	Decimal Equivalent	Number of Binary 1s
00000000	0	0
10000000	128	1
11000000	192	2
11100000	224	3
11110000	240	4
11111000	248	5
11111100	252	6
11111110	254	7
11111111	255	8

255.224.0.0

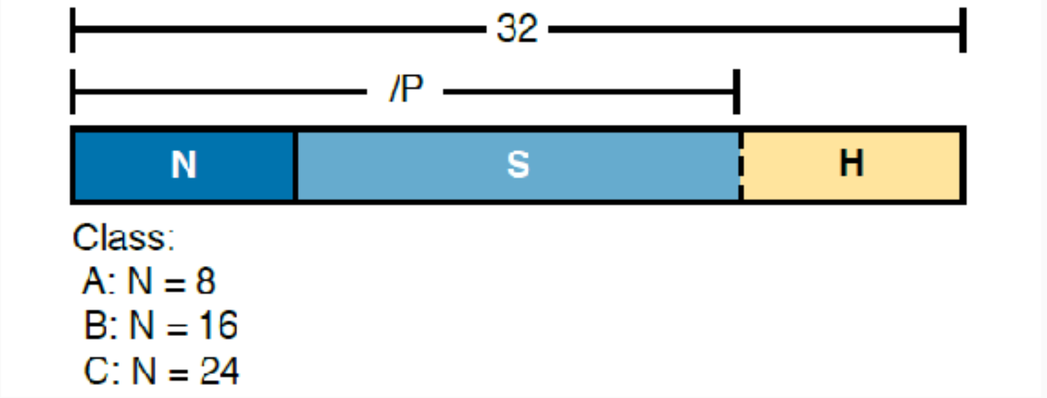
255.248.0.0

255.(255.)0.0 ✓



=> classful

CIDR



=> classless

A

$N = 8$

$H \Rightarrow 24 \Rightarrow S = 2$

$\boxed{H = 22} \Rightarrow S = 2$

$\Downarrow$

$2^{22} - 2$

$4, \ldots$

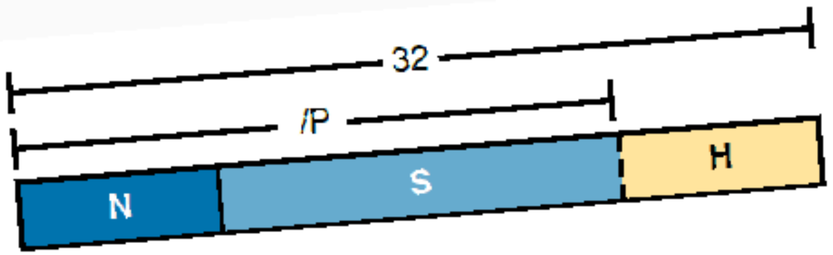
$2^S = 2^2 = 4$

IP : 8.1.4.5 → (A)

255.0.0.0

M : 255.255.0.0 /16

8 | 8 | 16



Class:
A: N = 8
B: N = 16
C: N = 24

S = P - N = 16 - 8 = 8

H = 32 - P = 32 - 16 = 16

S = 8 ⇒ $2^S = 2^8 = 256$

H = 16 ⇒ $2^H - 2 = 2^{16} - 2$

$= 65534$

ID => 199.1.1.100

M => 255.255.255.224

=> Subnet ?

=> H = 7

= class

S

H

P

Binary Mask Octet	Decimal Equivalent	Number of Binary 1s
00000000	0	0
10000000	128	1
11000000	192	2
11100000	224	3
11110000	240	4
11111000	248	5
11111100	252	6
11111110	254	7
11111111	255	8