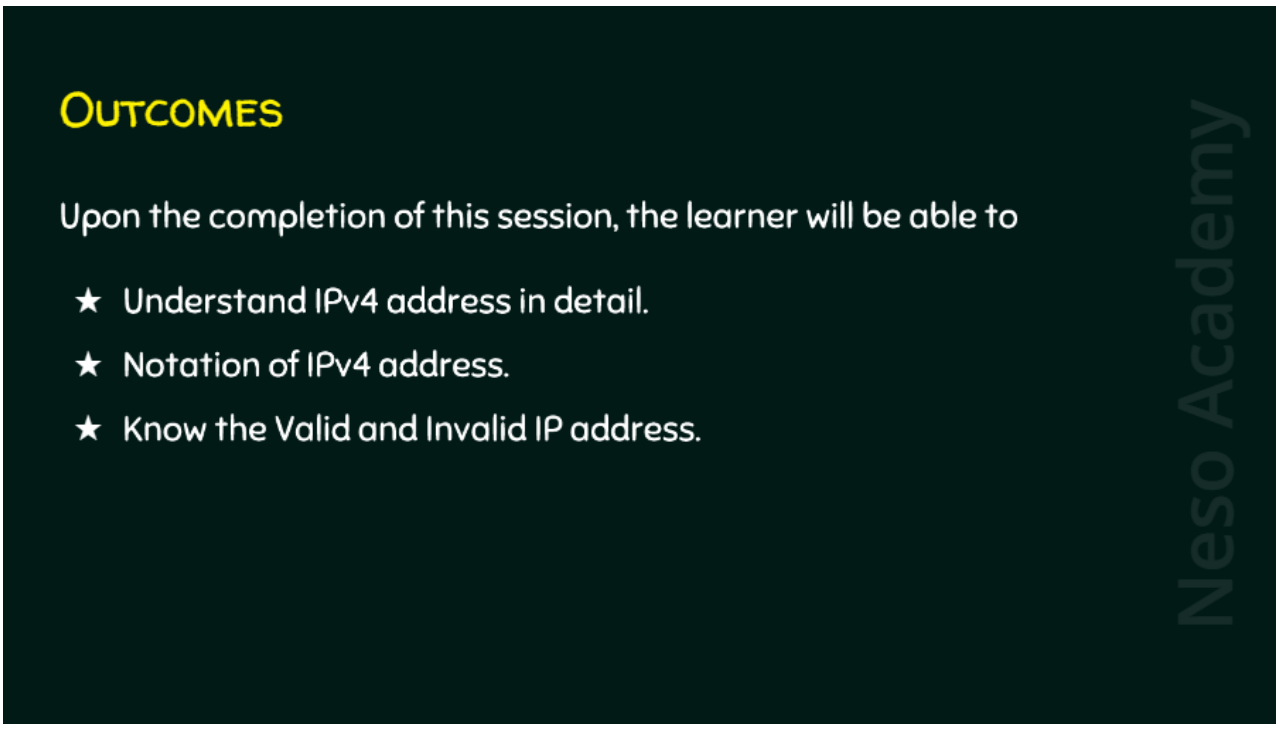
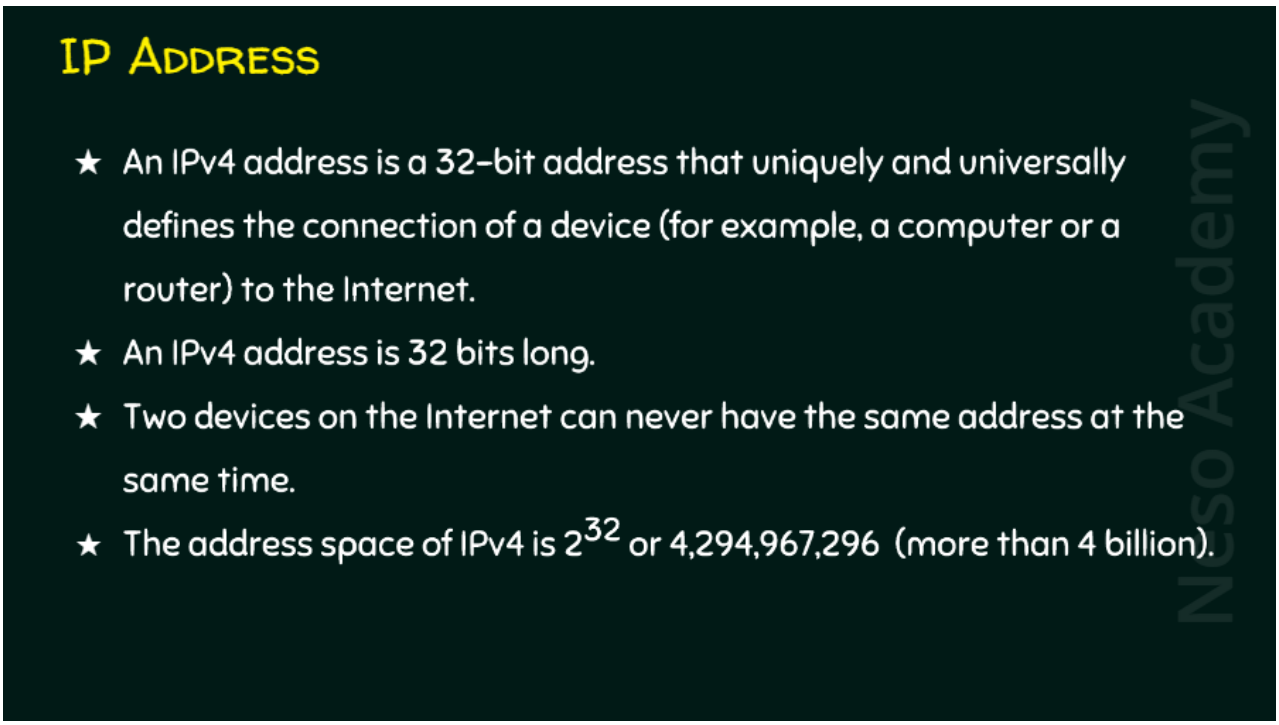
Logical Addressing & Subnetting | Neso Academy

nesoacademy.org/cs/06-computer-networks/ppts/03-logicaladdressing&subnetting

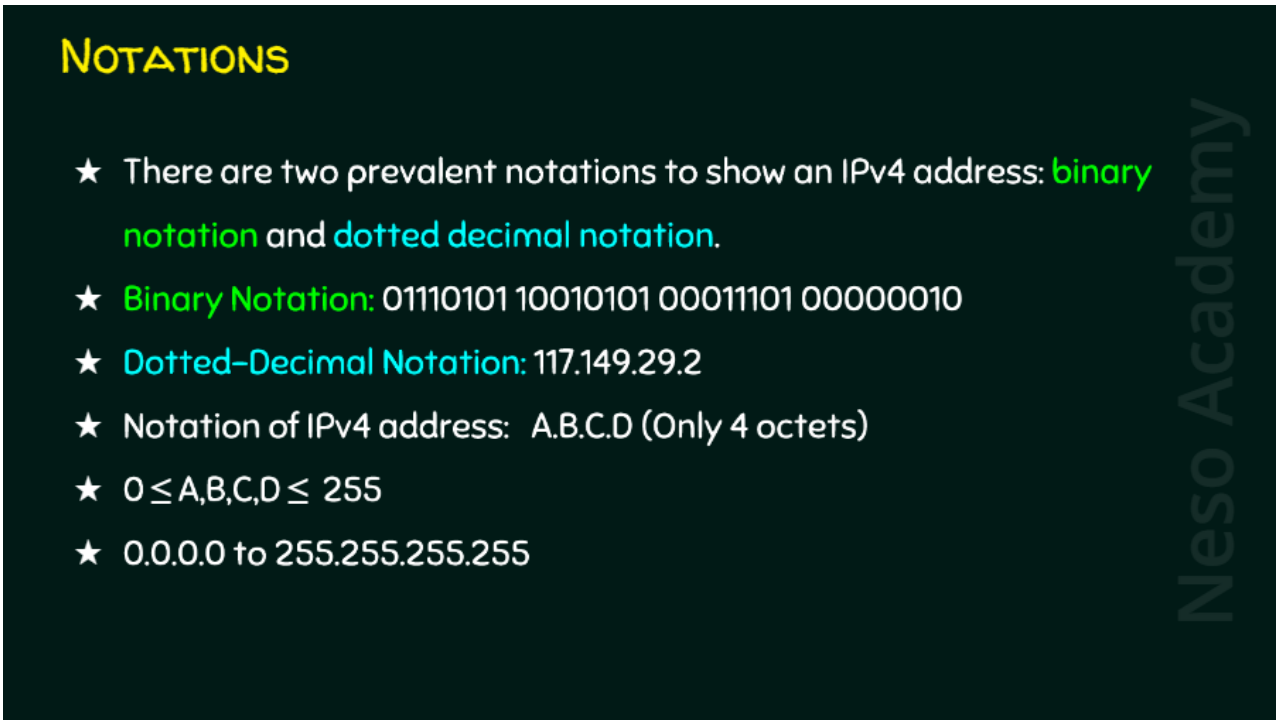
Logical Addressing & SubnettingNeso AcademyCHAPTER - 3



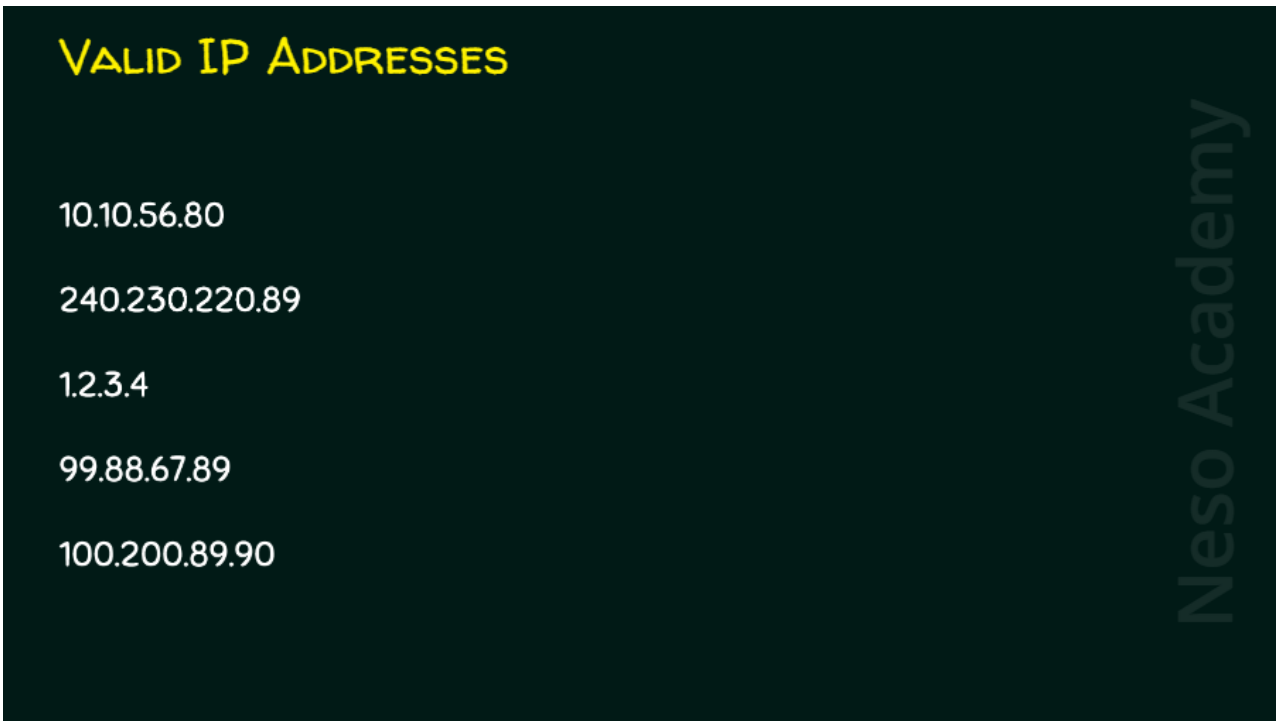
Outcomes★★★Neso Academy



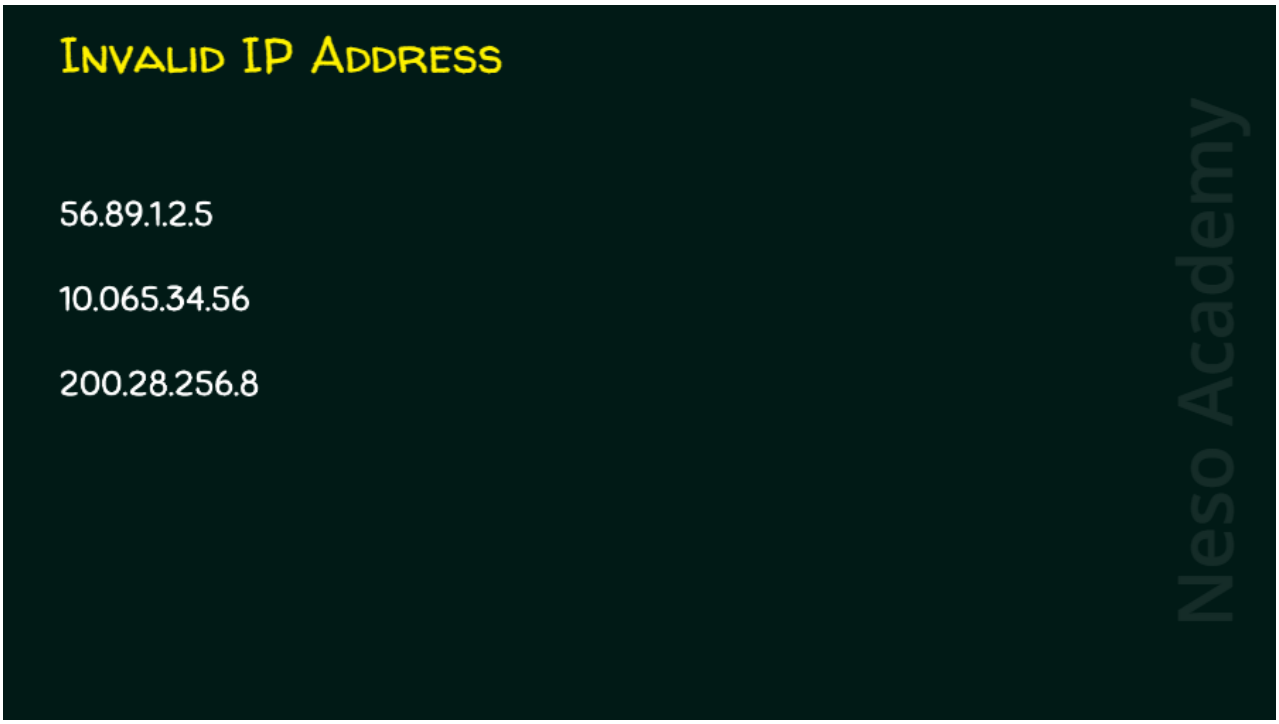
IP Address★★★★Neso Academy



Notations★★★★★≤≤★Neso Academy



Valid IP AddressesNeso Academy



Invalid IP AddressNeso Academy

Activity Time!

Spot the error, if any, in the following IPv4 addresses.

Question	Answer
111.56.045.78	There must be no leading zero (045)
221.34.7.8.20	4 octets only in IPv4 address.
75.45.301.14	Range of each octet is between 0 and 255.
11100010.23.14.67	A mixture of binary and dotted-decimal notation is not allowed

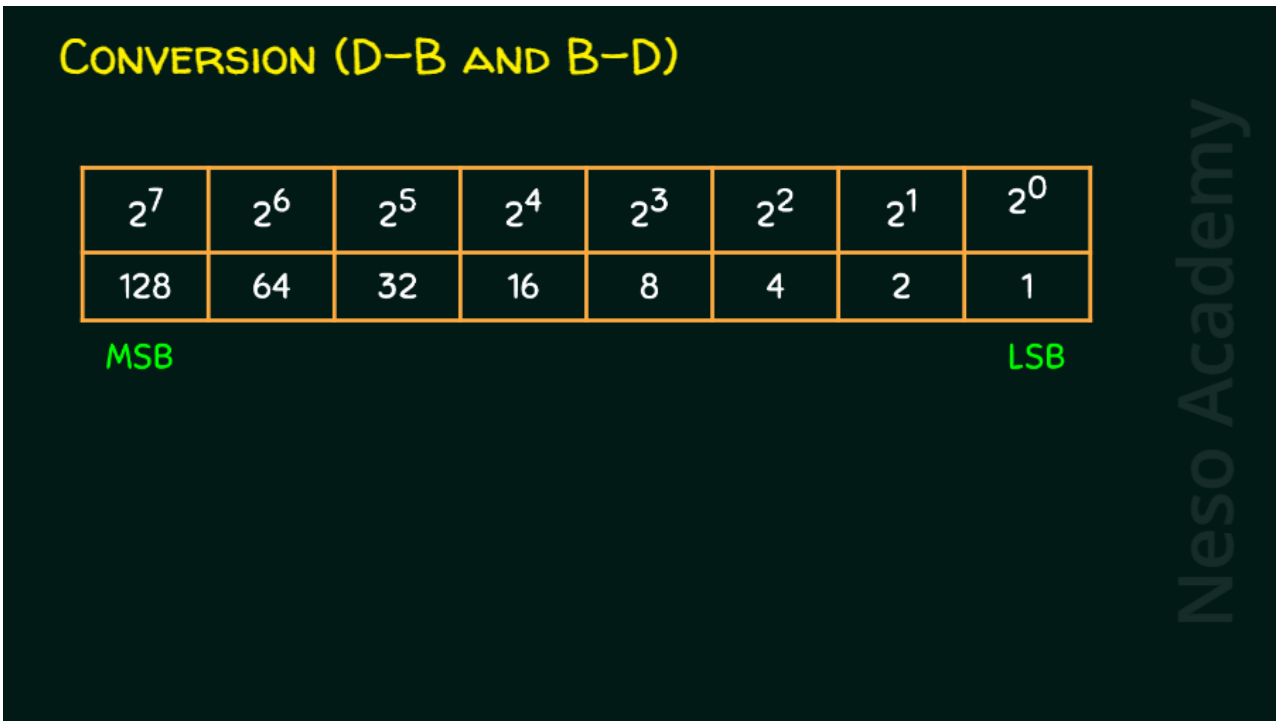
Activity Time!Neso Academy

Outcomes

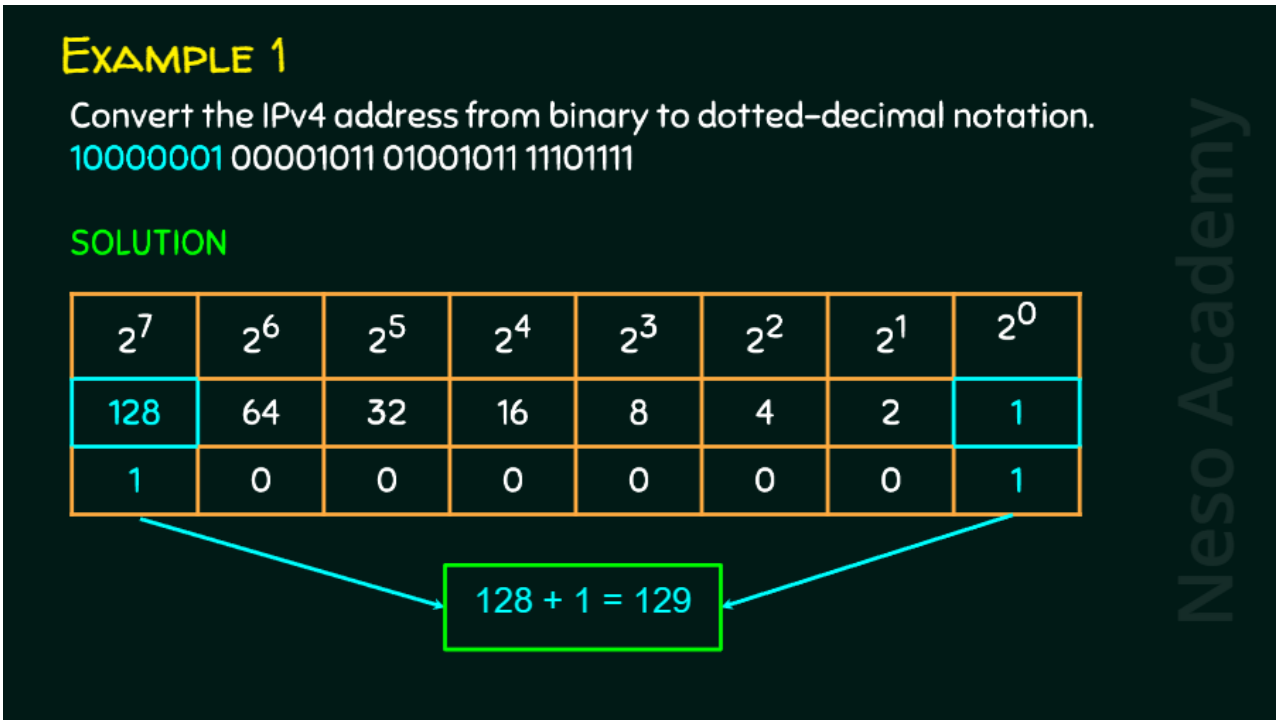
Upon the completion of this session, the learner will be able to

★ Understand the conversion of IP address from dotted-decimal to binary and vice versa.

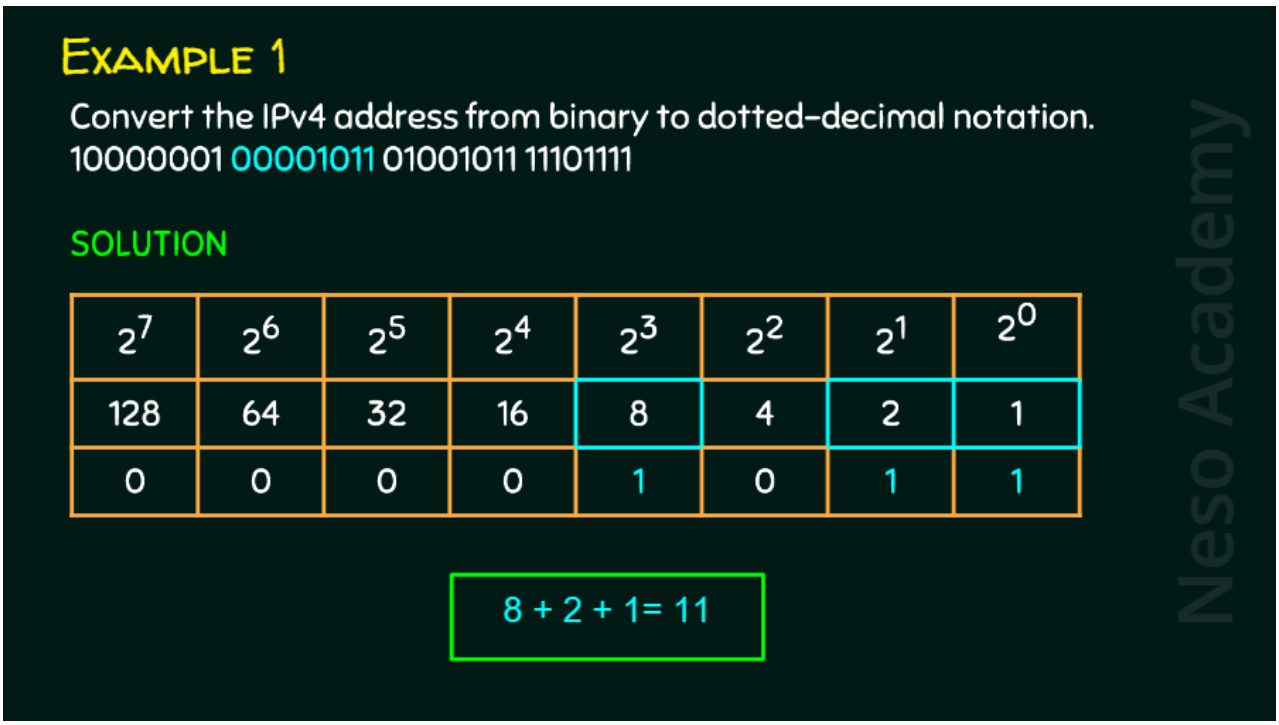
Outcomes★Neso Academy



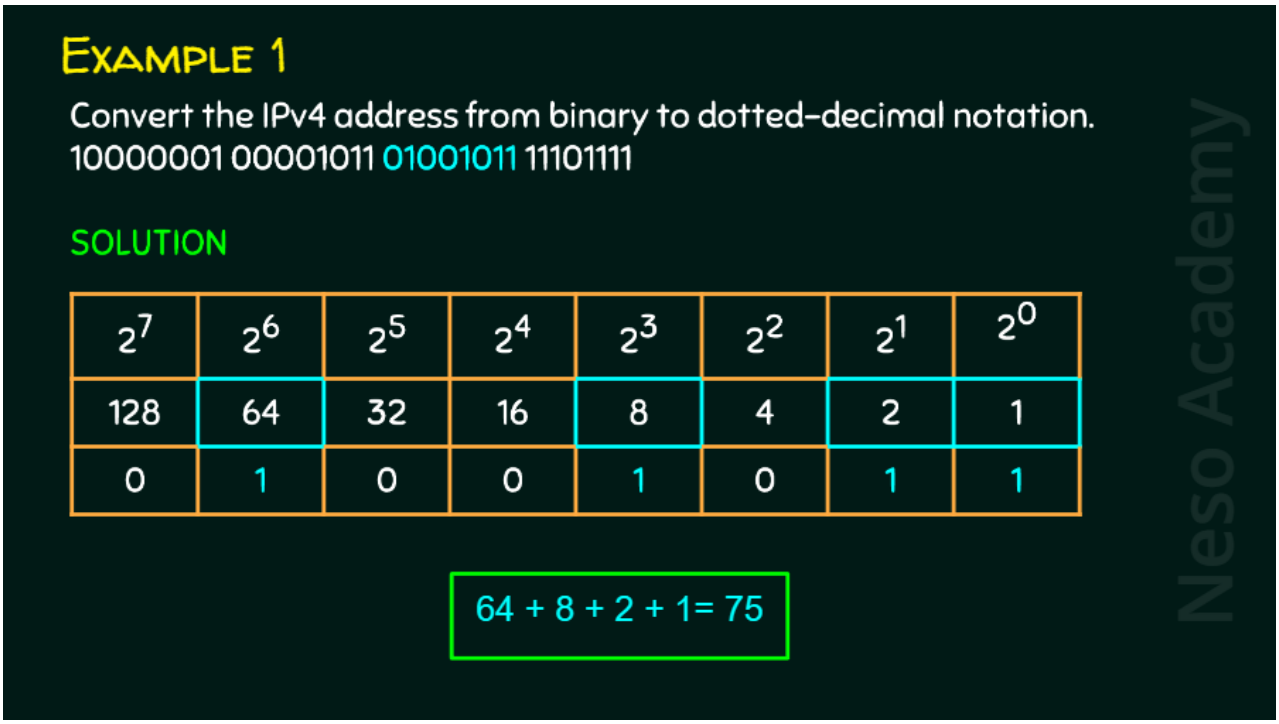
Conversion (D-B and B-D)Neso Academy



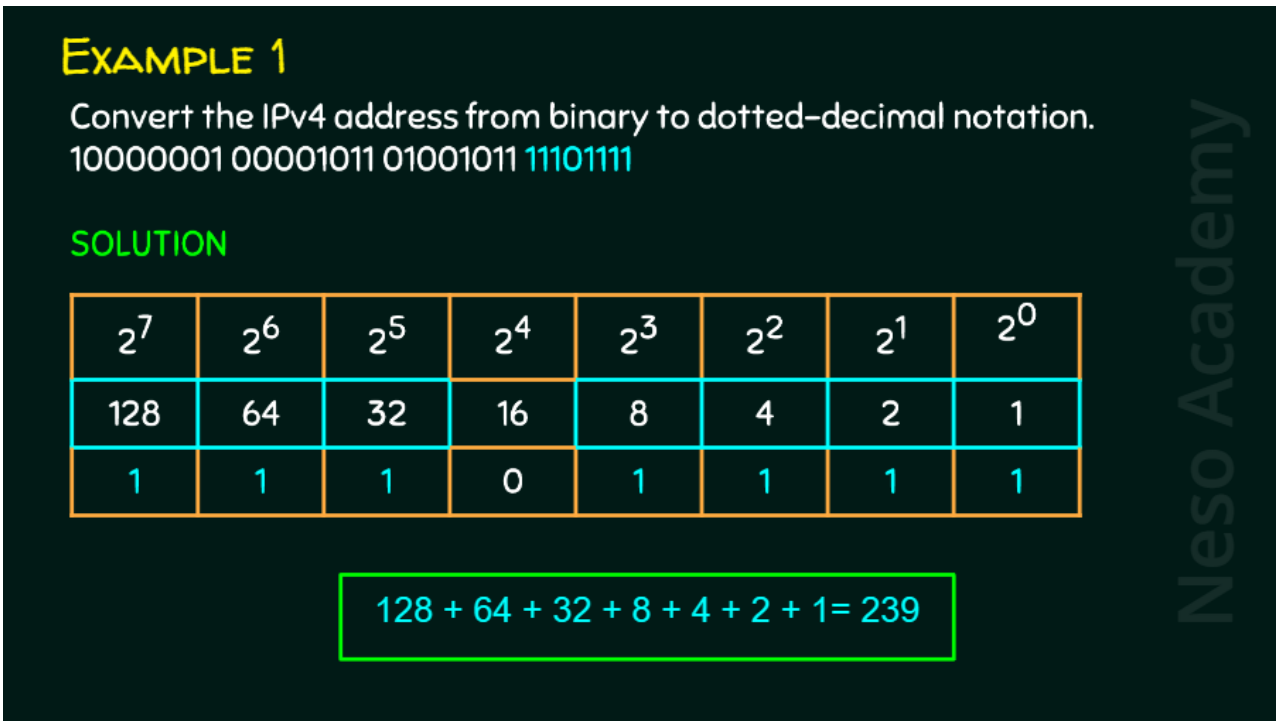
Example 1128 + 1 = 129Neso Academy



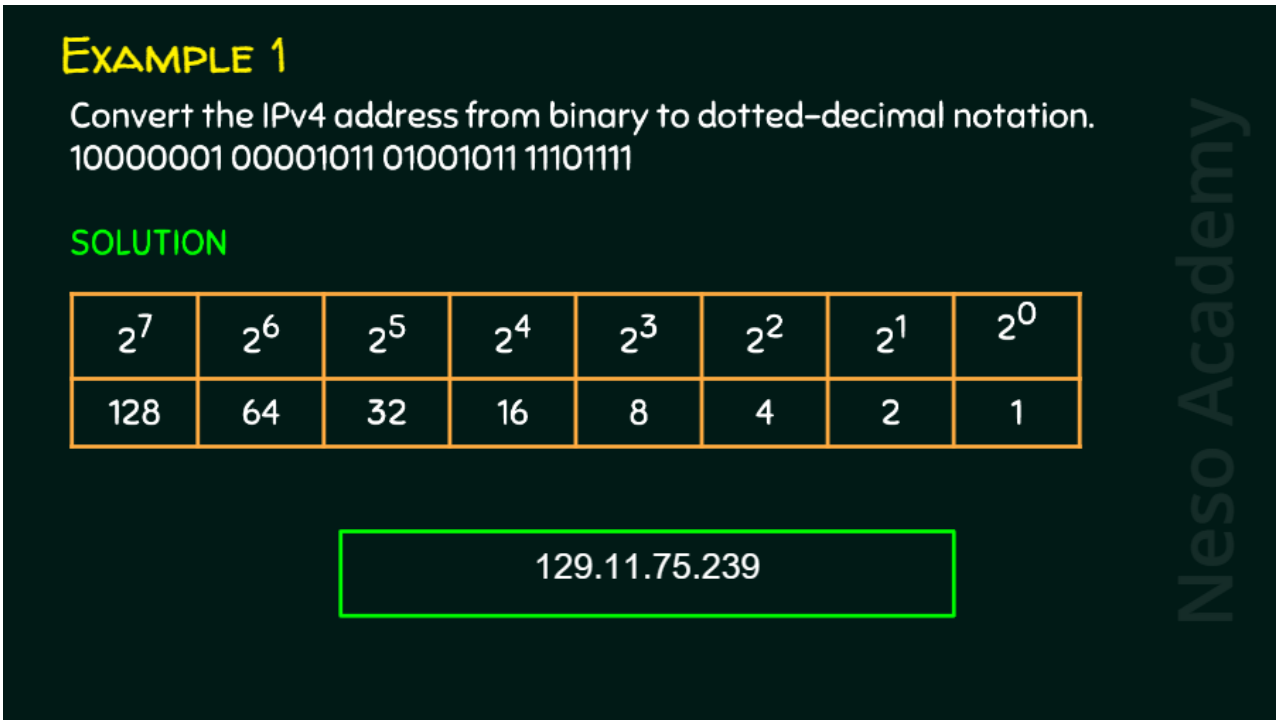
Example 18 + 2 + 1= 11Neso Academy



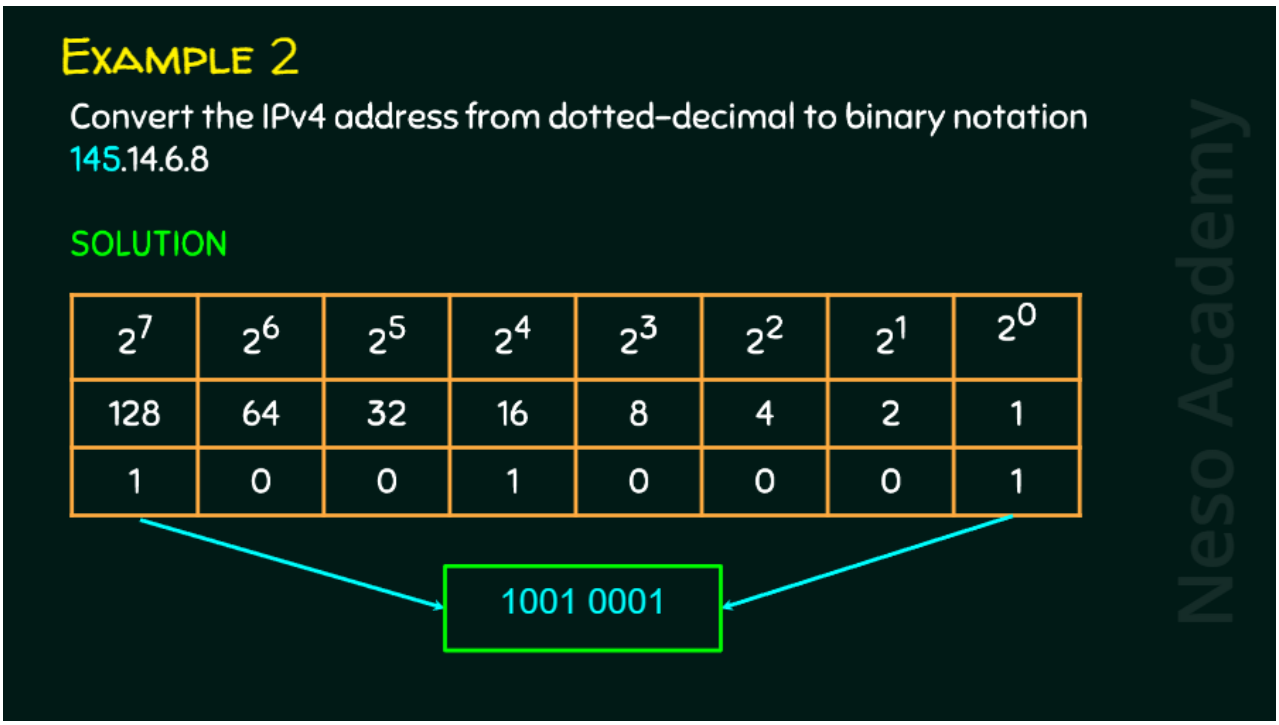
Example 164 + 8 + 2 + 1= 75Neso Academy



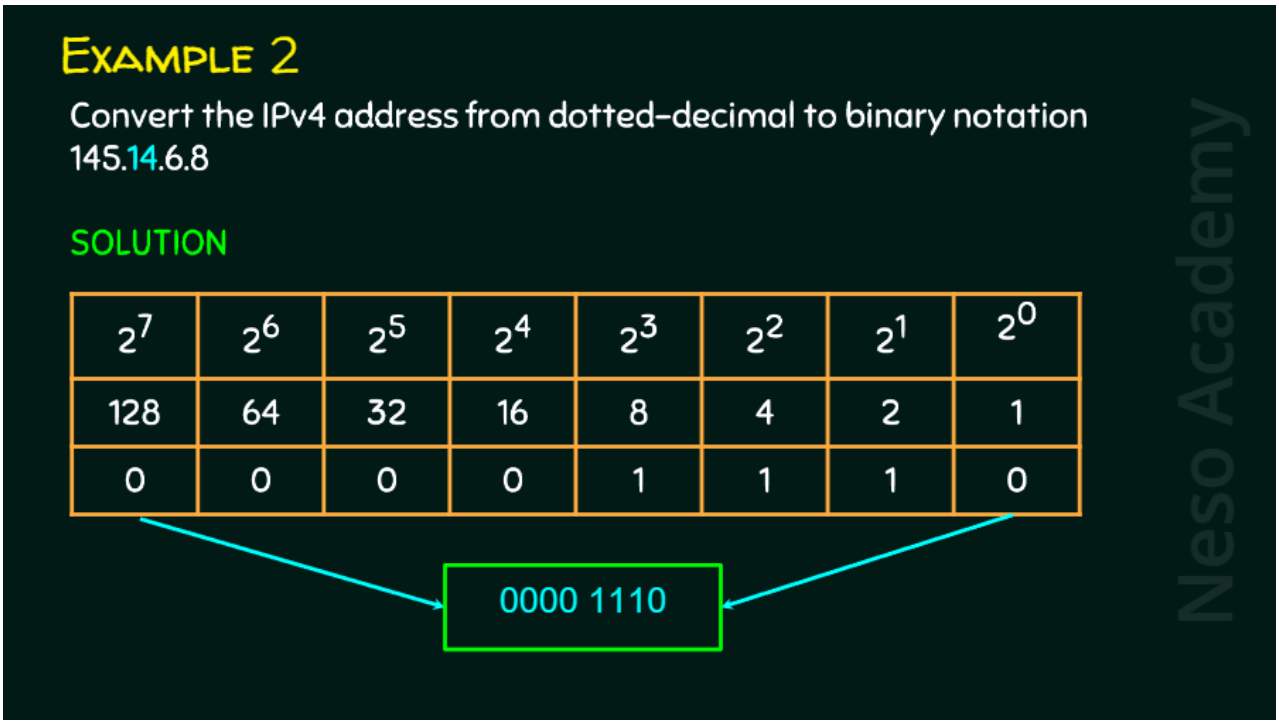
Example 1128 + 64 + 32 + 8 + 4 + 2 + 1= 239Neso Academy



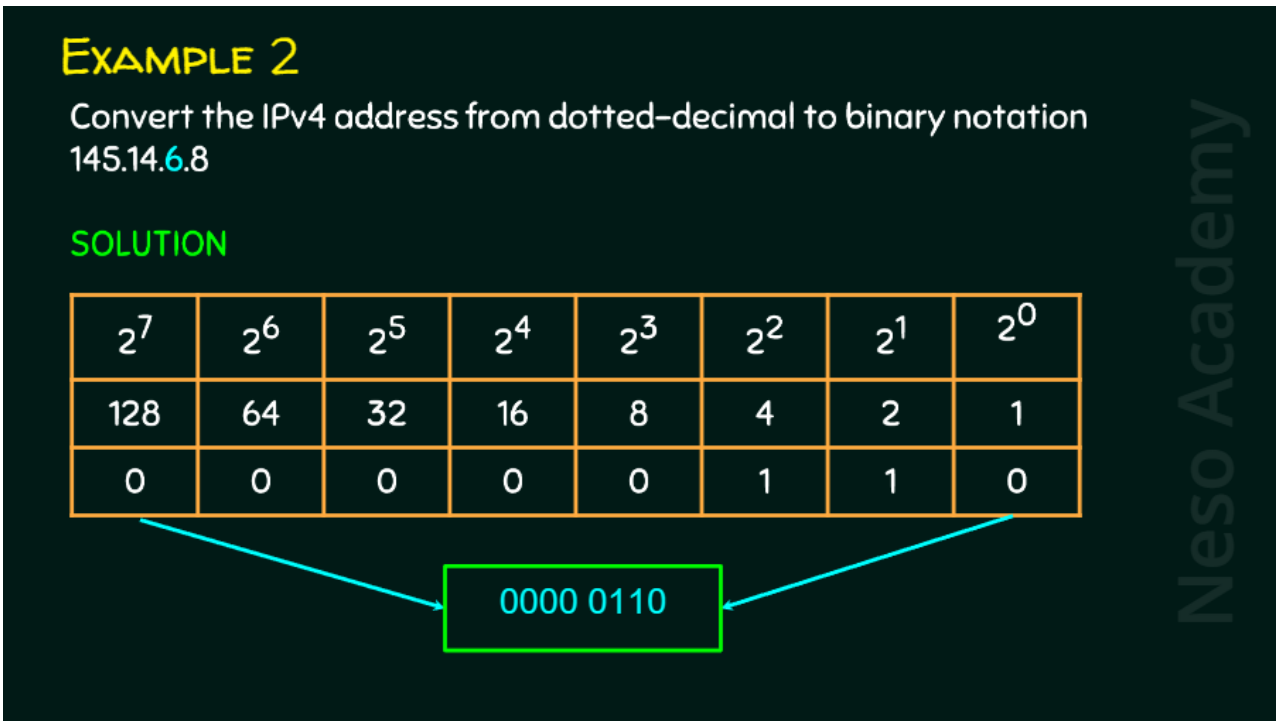
Example 1129.11.75.239Neso Academy



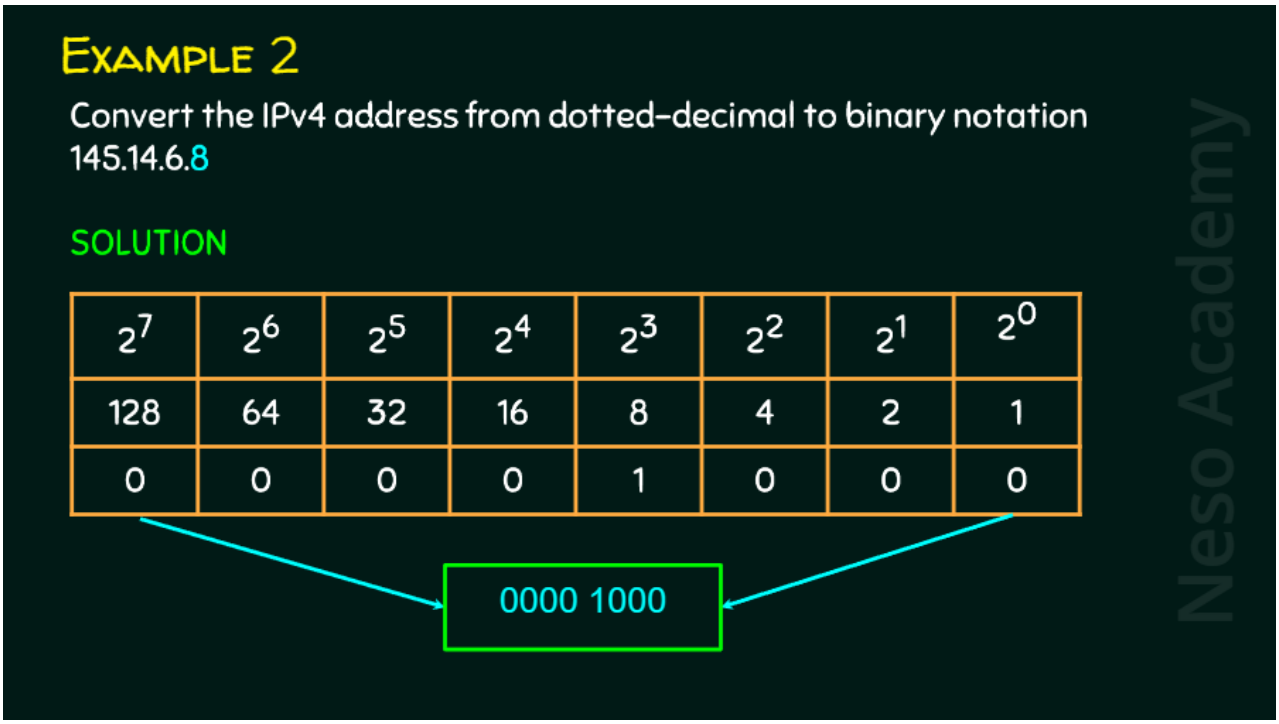
Example 21001 0001Neso Academy



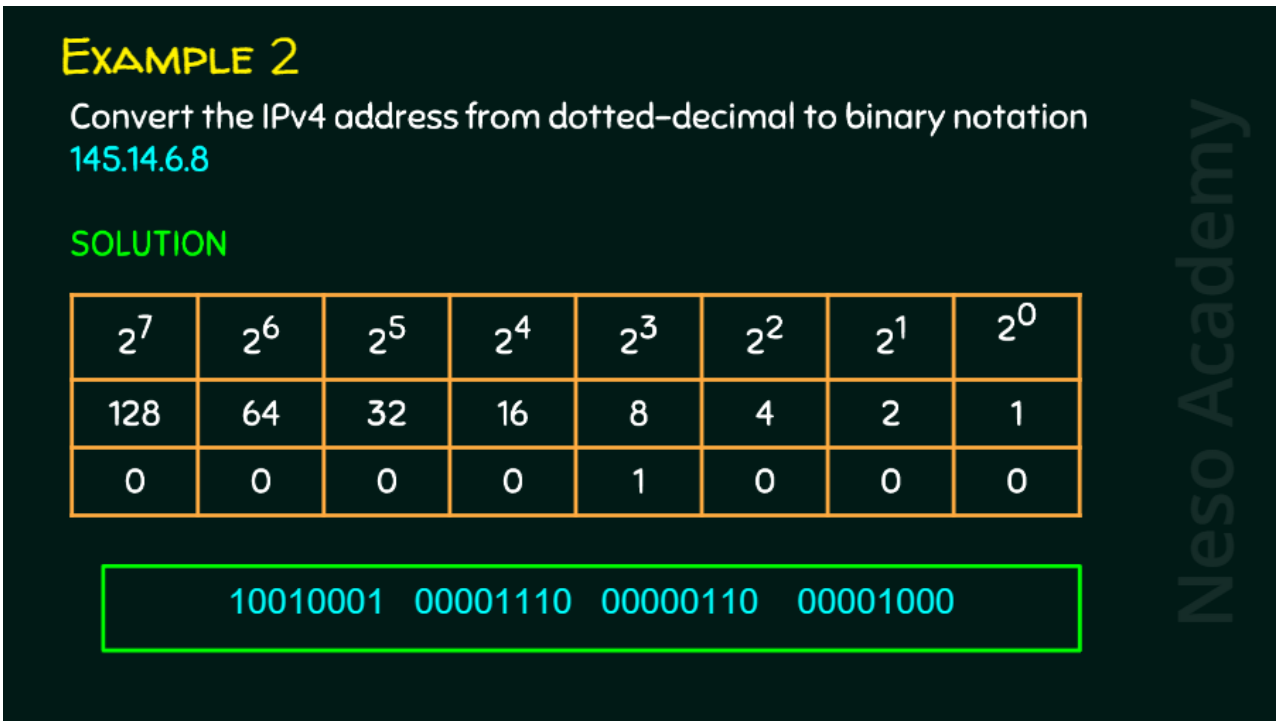
Example 20000 1110Neso Academy



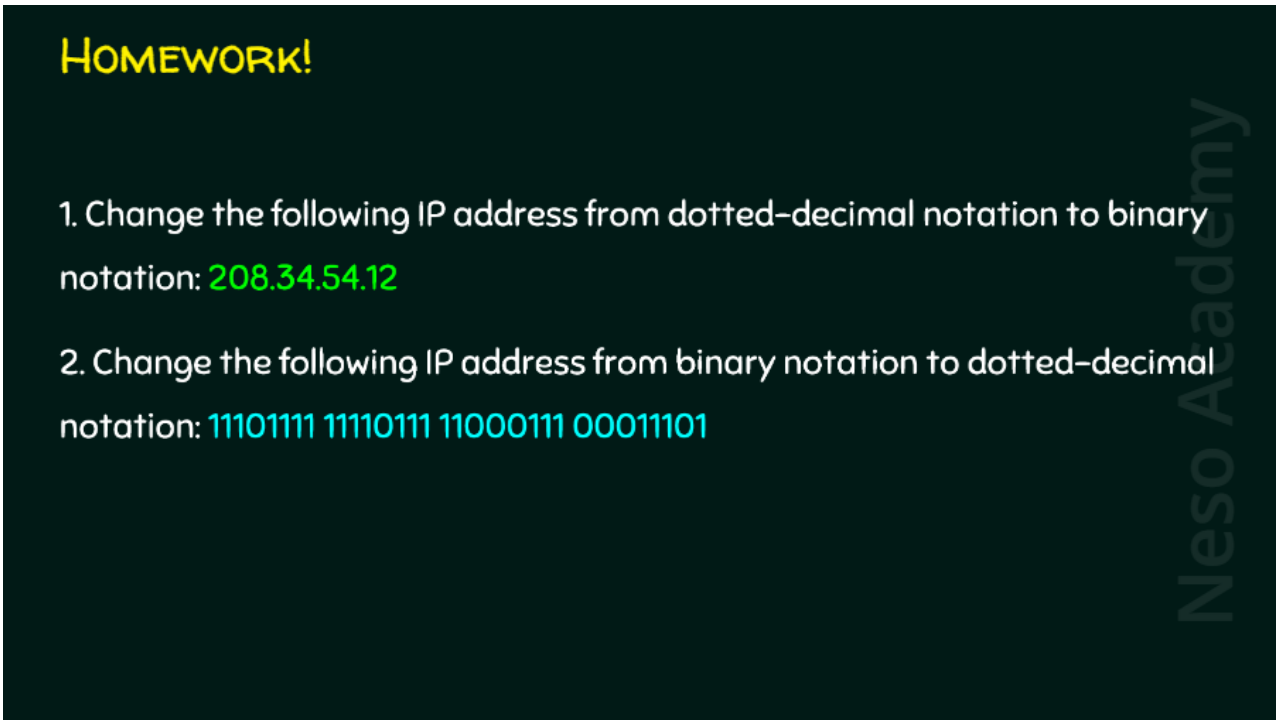
Example 20000 0110Neso Academy



Example 20000 1000Neso Academy



Example 210010001 00001110 00000110 00001000Neso Academy



Homework!Neso Academy

Outcomes

Upon the completion of this session, the learner will be able to

- ★ Understand various classes of IPv4 Address.
- ★ Identify the class of IP address. (Activity)

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Outcomes★★Neso Academy

Classes of IPv4 address

	First byte	Second byte	Third byte	Fourth byte
Class A	0			
Class B	10			
Class C	110			
Class D	1110			
Class E	1111			

a. Binary notation

	First byte	Second byte	Third byte	Fourth byte
Class A	0–127			
Class B	128–191			
Class C	192–223			
Class D	224–239			
Class E	240–255			

b. Dotted-decimal notation

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Classes of IPv4 addressNeso Academy

Classes of IPv4 address

Address Class	1st Octet range in decimal	1st Octet bits (Blue Dots do not change)	Network (N) and Host (H) Portion	Default mask (Decimal)	Number of possible networks and hosts per network
A	0–127	00000000 - 01111111	N.H.H.H	255.0.0.0	128 Nets (2^7) 16,777,214 hosts (2^{24}–2)
B	128–191	10000000 - 10111111	N.N.H.H	255.255.0.0	16,384 Nets (2^{14}) 65,534 hosts (2^{16}–2)
C	192–223	11000000 - 11011111	N.N.N.H	255.255.255.0	2,09,150 Nets (2^{21}) 254 hosts (2^8–2)
D	224–239	11100000 - 11101111	NA (Multicast)	-	-
E	240–255	11110000 - 11111111	NA (Experimental)	-	-

Classes of IPv4 address00000000 -0111111110000000 -1011111111000000 -1101111111100000 -1110111111110000 -11111111Neso Academy

Activity Time!

Find the class of the following dotted decimal IPv4 addresses.

IP Address	Class
192.168.1.10	C
10.10.200.6	A
172.15.165.1	B
230.10.65.30	D (Multicast)

Activity Time!Neso Academy

Homework!

Find the class of the following IPv4 address:

a. 11110111 11110011 10000111 11011101

b. 10101111 11000000 11110000 00011101

c. 11011111 10110000 00011111 01011101

d. 11101111 11110111 11000111 00011101

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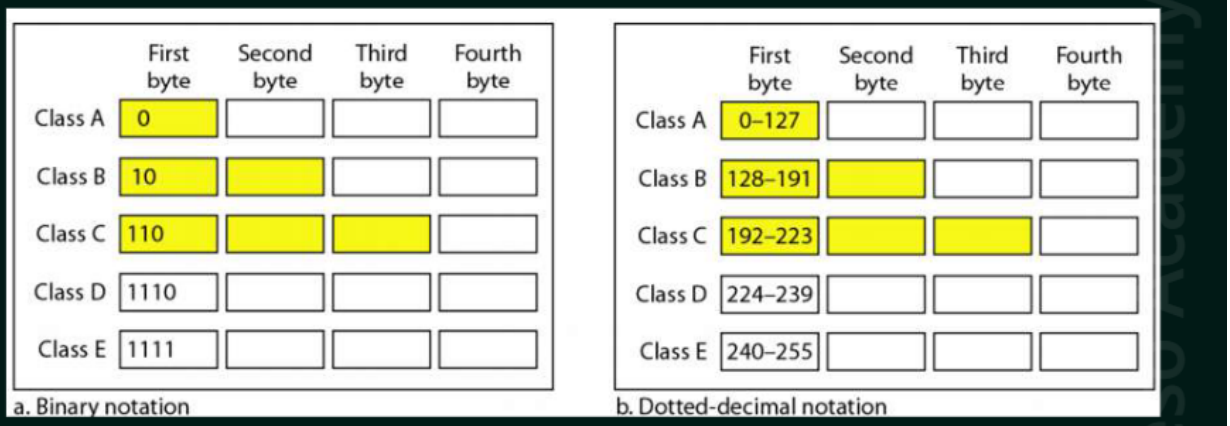
Homework!Neso Academy

Classes of IPv4 address



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Classes of IPv4 addressNeso Academy

Valid Subnet masks

Valid Subnet Masks

Subnet Value	Bit Value							
	128	64	32	16	8	4	2	1
255	1	1	1	1	1	1	1	1
254	1	1	1	1	1	1	1	0
252	1	1	1	1	1	1	0	0
248	1	1	1	1	1	0	0	0
240	1	1	1	1	0	0	0	0
224	1	1	1	0	0	0	0	0
192	1	1	0	0	0	0	0	0
128	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

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Valid Subnet masksNeso Academy

Outcomes

Upon the completion of this session, the learner will be able to

- ★ Recall various classes of IPv4 Address.
- ★ Understand the purpose of subnet mask.
- ★ Identify whether the nodes belonging to same network or different network.

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Outcomes★★★Neso Academy

Classes of IPv4 address

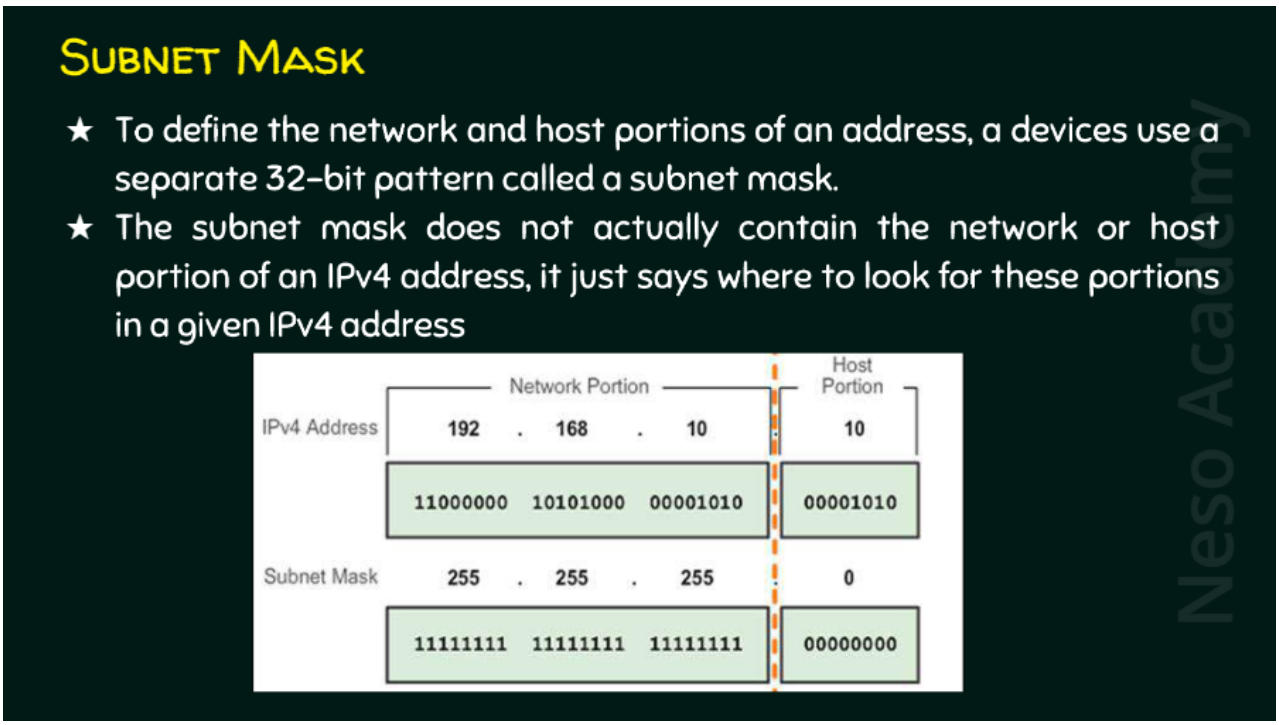
Address Class	1st Octet range in decimal	1st Octet bits (Blue Dots do not change)	Network (N) and Host (H) Portion	Default mask (Decimal)	Number of possible networks and hosts per network
A	0–127	00000000 - 01111111	N.H.H.H	255.0.0.0	128 Nets (2^7) 16,777,214 hosts (2^{24}–2)
B	128–191	10000000 - 10111111	N.N.H.H	255.255.0.0	16,384 Nets (2^{14}) 65,534 hosts (2^{16}–2)
C	192–223	11000000 - 11011111	N.N.N.H	255.255.255.0	2,09,150 Nets (2^{21}) 254 hosts (2^8–2)
D	224–239	11100000 - 11101111	NA (Multicast)	-	-
E	240–255	11110000 - 11111111	NA (Experimental)	-	-

Classes of IPv4 address00000000 -0111111110000000 -1011111111000000 -1101111111100000 -1110111111110000 -11111111Neso Academy

Subnet mask (Slash notation)

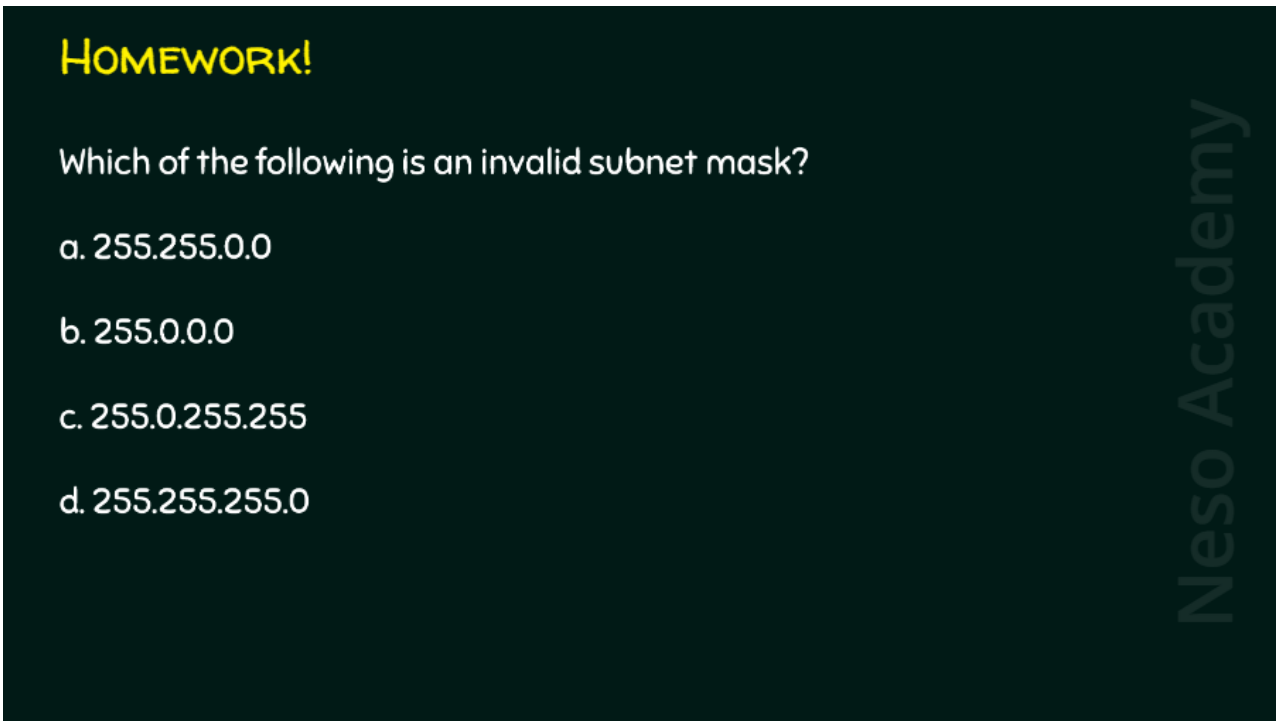
Class	Subnet Mask (in Decimal)	Subnet Mask (in Binary)	Slash Notation
A	255.0.0.0	11111111.00000000.00000000.00000000	/8
B	255.255.0.0	11111111.11111111.00000000.00000000	/16
C	255.255.255.0	11111111.11111111.11111111.00000000	/24

Subnet mask (Slash notation)Neso Academy

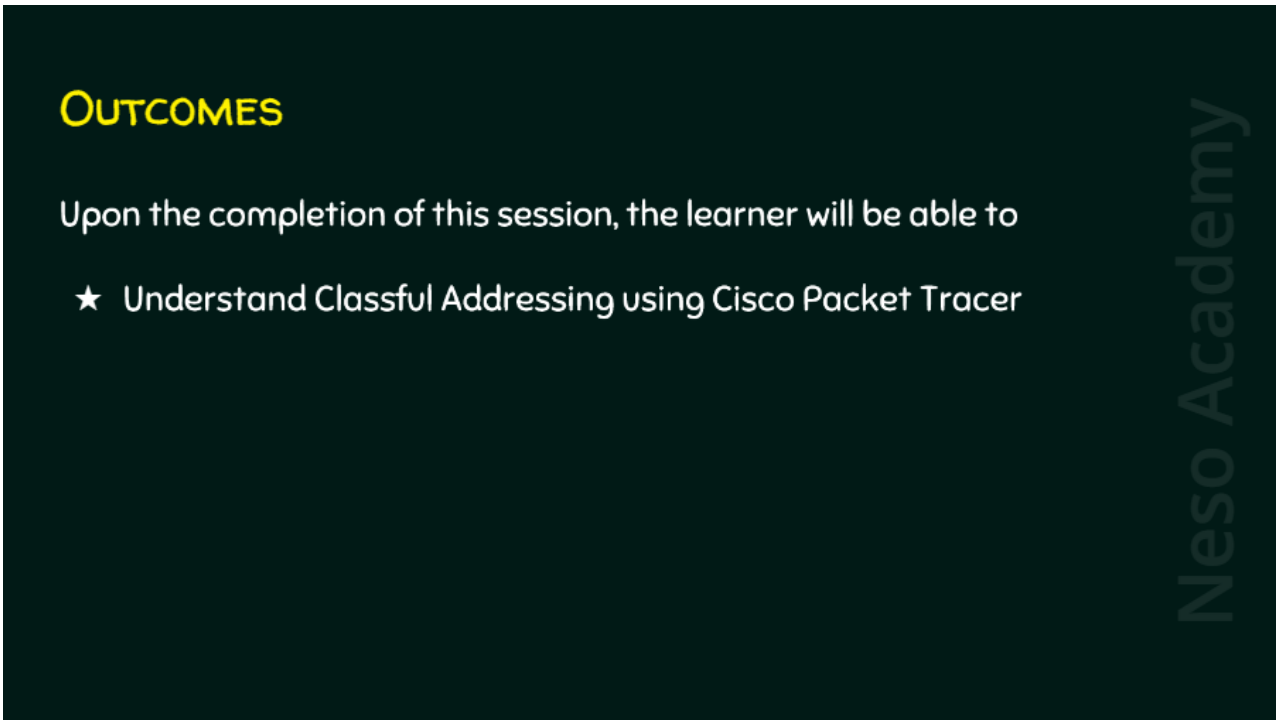


Subnet Mask★★Neso Academy

Subnet Mask255.0.0.0 ; Same N/W255.255.255.0 ; Different N/W255.255.0.0 ; Same N/W255.255.255.0 ; Different N/W255.255.0.0 ; Same N/W255.255.25.0 ; Different N/WNeso Academy



Homework!Neso Academy



Outcomes★Neso Academy

Classes of IPv4 address

Address Class	1st Octet range in decimal	1st Octet bits (Blue Dots do not change)	Network (N) and Host (H) Portion	Default mask (Decimal)	Number of possible networks and hosts per network
A	1–127	00000000 - 01111111	N.H.H.H	255.0.0.0	128 Nets (2^7) 16,777,214 hosts ($2^{24}-2$)
B	128–191	10000000 - 10111111	N.N.H.H	255.255.0.0	16,384 Nets (2^{14}) 65,534 hosts ($2^{16}-2$)
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D	224–239	11100000 - 11101111	NA (Multicast)	-	-
E	240–255	11110000 - 11111111	NA (Experimental)	-	-

Classes of IPv4 address00000000 -0111111110000000 -1011111111000000 -1101111111100000 -1110111111110000 -11111111Neso Academy

Outcomes

Upon the completion of this session, the learner will be able to

★ Understand the different ways host can communicate using IPv4 address.

Outcomes★Neso Academy

Different ways of transmission in IPv4

In an IPv4 network, the hosts can communicate one of three different ways:

1. Unicast
2. Broadcast
3. Multicast

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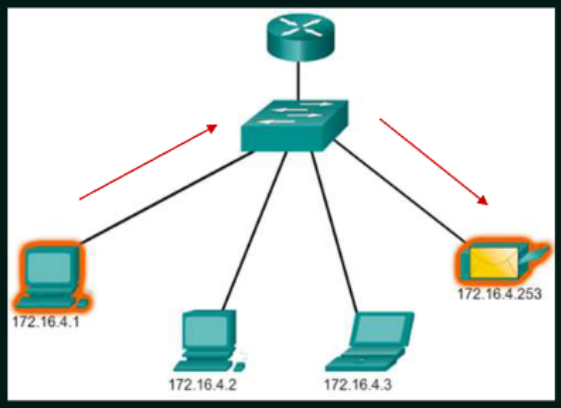
Different ways of transmission in IPv4Neso Academy

Unicast transmission

Unicast Transmission: The process of sending a packet from one host to an individual host.

Source: 172.16.4.1
Destination: 172.16.4.253



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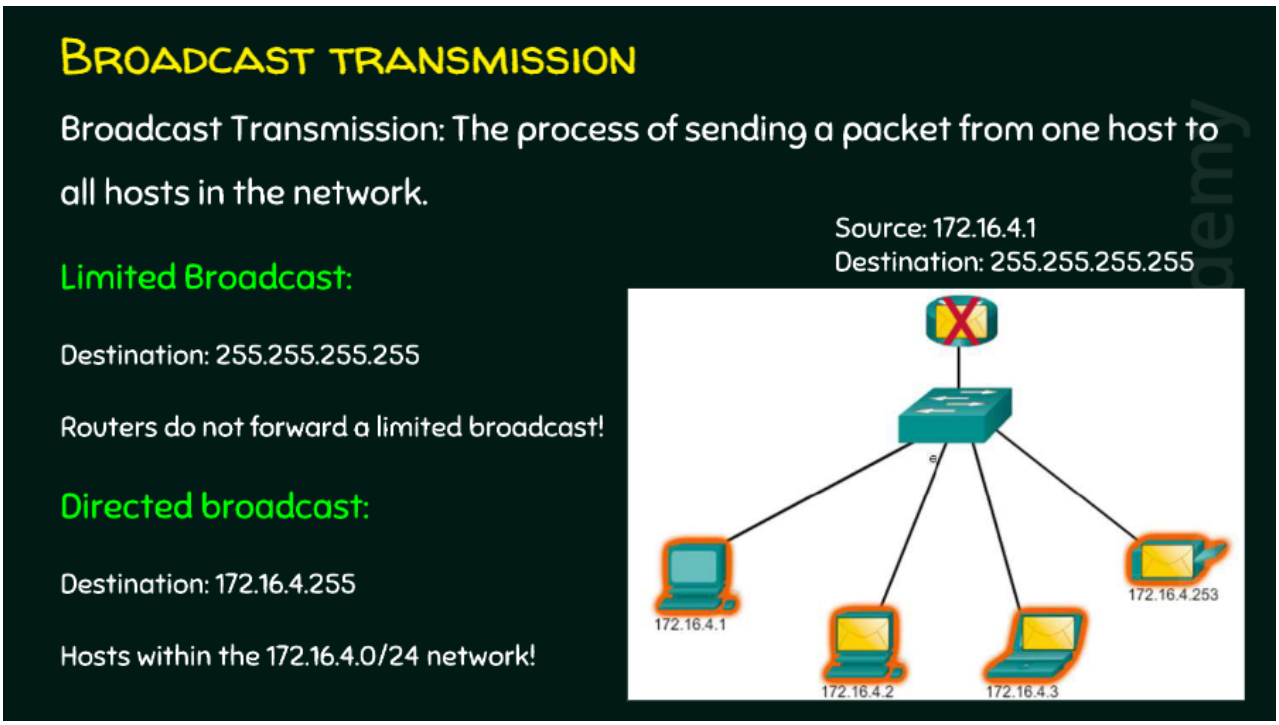
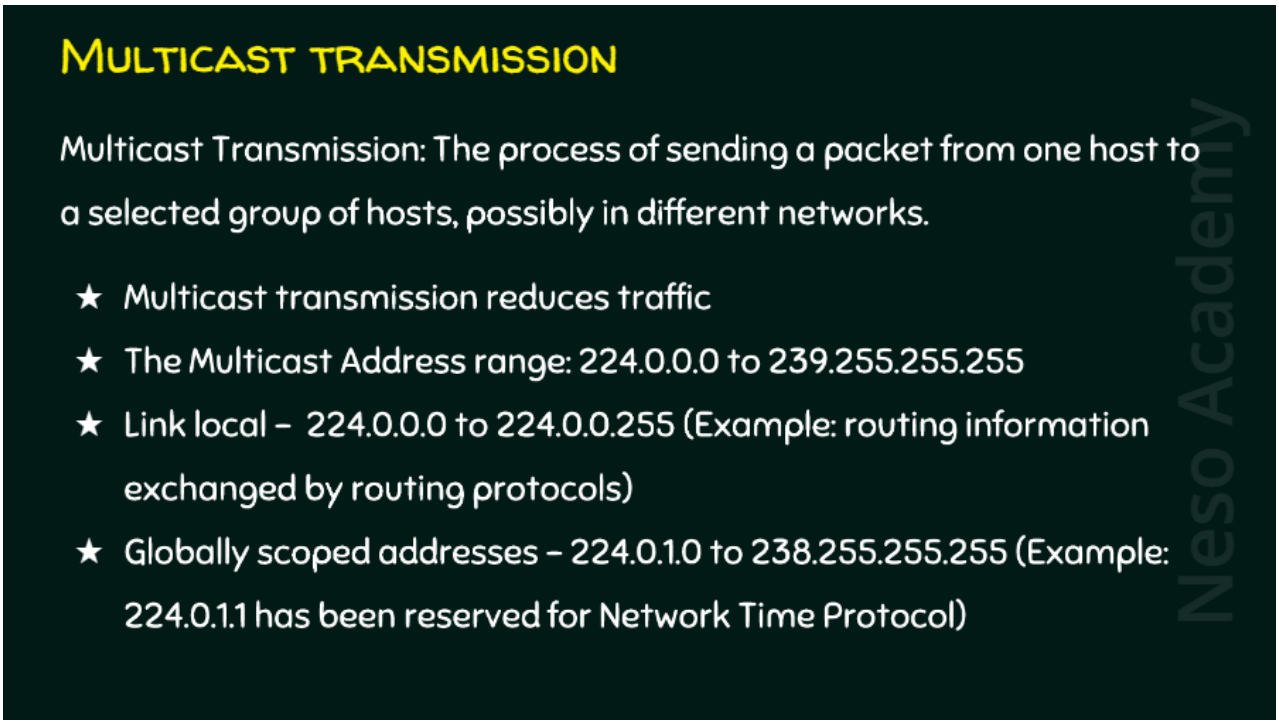
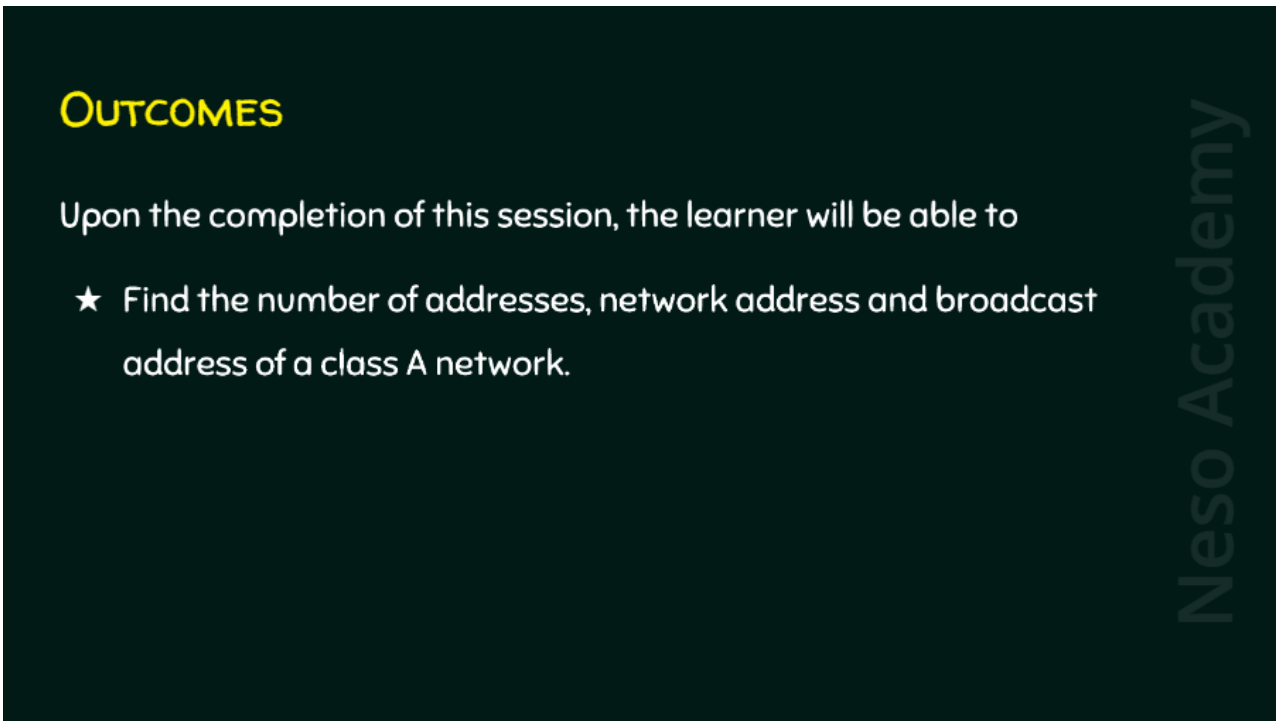
Unicast transmissionNeso Academy



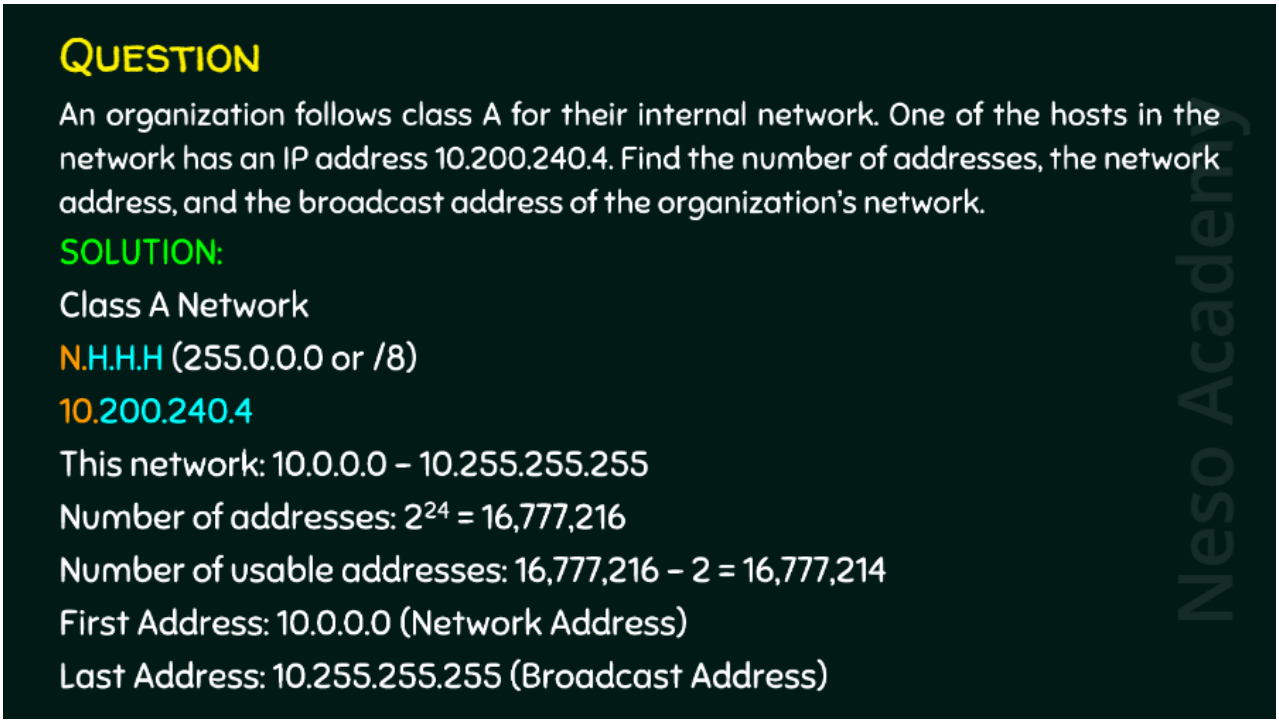
Broadcast transmissionNeso Academy



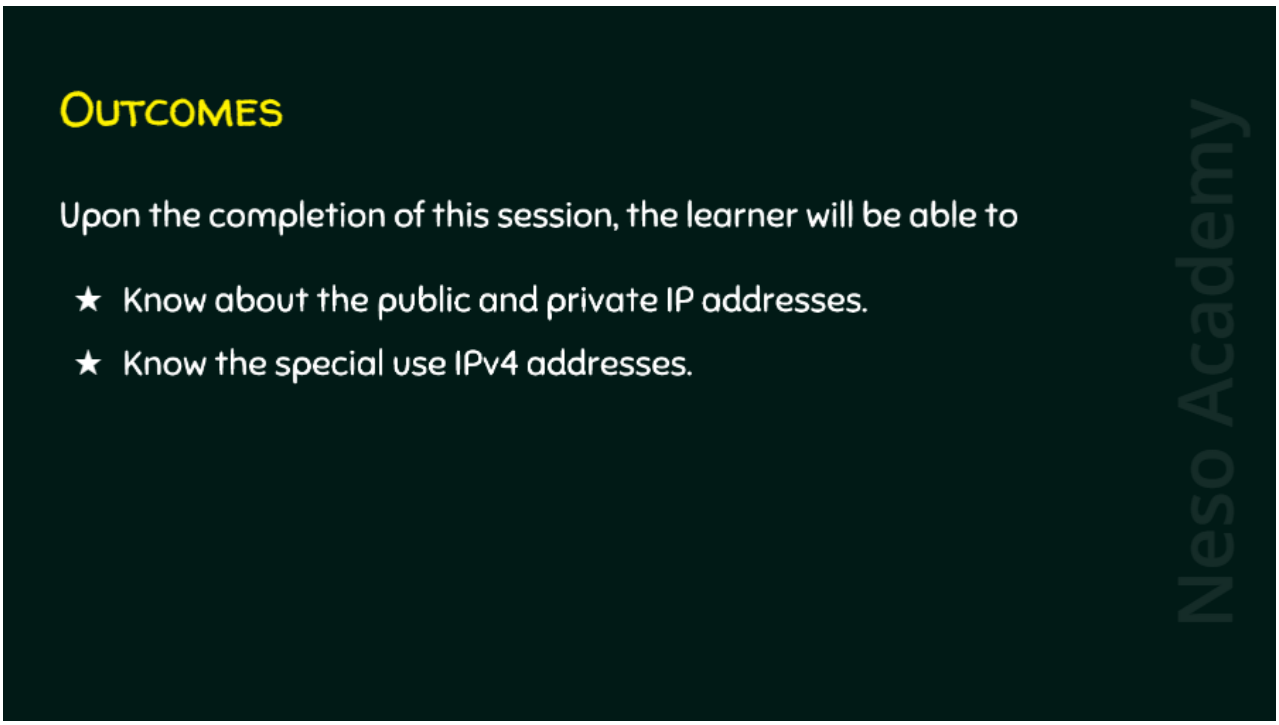
★★★★Multicast transmissionNeso Academy



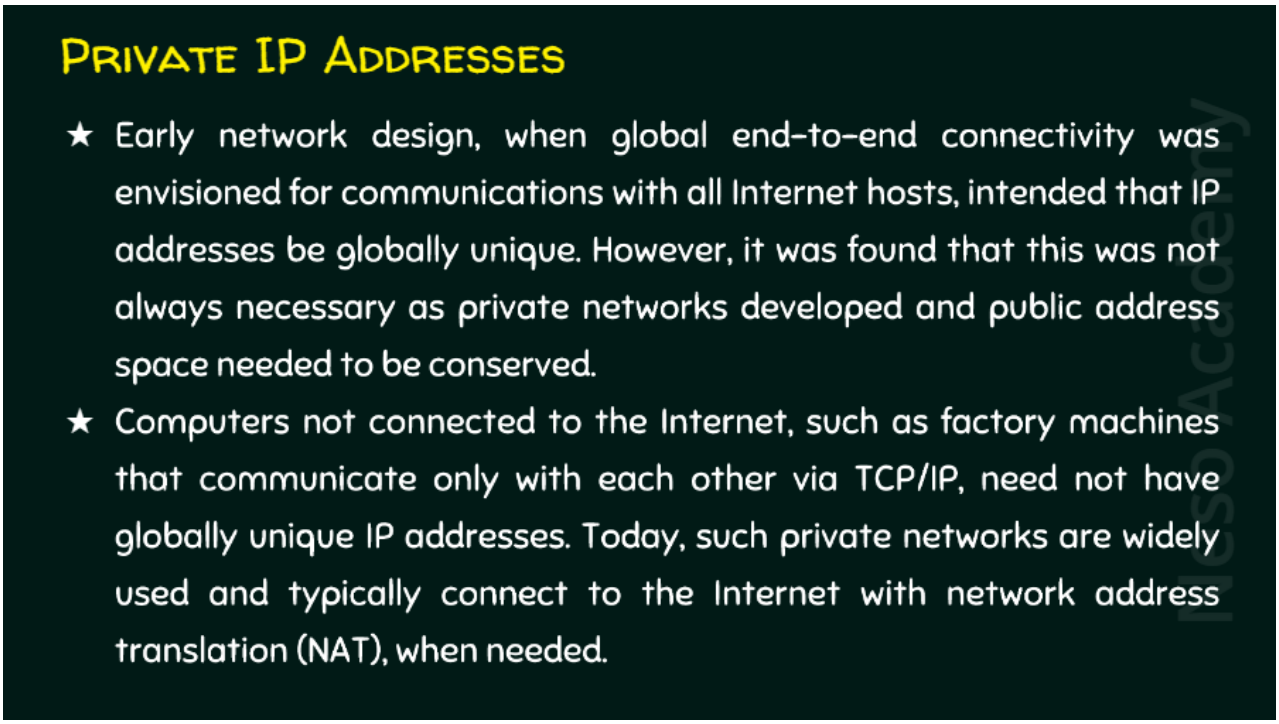
Outcomes★Neso Academy



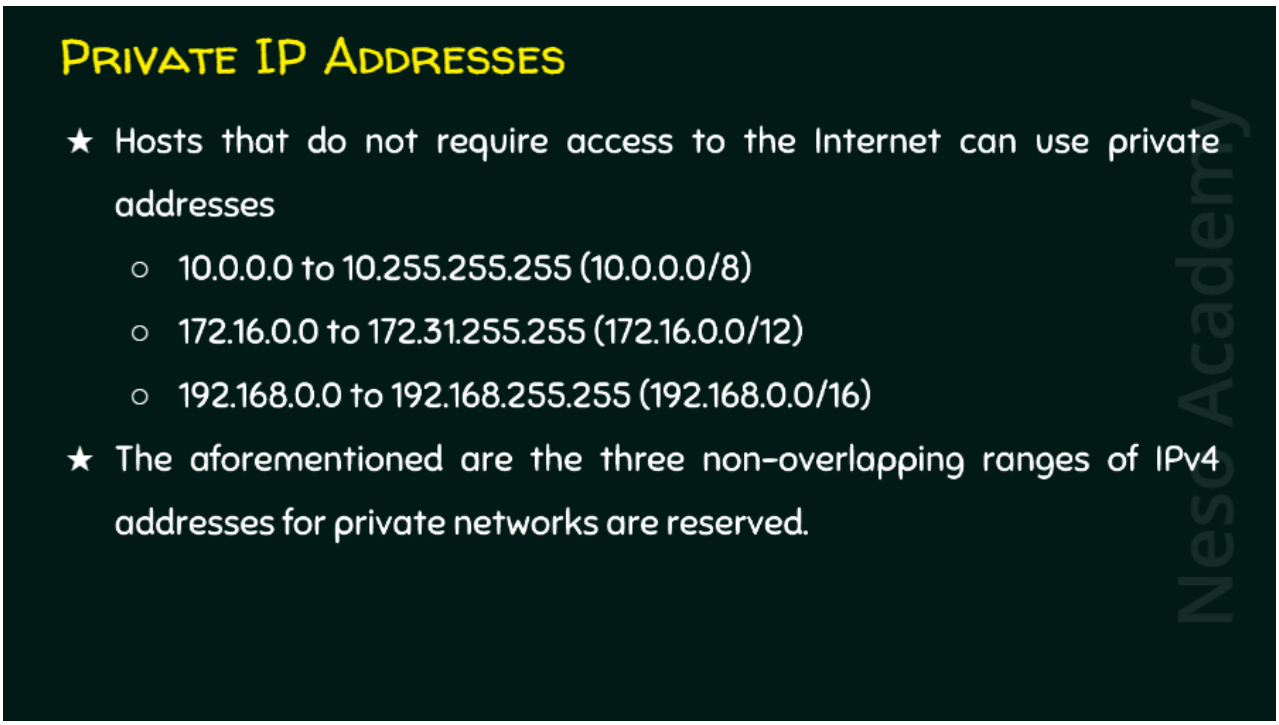
QuestionNeso Academy



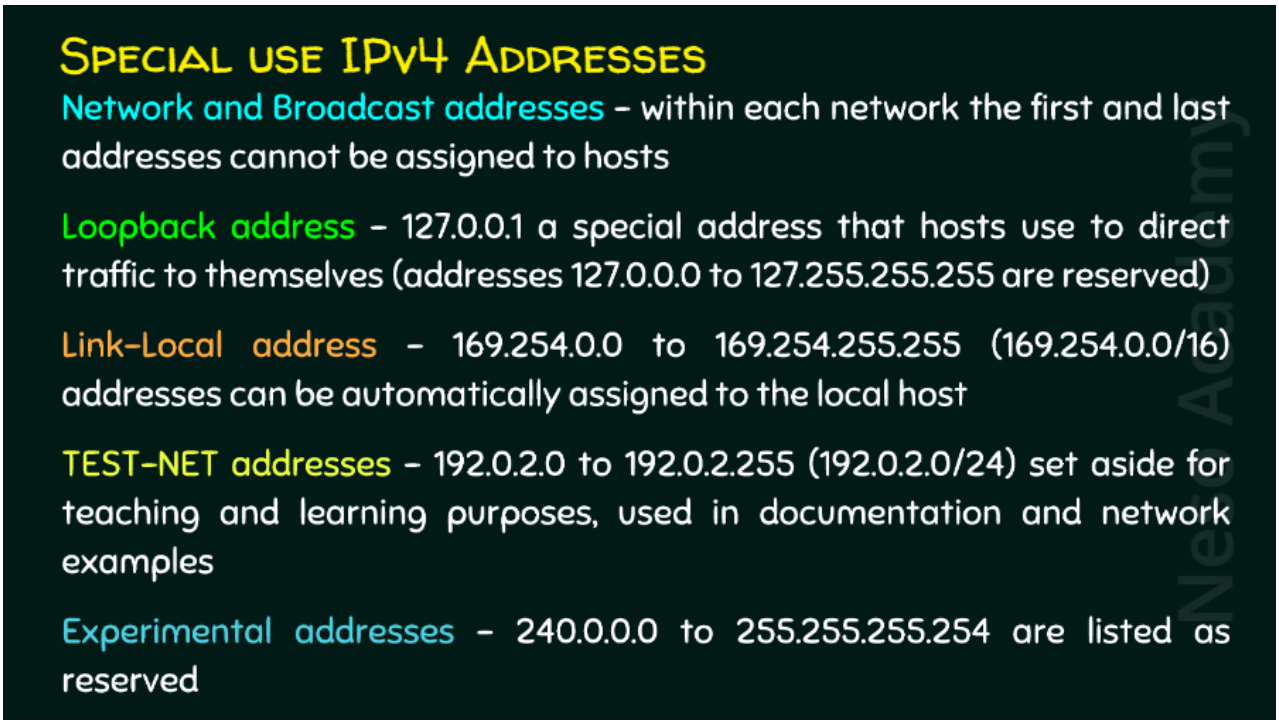
Outcomes★★Neso Academy



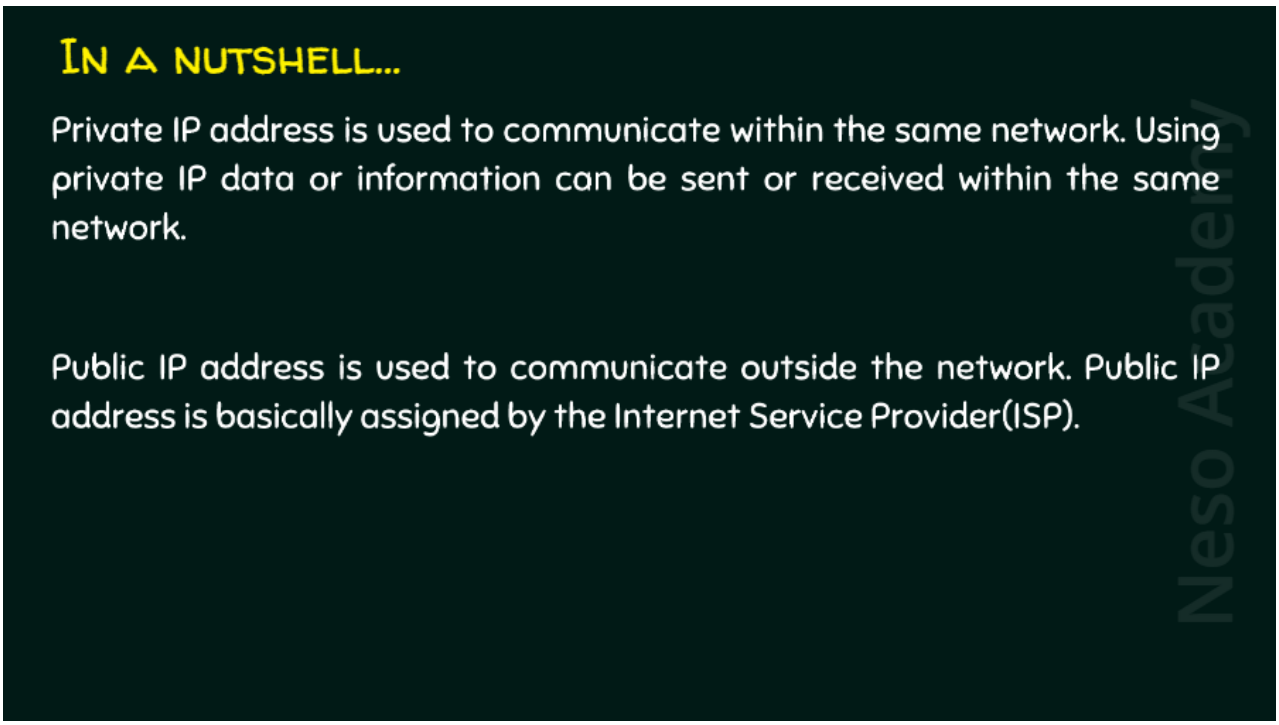
Private IP Addresses★★Neso Academy



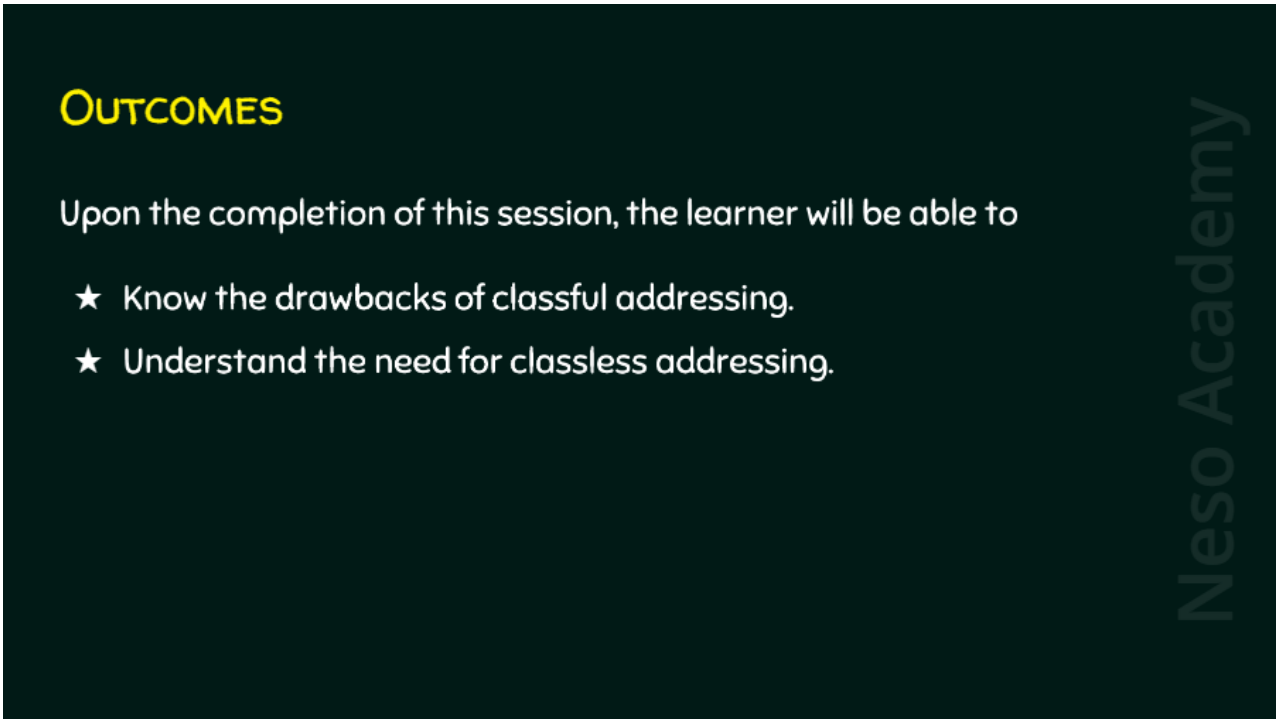
Private IP Addresses★○○○★Neso Academy



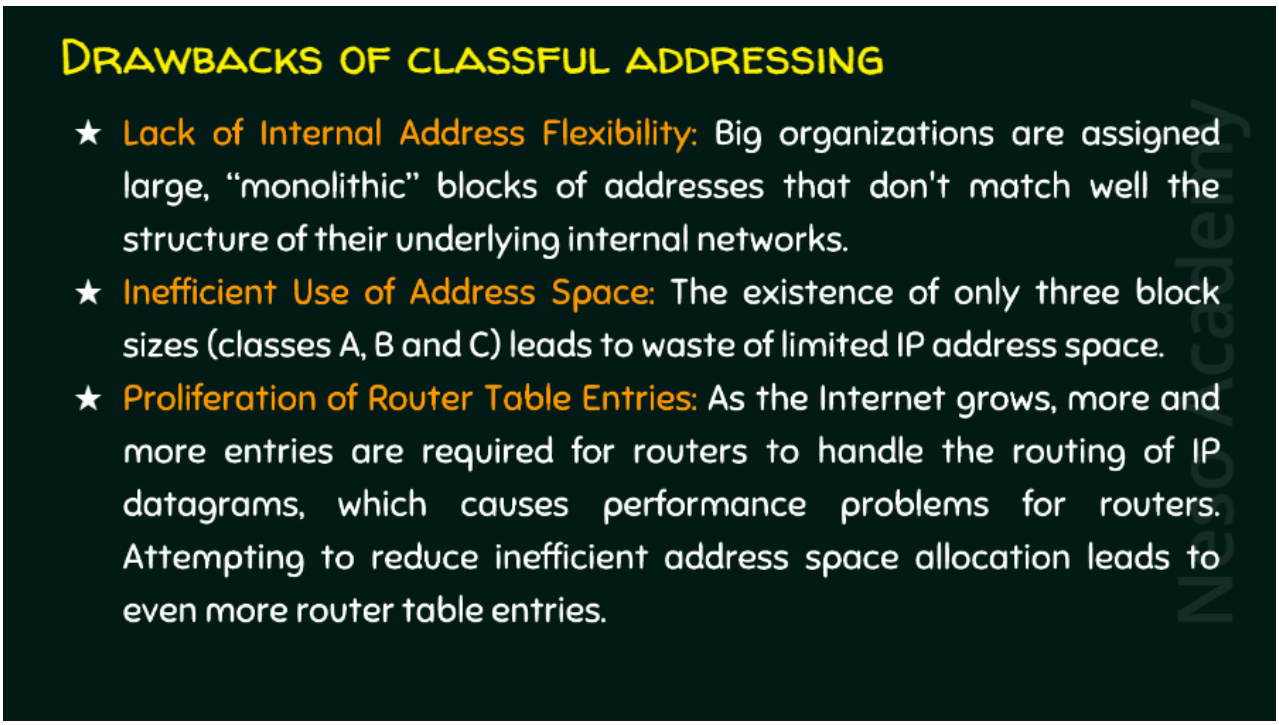
Special use IPv4 AddressesNeso Academy



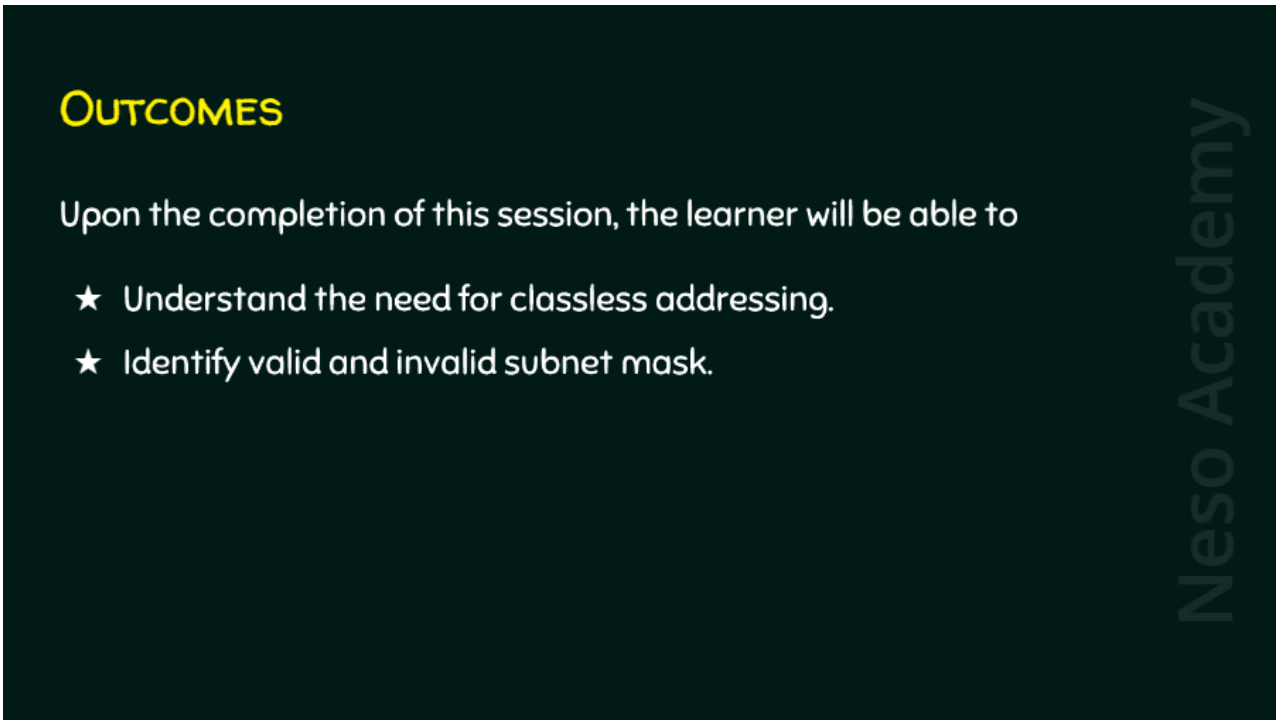
In a nutshell...Neso Academy



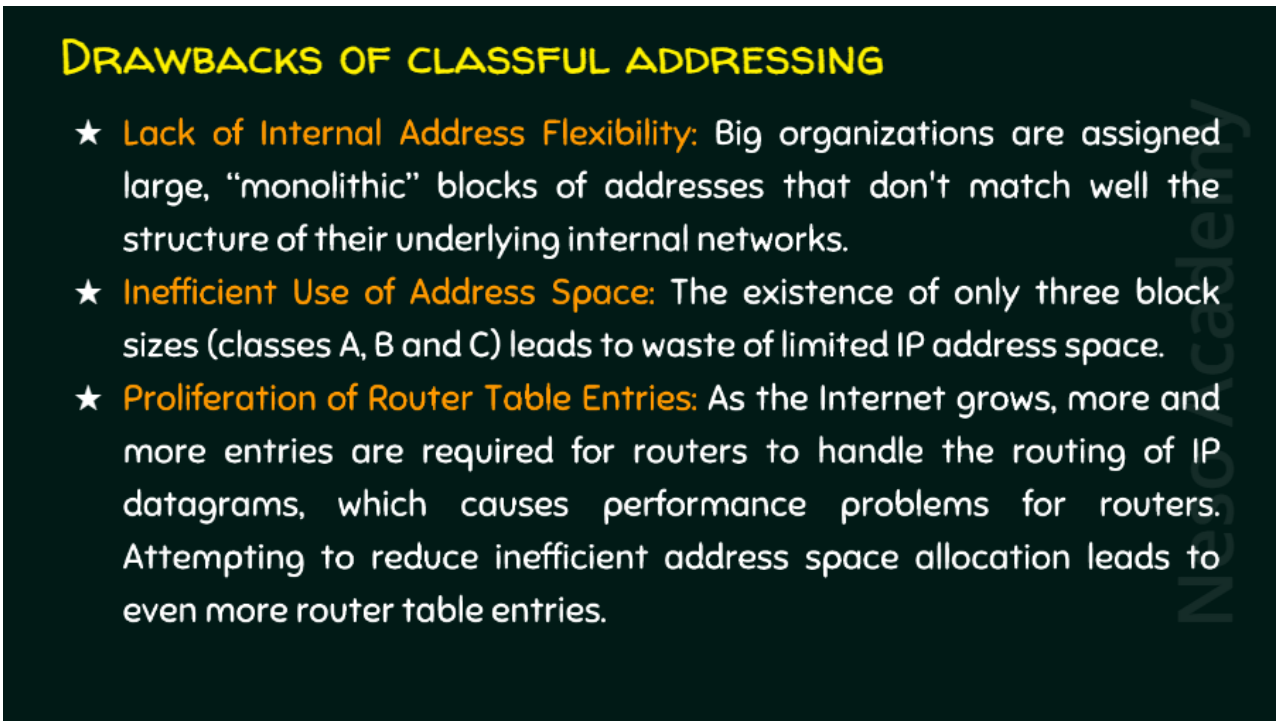
Outcomes★★Neso Academy



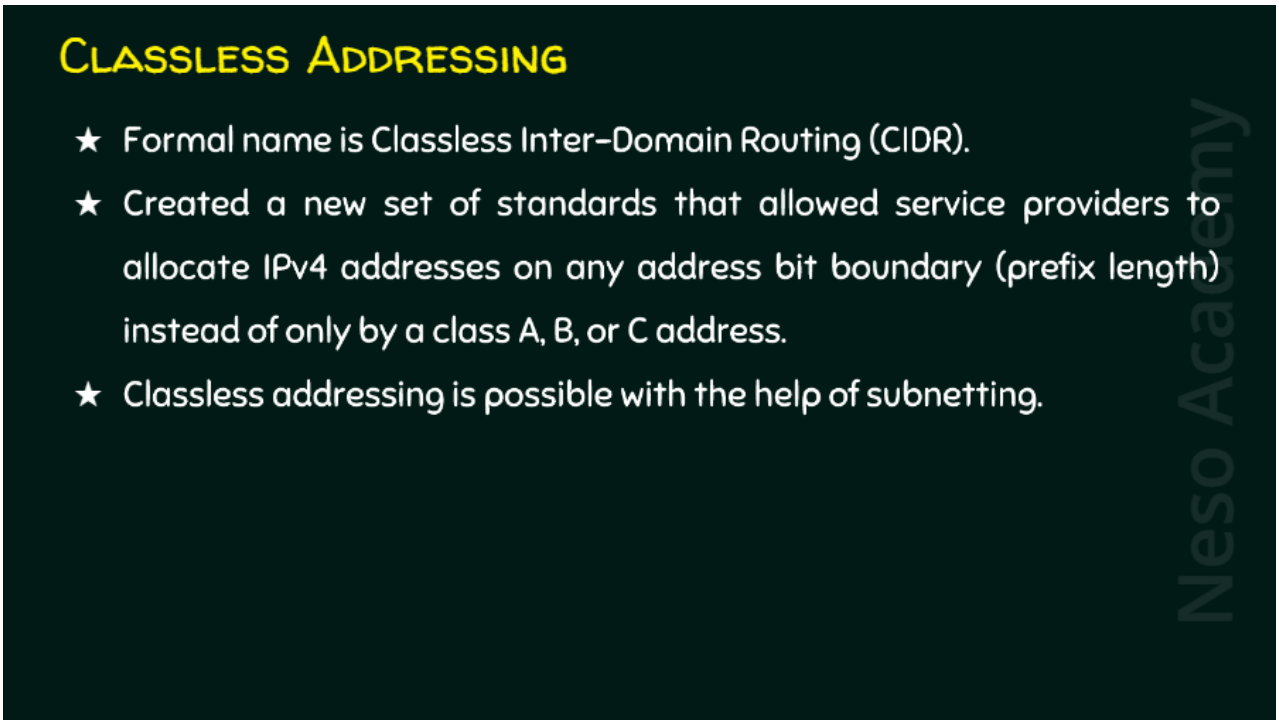
Drawbacks of classful addressing★★★Neso Academy



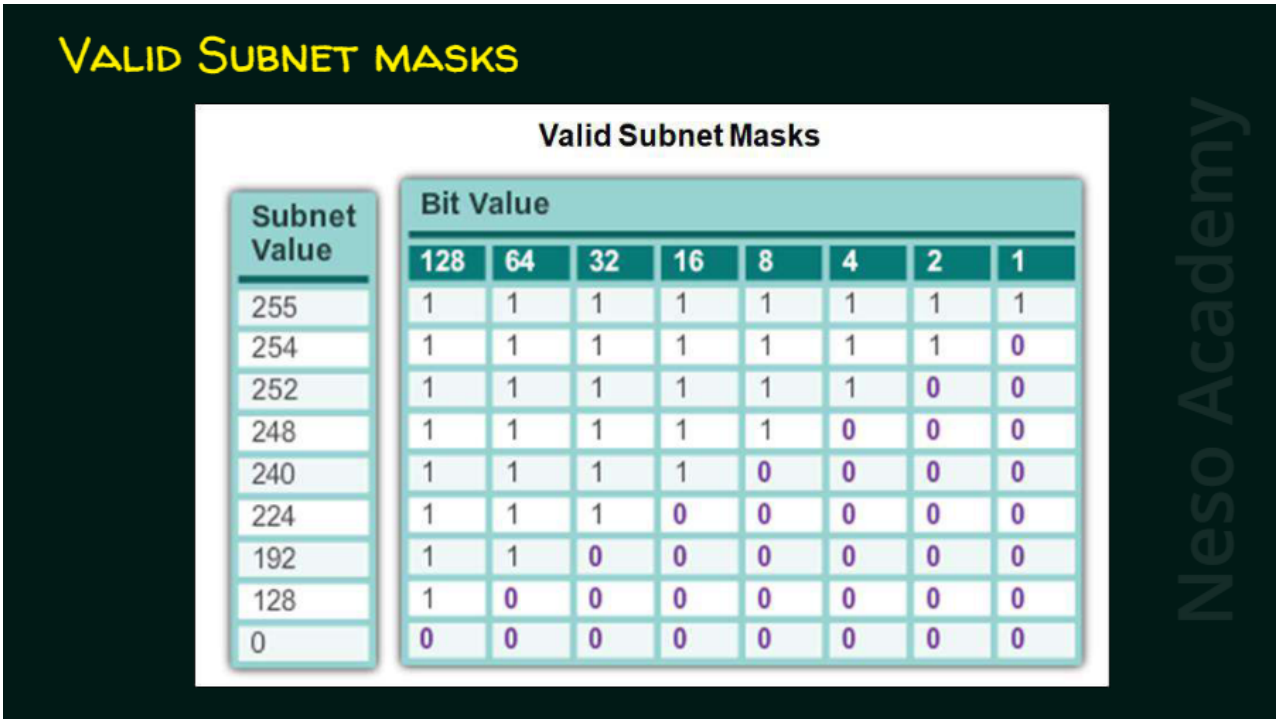
Outcomes★★Neso Academy



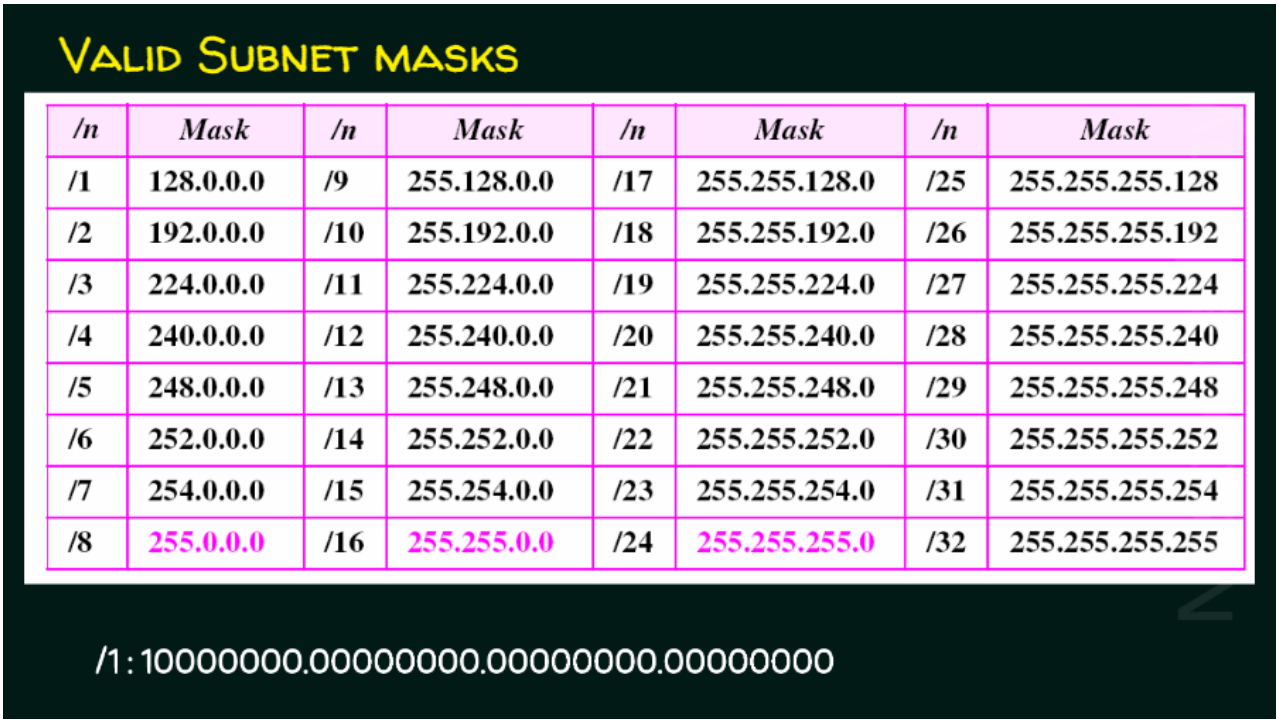
Drawbacks of classful addressing★★★Neso Academy



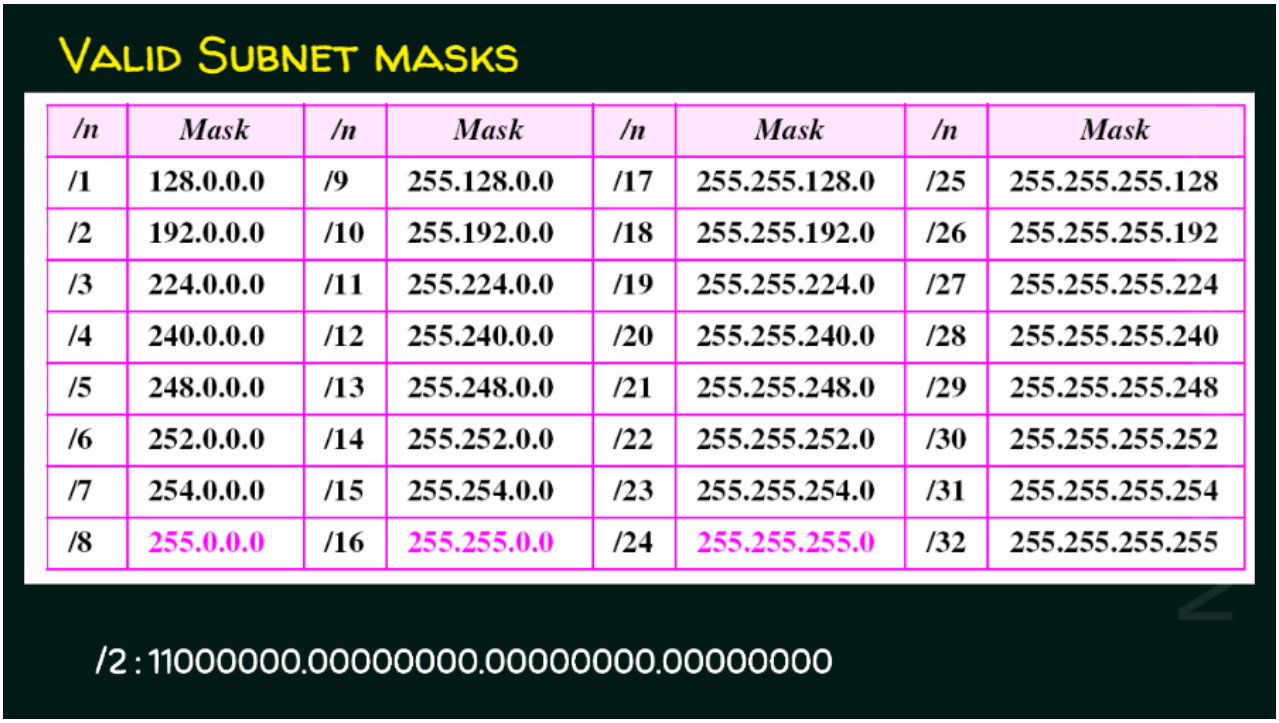
Classless Addressing★★★Neso Academy



Valid Subnet masksNeso Academy

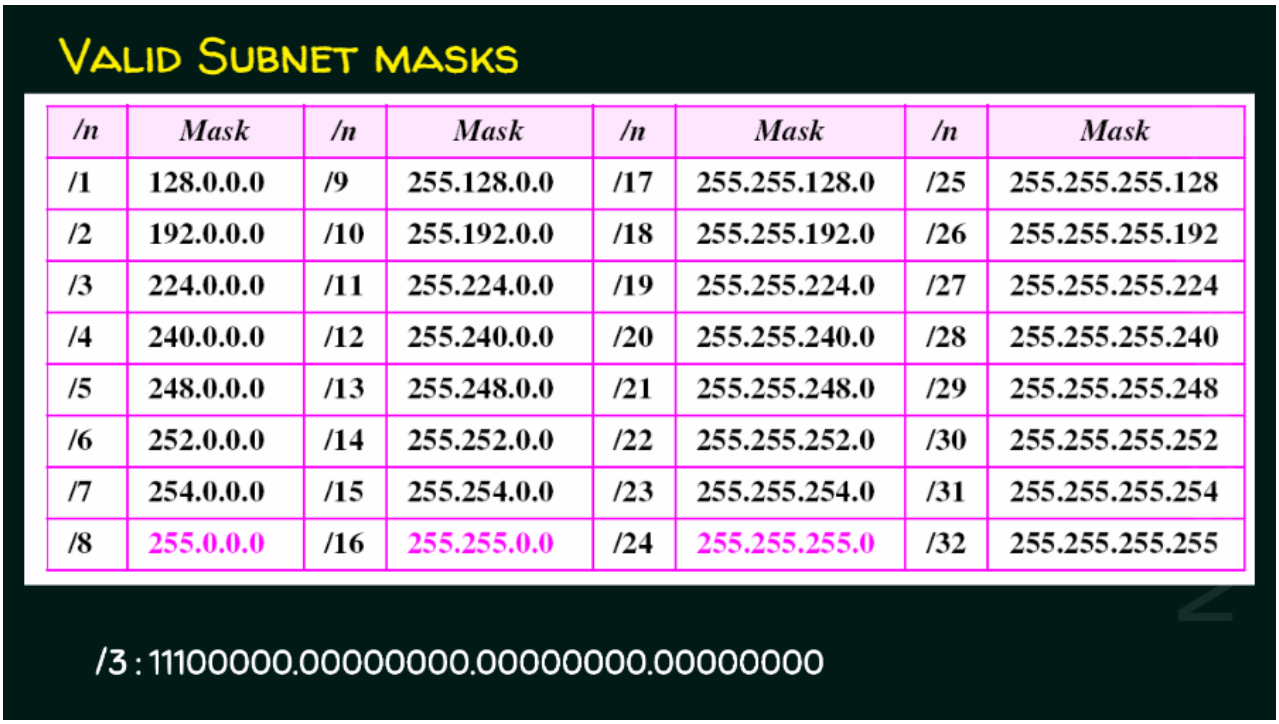


Valid Subnet masksNeso Academy



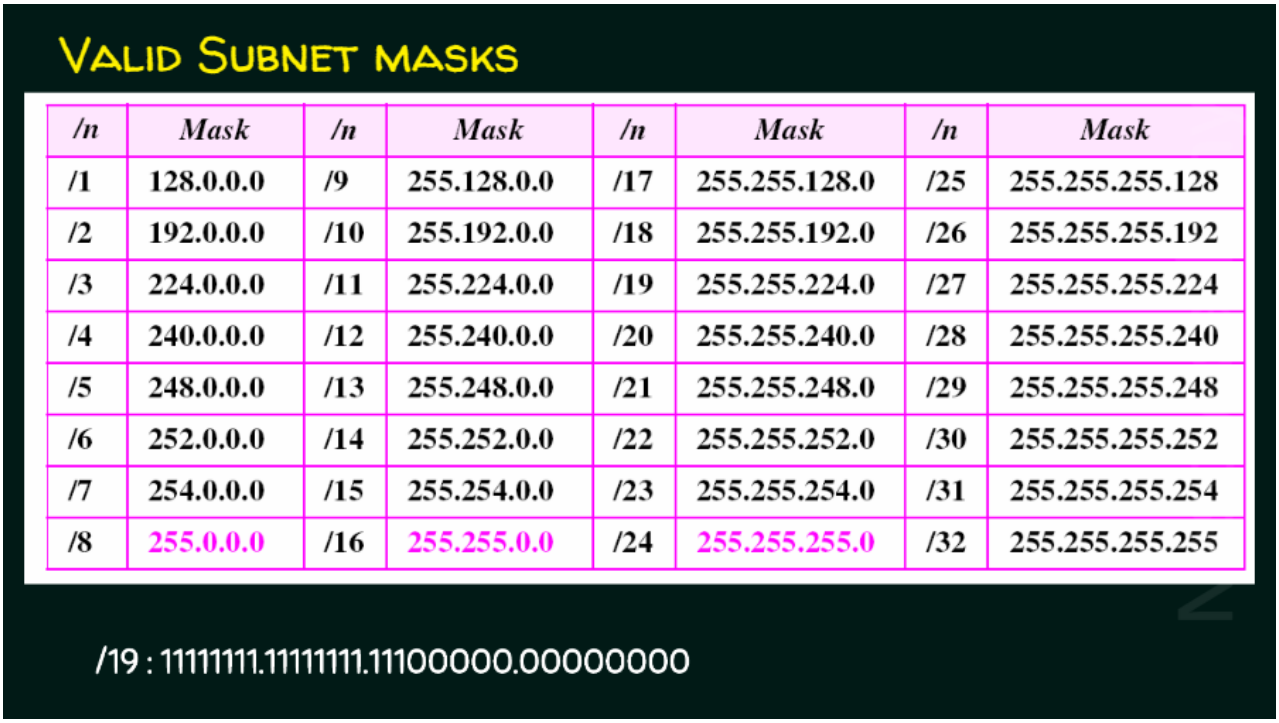
/n	Mask	/n	Mask	/n	Mask	/n	Mask
/1	128.0.0.0	/9	255.128.0.0	/17	255.255.128.0	/25	255.255.255.128
/2	192.0.0.0	/10	255.192.0.0	/18	255.255.192.0	/26	255.255.255.192
/3	224.0.0.0	/11	255.224.0.0	/19	255.255.224.0	/27	255.255.255.224
/4	240.0.0.0	/12	255.240.0.0	/20	255.255.240.0	/28	255.255.255.240
/5	248.0.0.0	/13	255.248.0.0	/21	255.255.248.0	/29	255.255.255.248
/6	252.0.0.0	/14	255.252.0.0	/22	255.255.252.0	/30	255.255.255.252
/7	254.0.0.0	/15	255.254.0.0	/23	255.255.254.0	/31	255.255.255.254
/8	255.0.0.0	/16	255.255.0.0	/24	255.255.255.0	/32	255.255.255.255

Valid Subnet masksNeso Academy



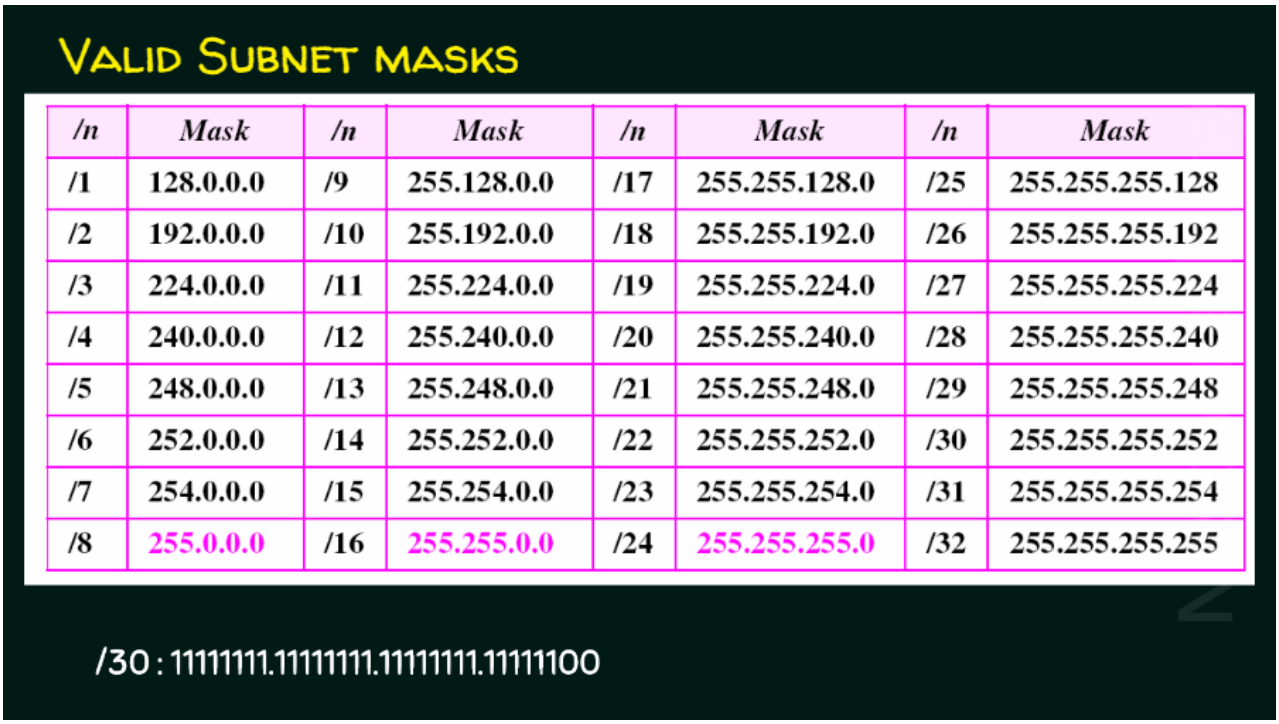
/n	Mask	/n	Mask	/n	Mask	/n	Mask
/1	128.0.0.0	/9	255.128.0.0	/17	255.255.128.0	/25	255.255.255.128
/2	192.0.0.0	/10	255.192.0.0	/18	255.255.192.0	/26	255.255.255.192
/3	224.0.0.0	/11	255.224.0.0	/19	255.255.224.0	/27	255.255.255.224
/4	240.0.0.0	/12	255.240.0.0	/20	255.255.240.0	/28	255.255.255.240
/5	248.0.0.0	/13	255.248.0.0	/21	255.255.248.0	/29	255.255.255.248
/6	252.0.0.0	/14	255.252.0.0	/22	255.255.252.0	/30	255.255.255.252
/7	254.0.0.0	/15	255.254.0.0	/23	255.255.254.0	/31	255.255.255.254
/8	255.0.0.0	/16	255.255.0.0	/24	255.255.255.0	/32	255.255.255.255

Valid Subnet masksNeso Academy



/n	Mask	/n	Mask	/n	Mask	/n	Mask
/1	128.0.0.0	/9	255.128.0.0	/17	255.255.128.0	/25	255.255.255.128
/2	192.0.0.0	/10	255.192.0.0	/18	255.255.192.0	/26	255.255.255.192
/3	224.0.0.0	/11	255.224.0.0	/19	255.255.224.0	/27	255.255.255.224
/4	240.0.0.0	/12	255.240.0.0	/20	255.255.240.0	/28	255.255.255.240
/5	248.0.0.0	/13	255.248.0.0	/21	255.255.248.0	/29	255.255.255.248
/6	252.0.0.0	/14	255.252.0.0	/22	255.255.252.0	/30	255.255.255.252
/7	254.0.0.0	/15	255.254.0.0	/23	255.255.254.0	/31	255.255.255.254
/8	255.0.0.0	/16	255.255.0.0	/24	255.255.255.0	/32	255.255.255.255

Valid Subnet masksNeso Academy



/n	Mask	/n	Mask	/n	Mask	/n	Mask
/1	128.0.0.0	/9	255.128.0.0	/17	255.255.128.0	/25	255.255.255.128
/2	192.0.0.0	/10	255.192.0.0	/18	255.255.192.0	/26	255.255.255.192
/3	224.0.0.0	/11	255.224.0.0	/19	255.255.224.0	/27	255.255.255.224
/4	240.0.0.0	/12	255.240.0.0	/20	255.255.240.0	/28	255.255.255.240
/5	248.0.0.0	/13	255.248.0.0	/21	255.255.248.0	/29	255.255.255.248
/6	252.0.0.0	/14	255.252.0.0	/22	255.255.252.0	/30	255.255.255.252
/7	254.0.0.0	/15	255.254.0.0	/23	255.255.254.0	/31	255.255.255.254
/8	255.0.0.0	/16	255.255.0.0	/24	255.255.255.0	/32	255.255.255.255

Valid Subnet masksNeso Academy

Activity Time

Valid and Invalid Subnet Masks

Subnet Mask (Decimal)	Subnet Mask (Binary)	Valid/ Invalid
255.255.255.240	11111111.11111111.11111111.11110000	Valid
255.230.255.0	11111111.11100110.11111111.00000000	Invalid
255.255.0.0	11111111.11111111.00000000.00000000	Valid
240.0.0.0	11110000.00000000.00000000.00000000	Valid
223.0.0.0	11011111.00000000.00000000.00000000	Invalid
255.0.255.0	11111111.00000000.11111111.00000000	Invalid

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Activity TimeNeso Academy

Homework!

Identify the Invalid subnet mask from the following.

a. 255.240.0.0
b. 248.0.0.0
c. 255.255.128.0
d. 255.255.255.252
e. 255.255.242.0

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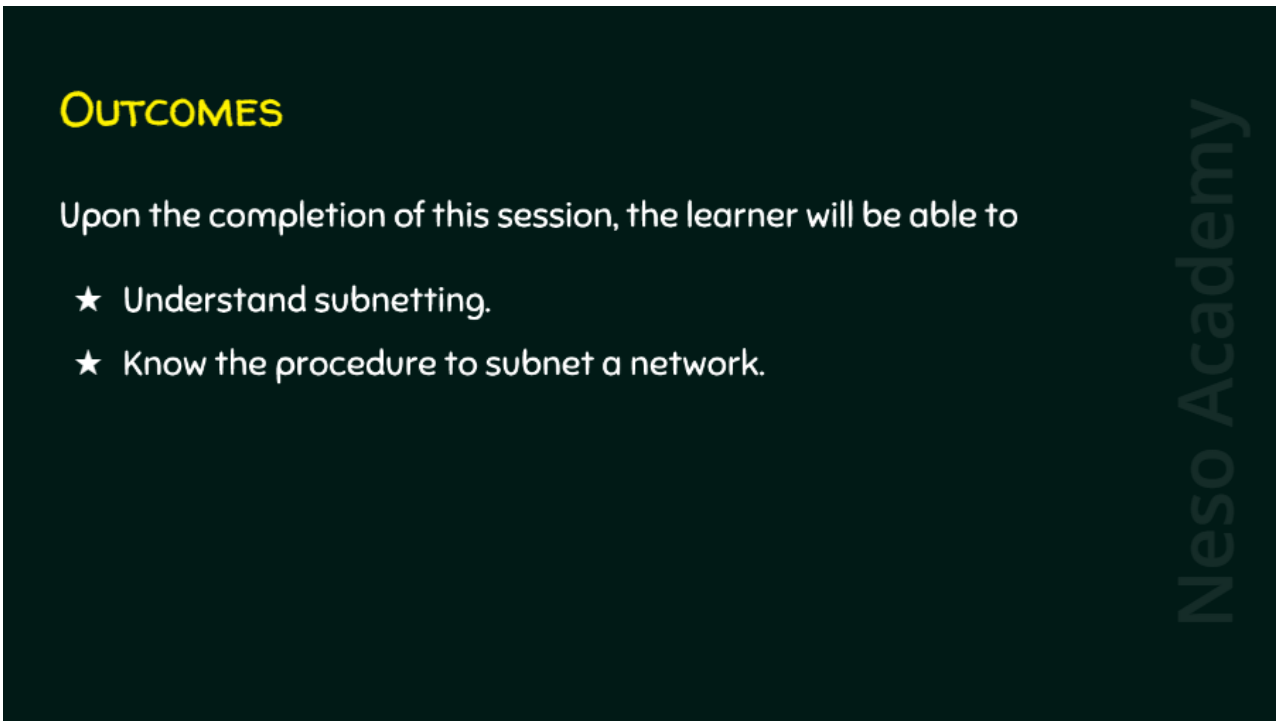
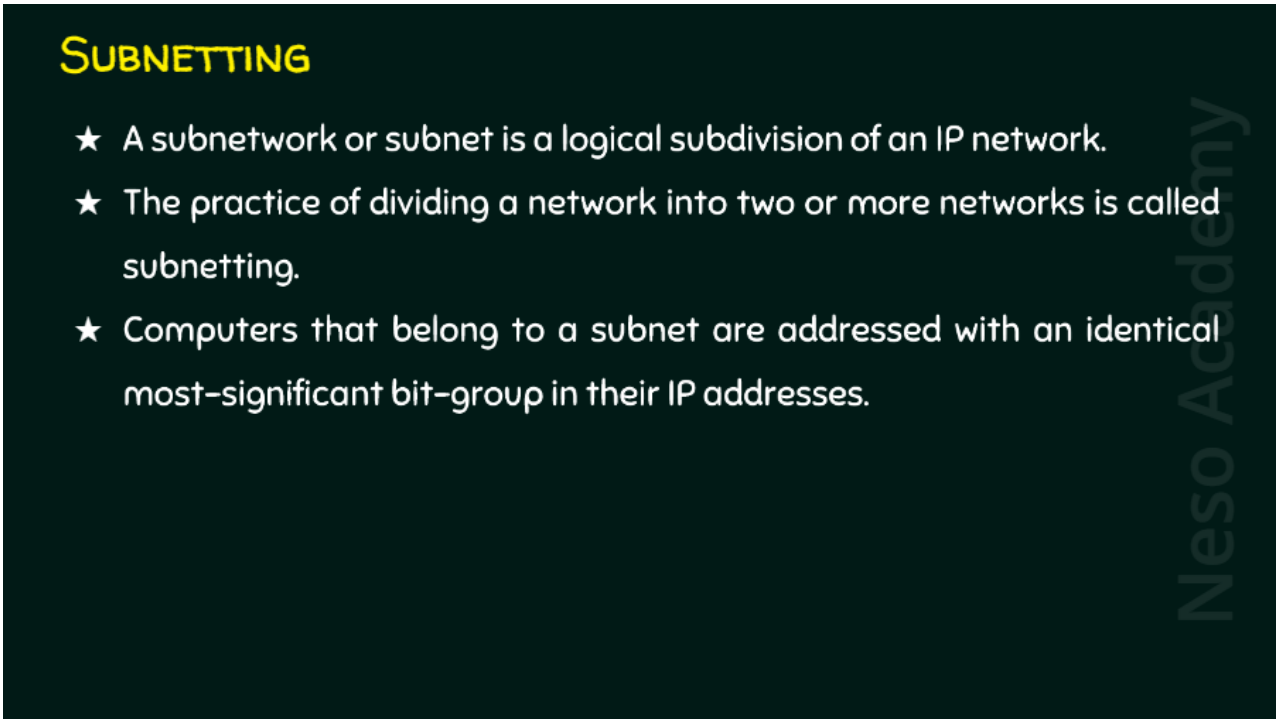
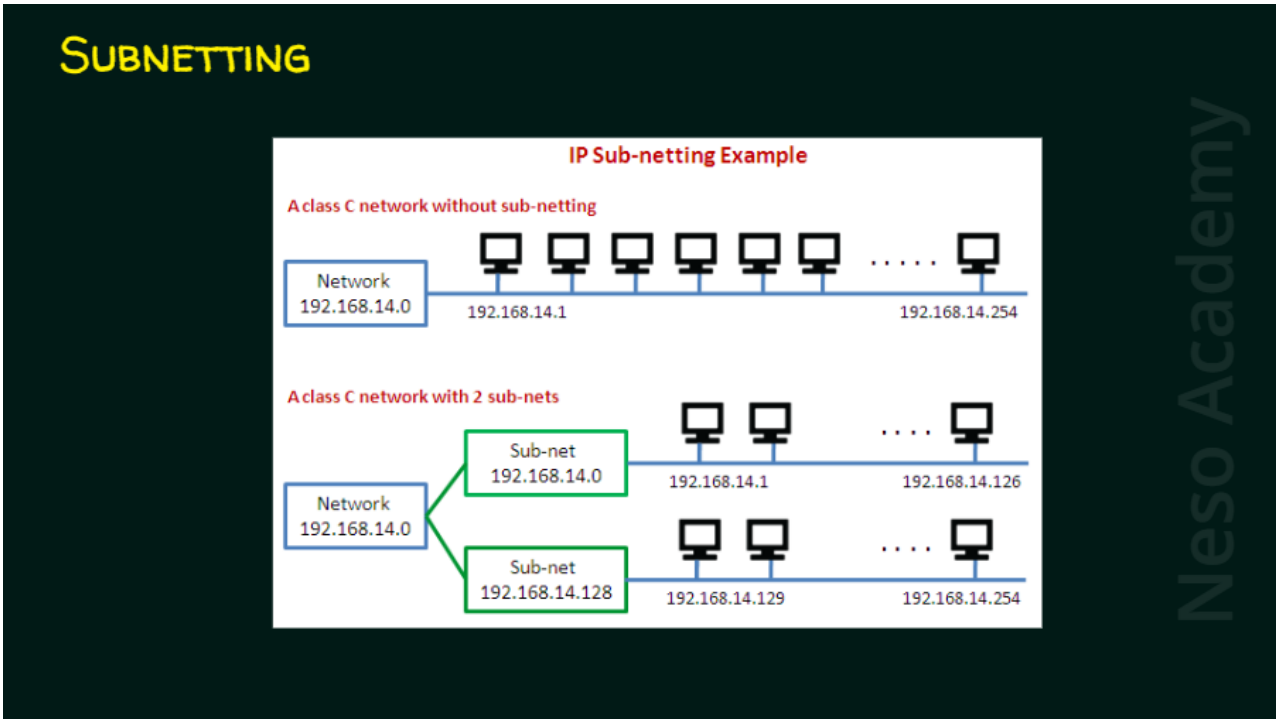
Homework!Neso Academy



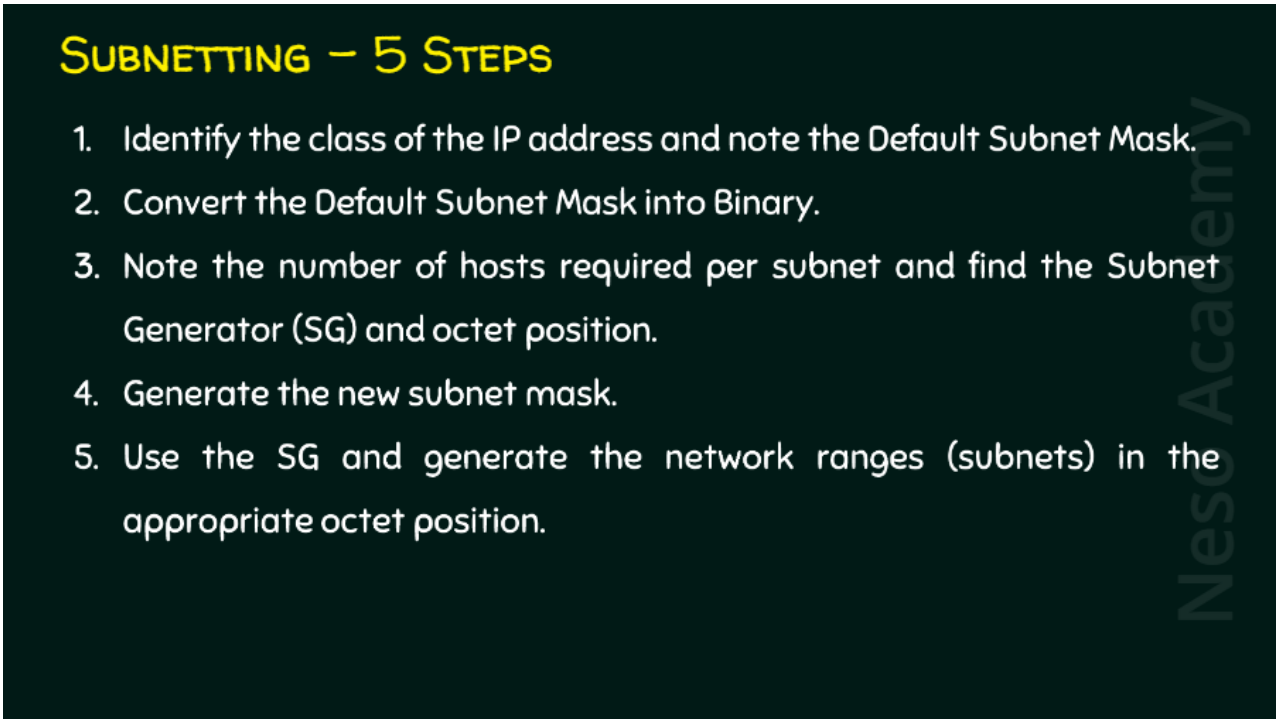
Outcomes★★Neso Academy



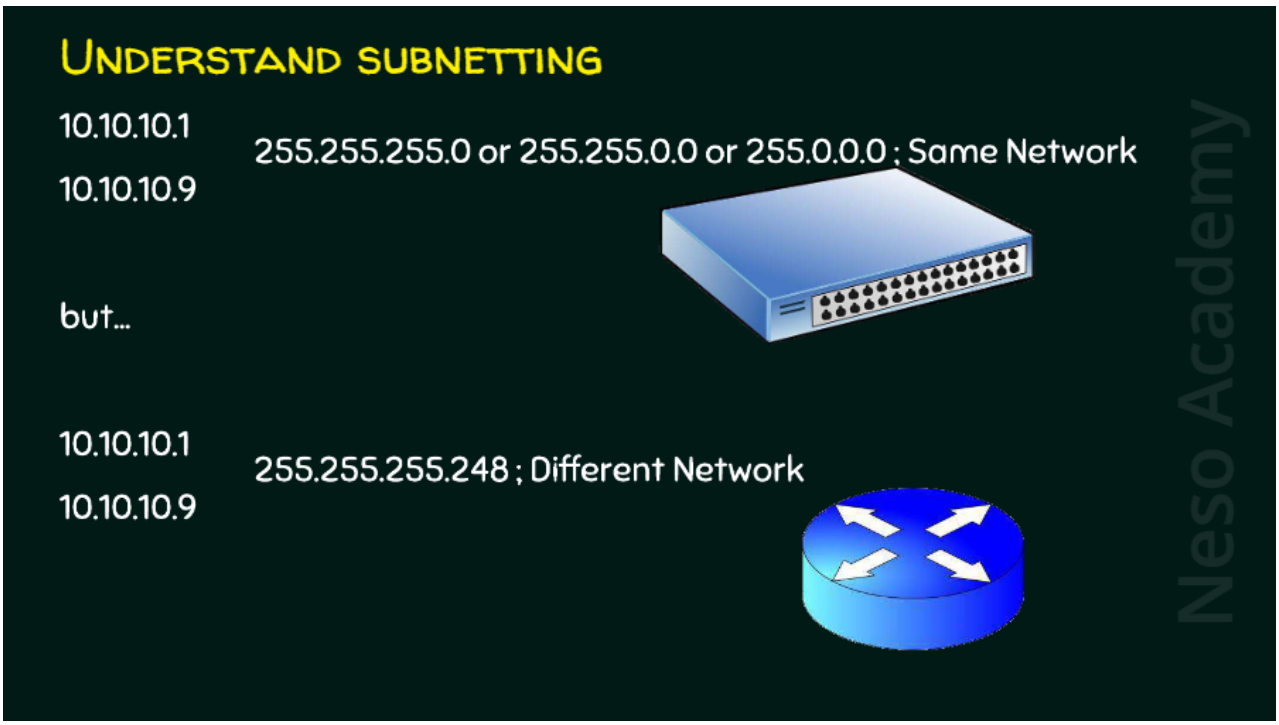
Subnetting★★★Neso Academy



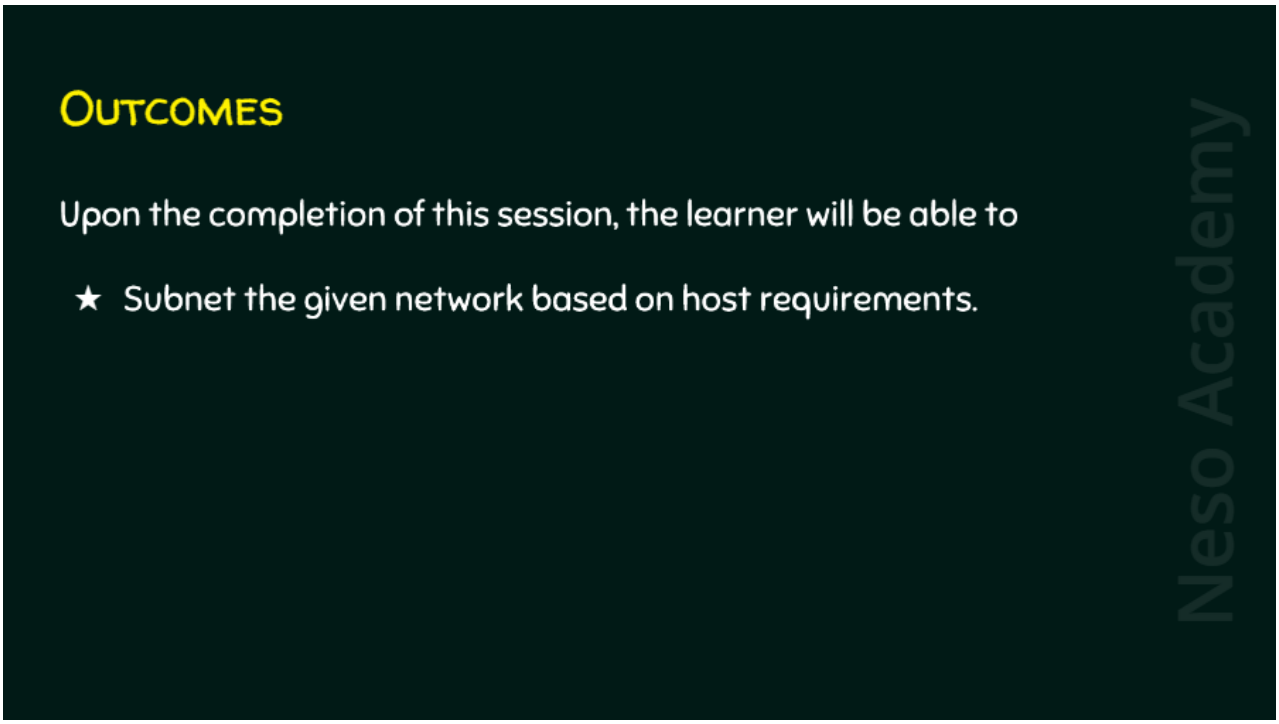
SubnettingNeso Academy



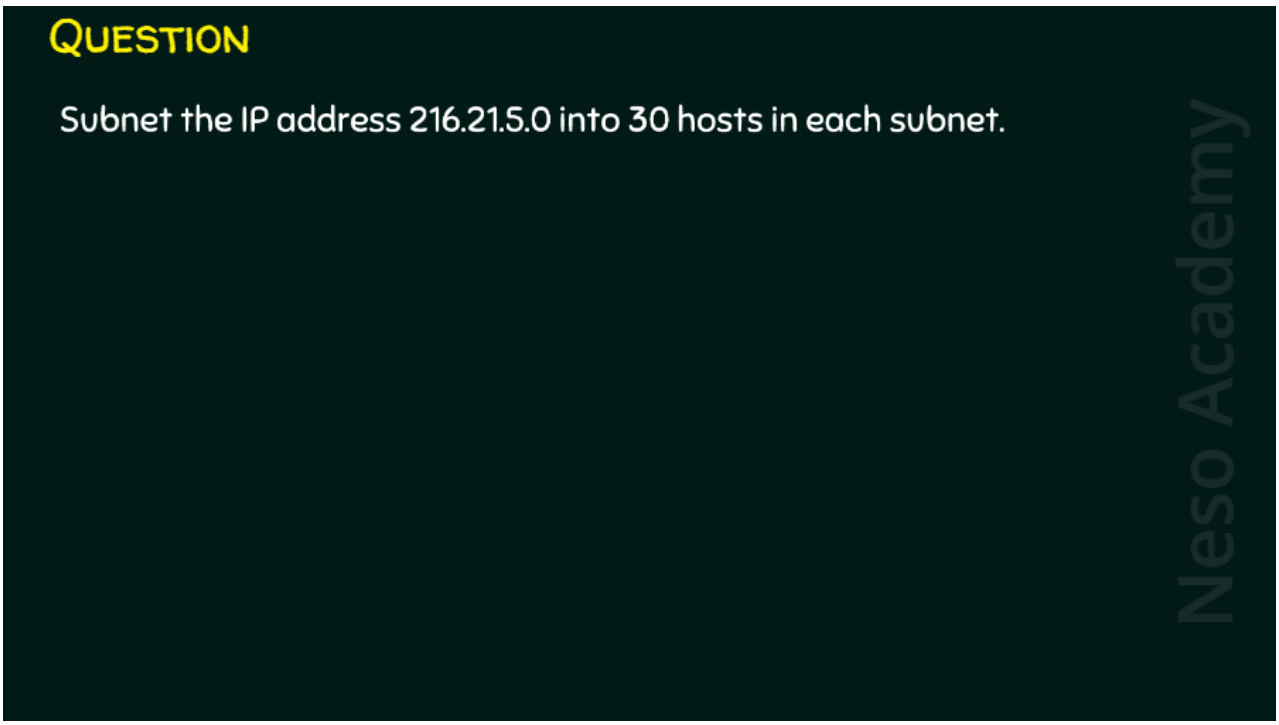
Subnetting -5 StepsNeso Academy



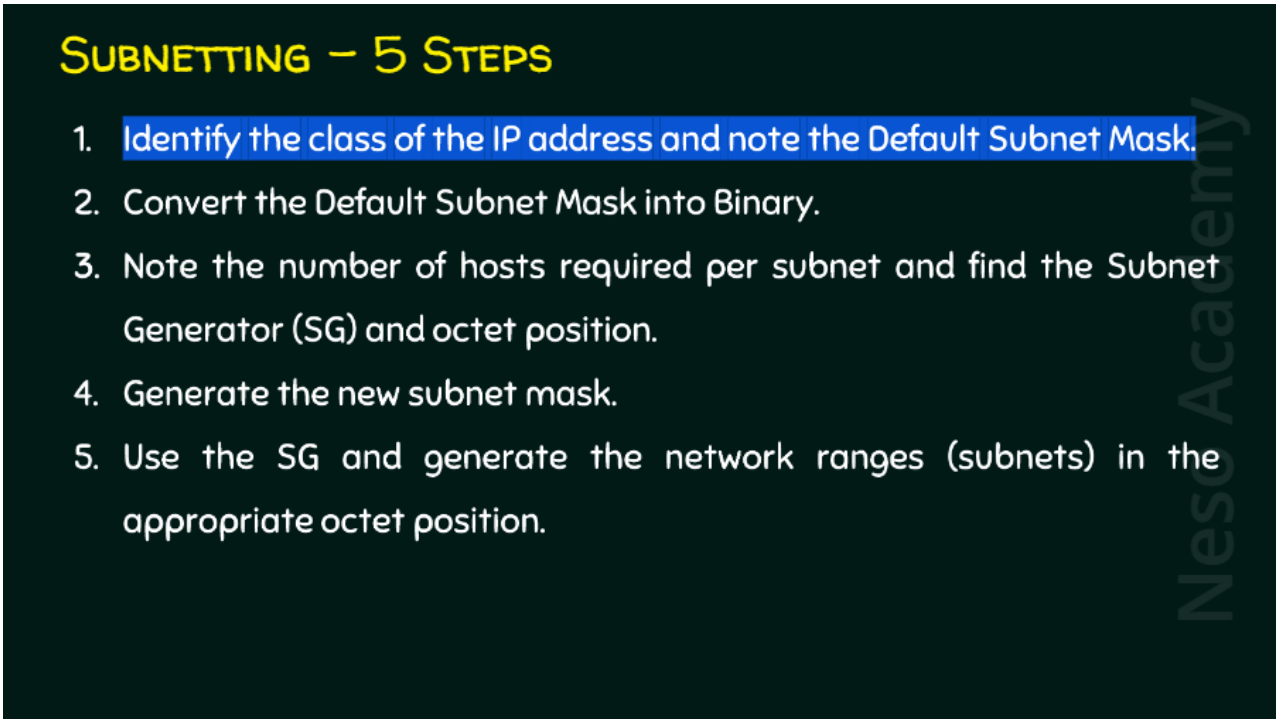
Understand subnettingNeso Academy



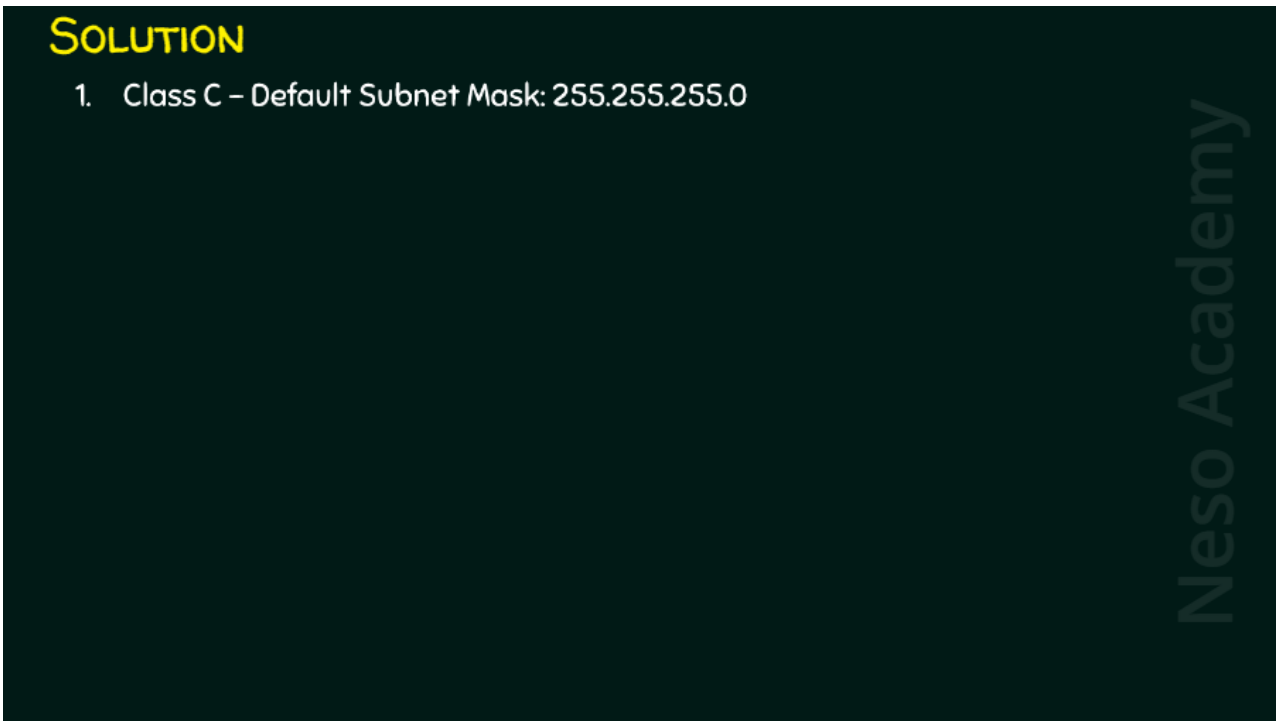
Outcomes★Neso Academy



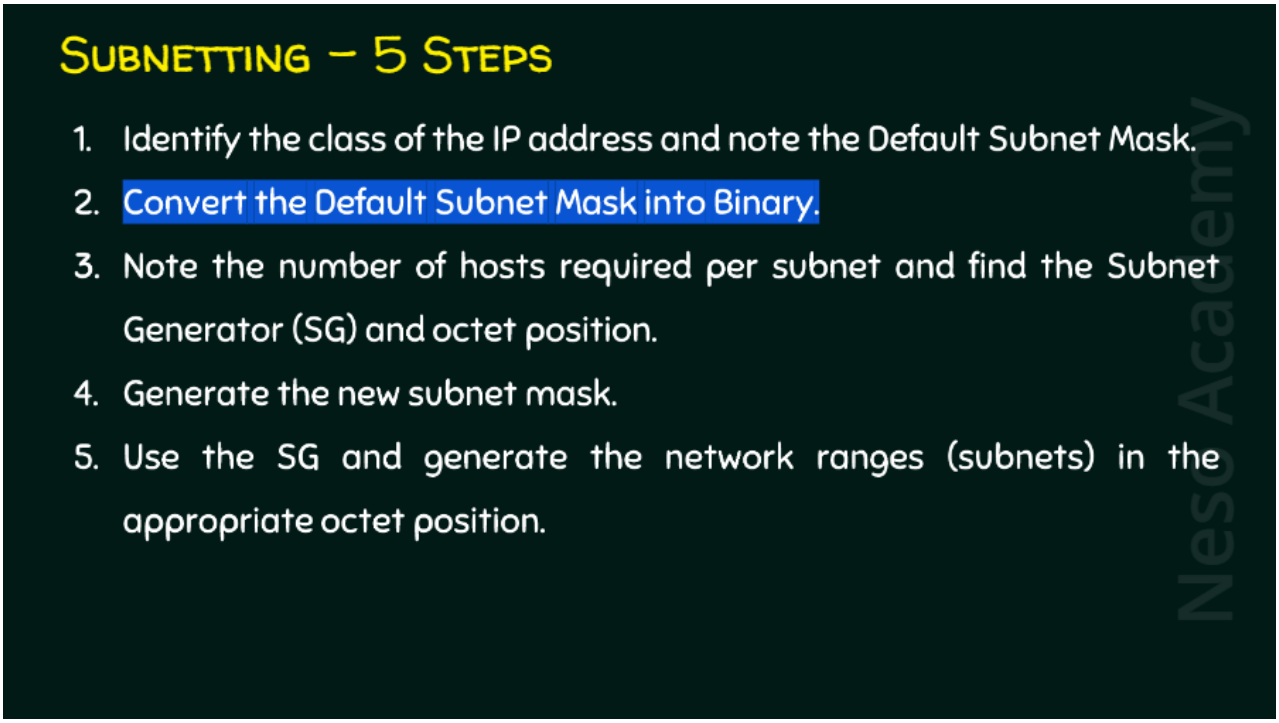
QuestionNeso Academy



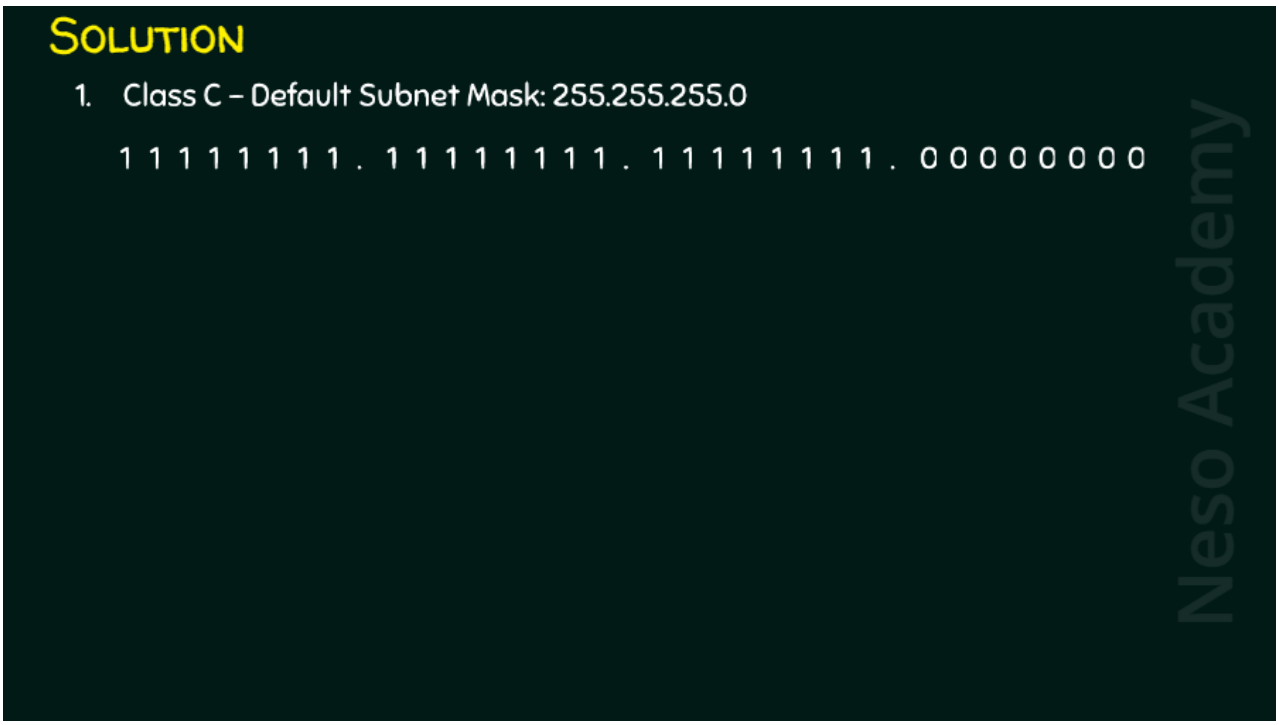
Subnetting -5 StepsNeso Academy



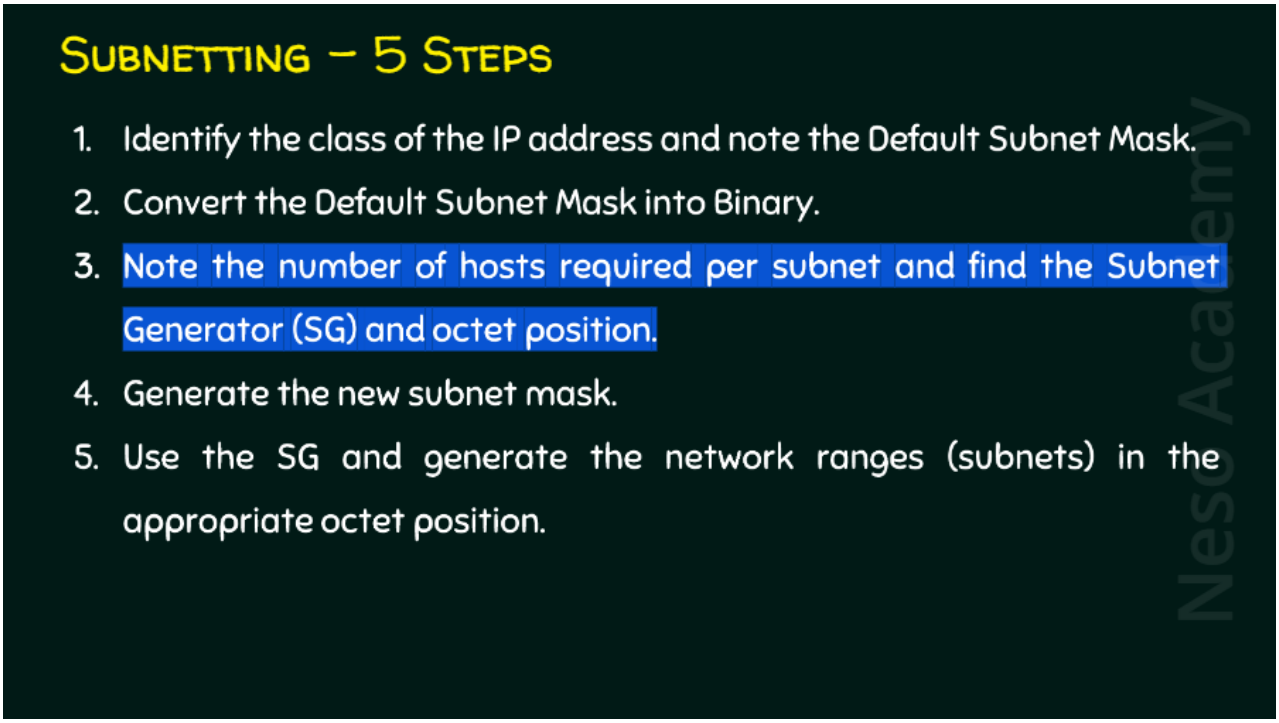
SolutionNeso Academy



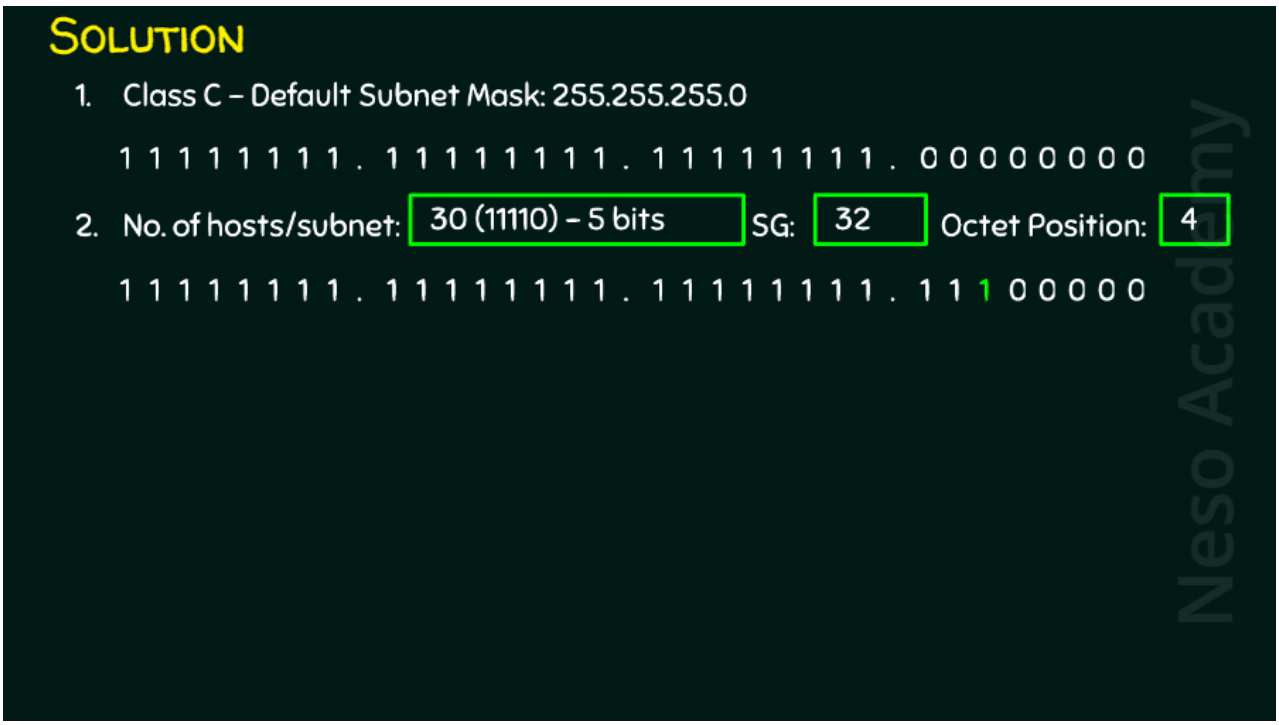
Subnetting -5 StepsNeso Academy



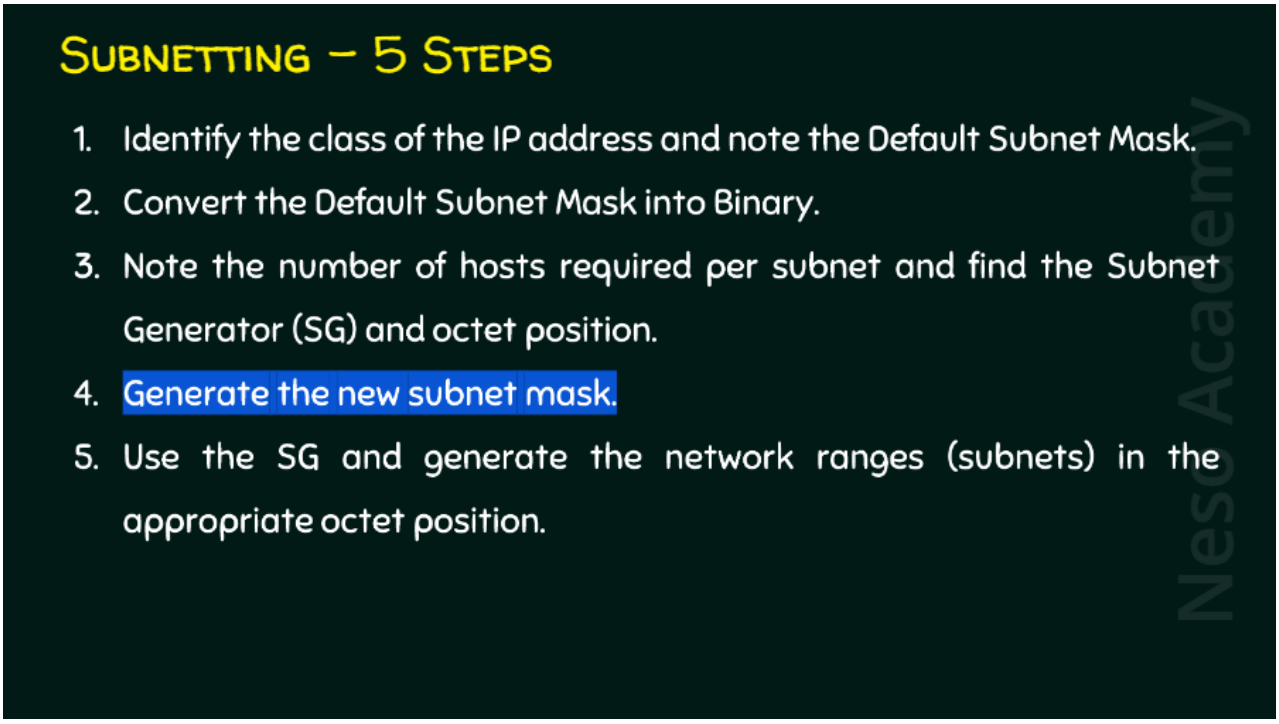
SolutionNeso Academy



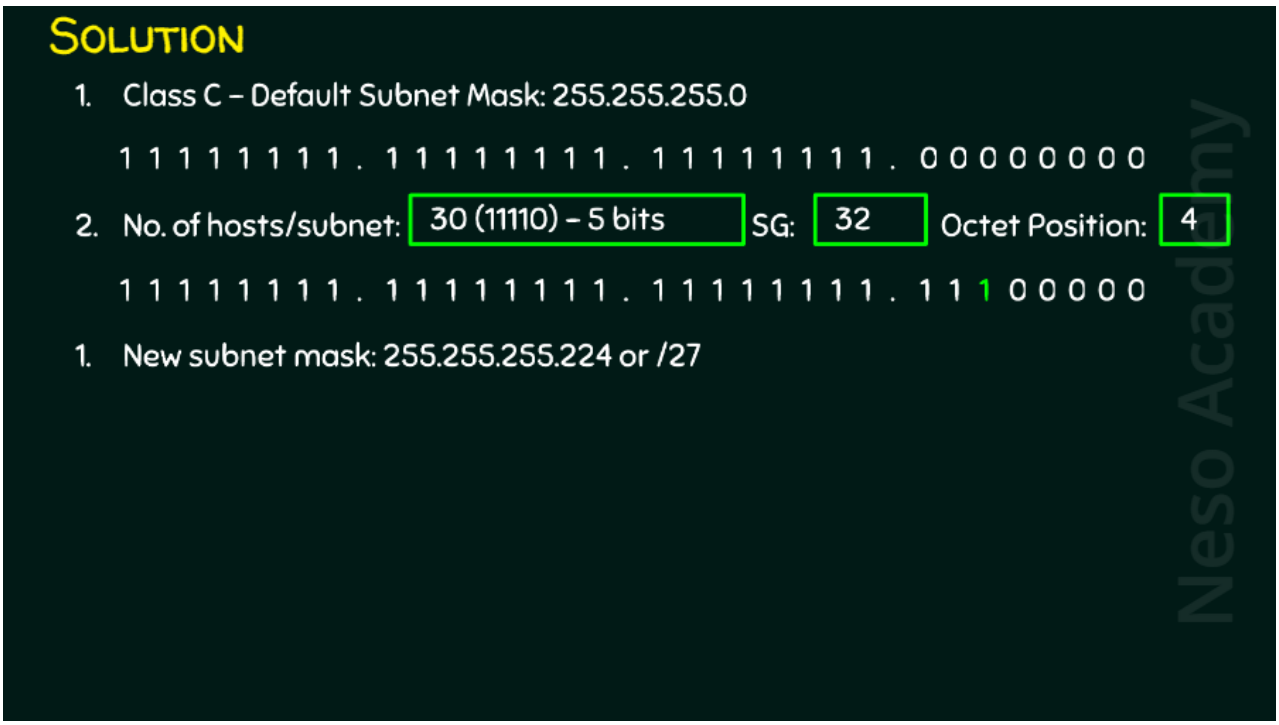
Subnetting -5 StepsNeso Academy



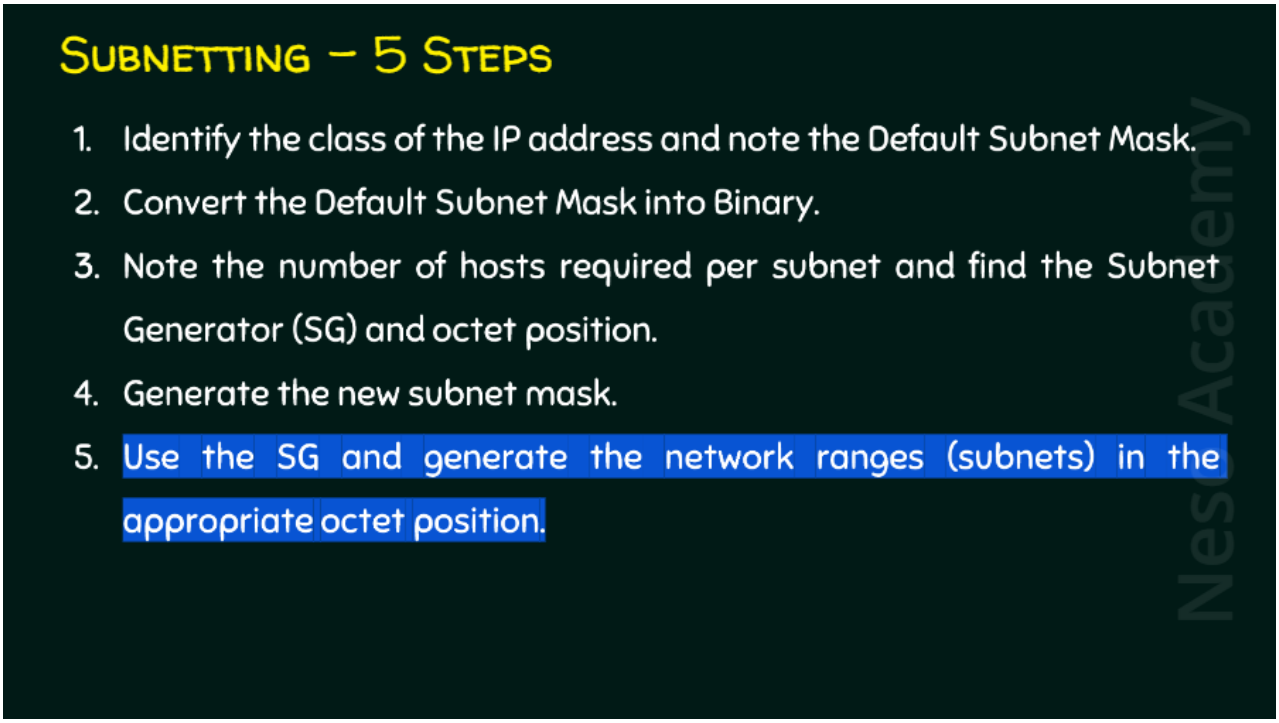
SolutionNeso Academy



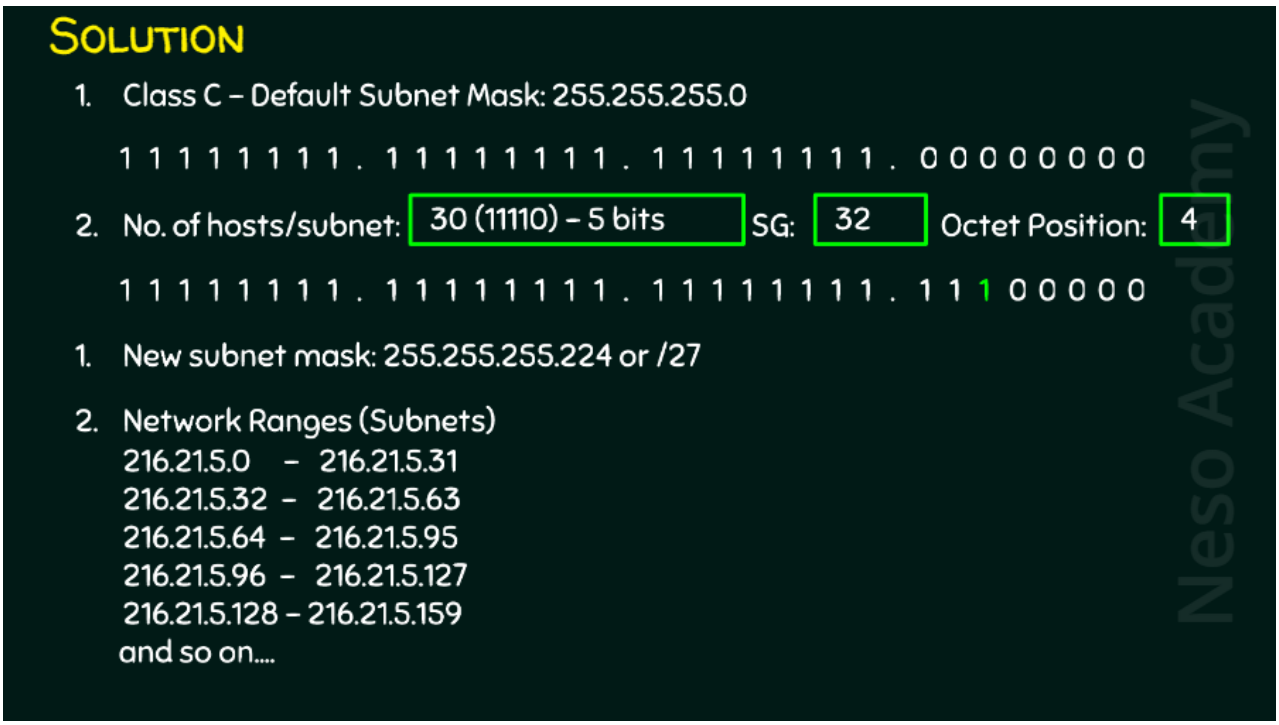
Subnetting -5 StepsNeso Academy



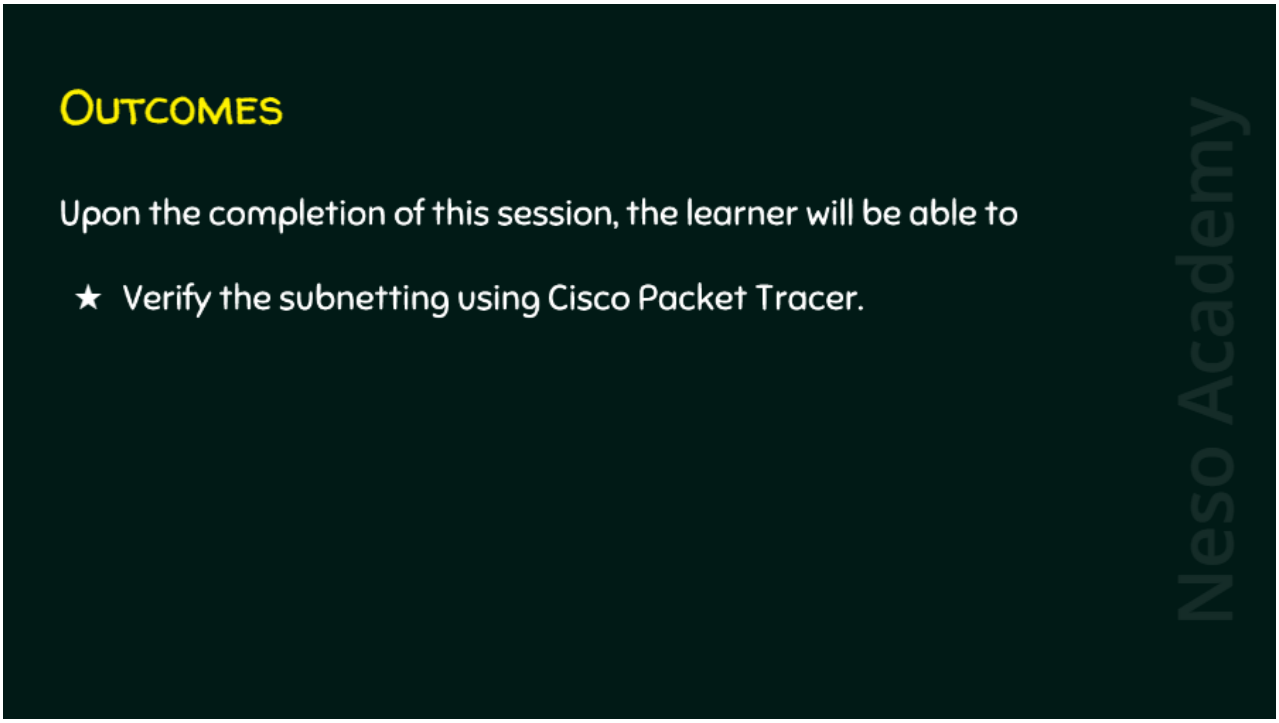
SolutionNeso Academy



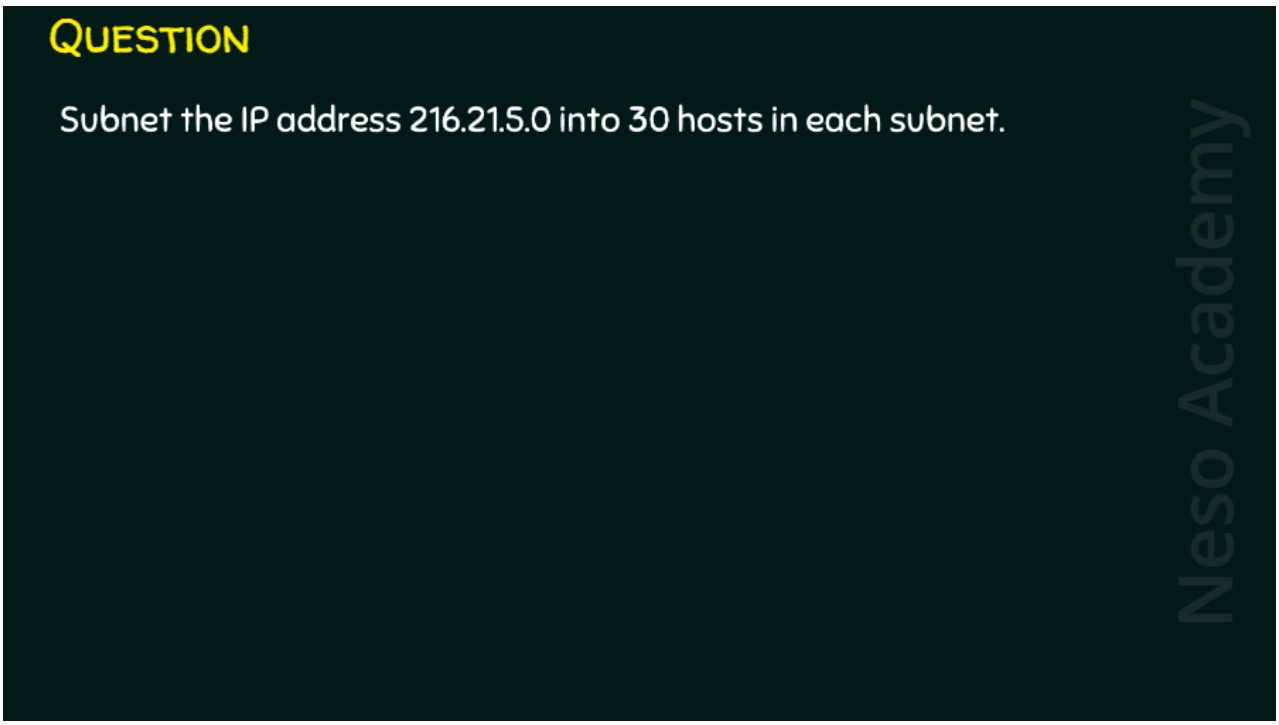
Subnetting -5 StepsNeso Academy



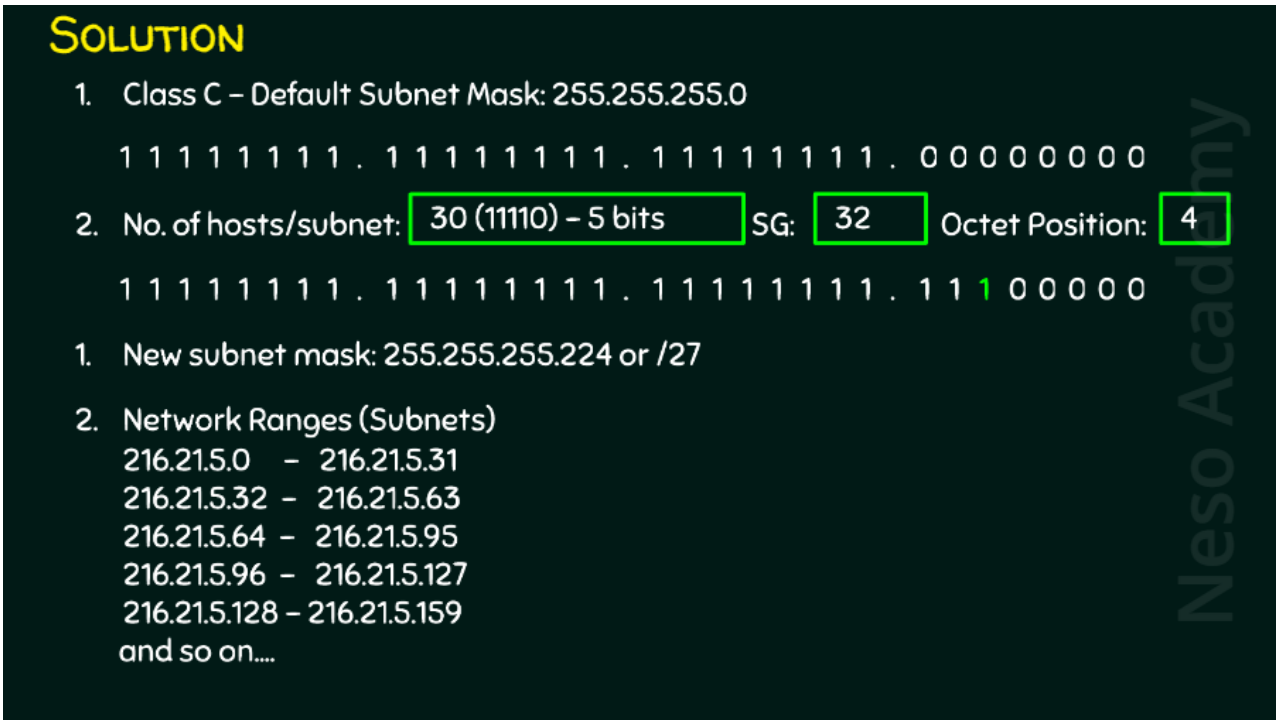
SolutionNeso Academy



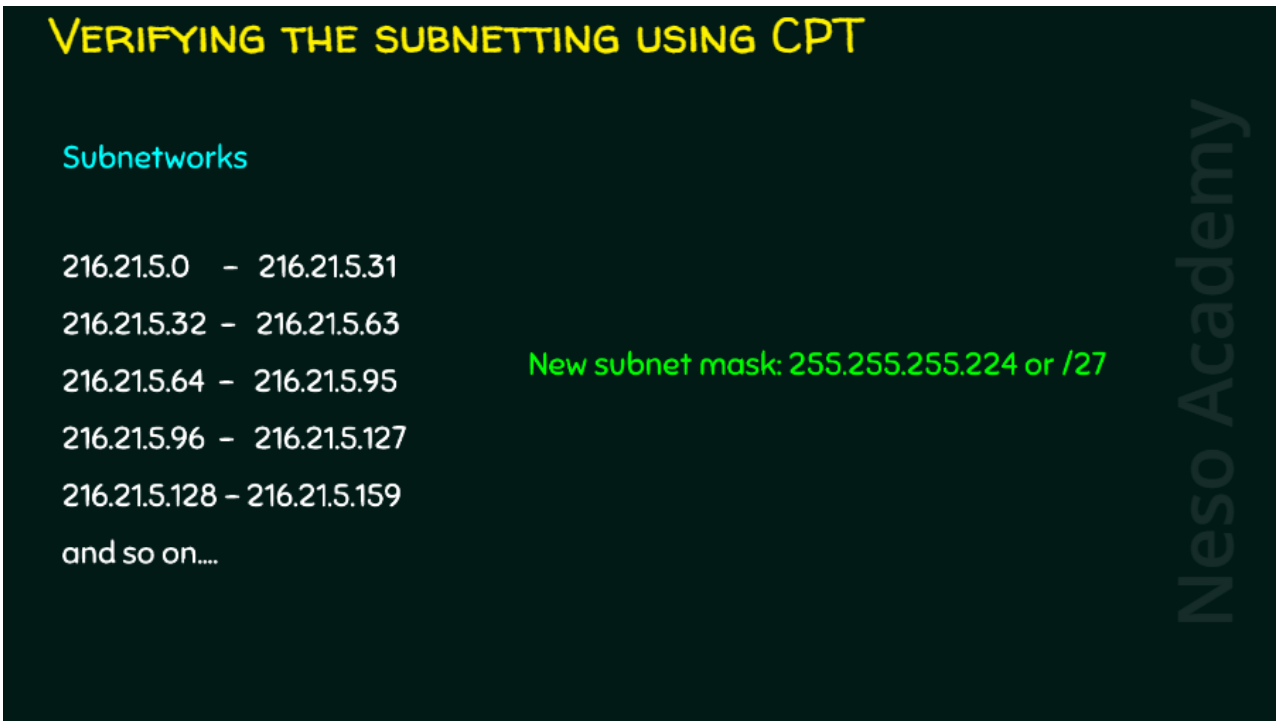
Outcomes★Neso Academy



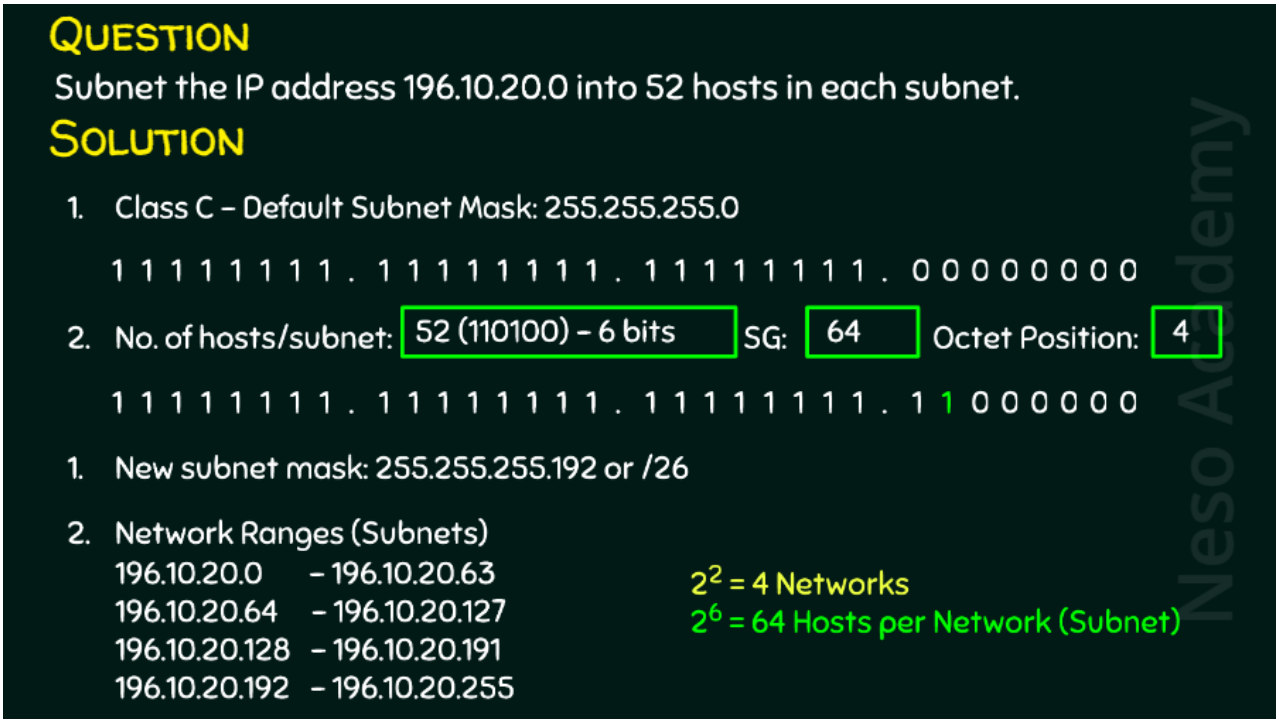
QuestionNeso Academy



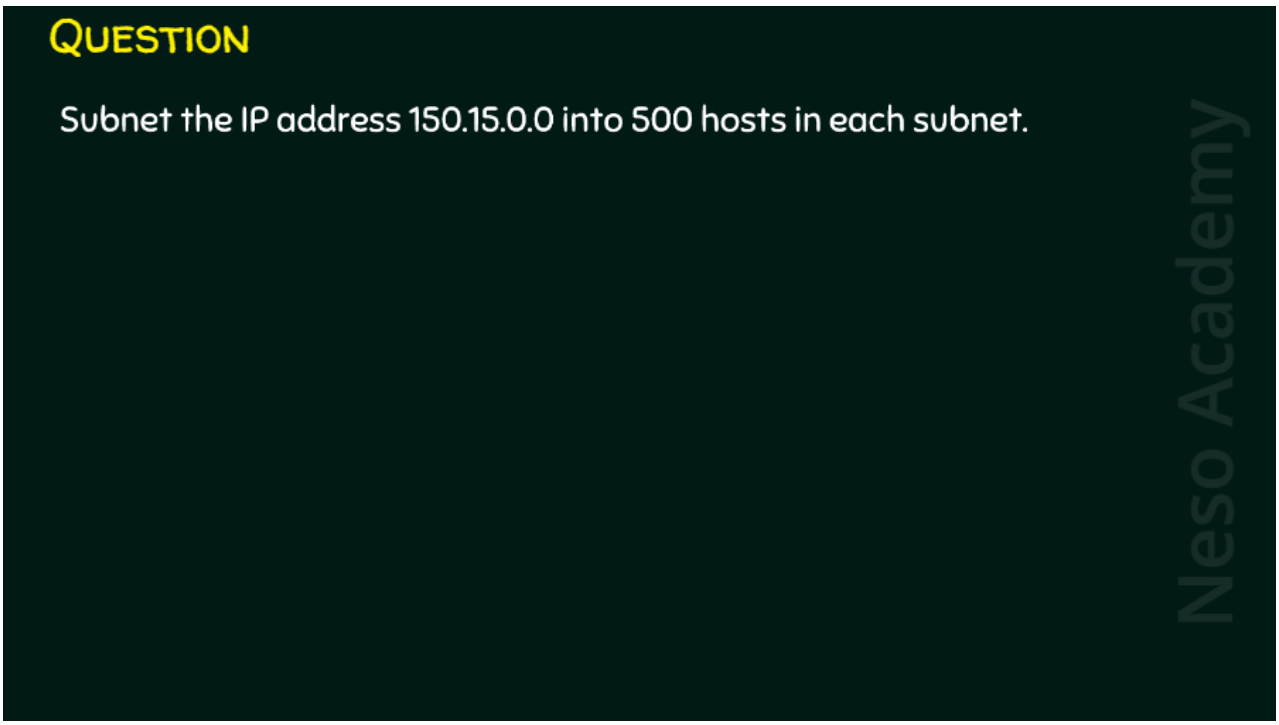
SolutionNeso Academy



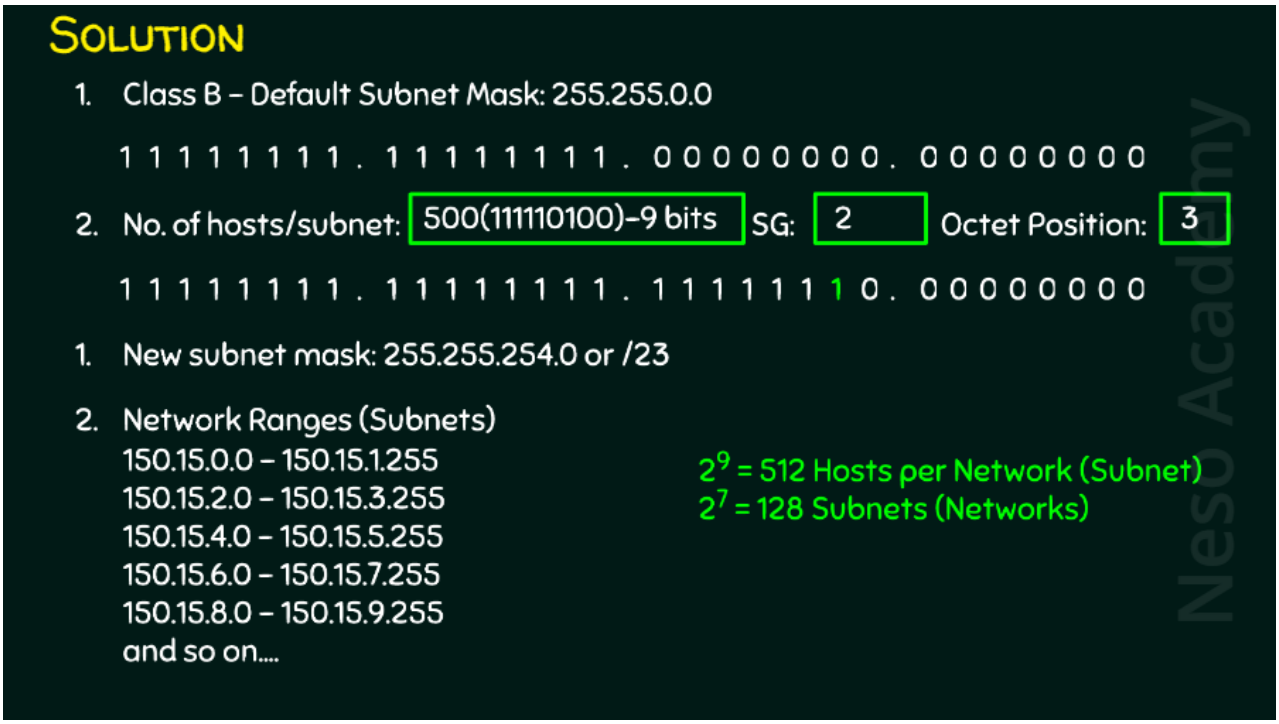
Verifying the subnetting using CPTNeso Academy



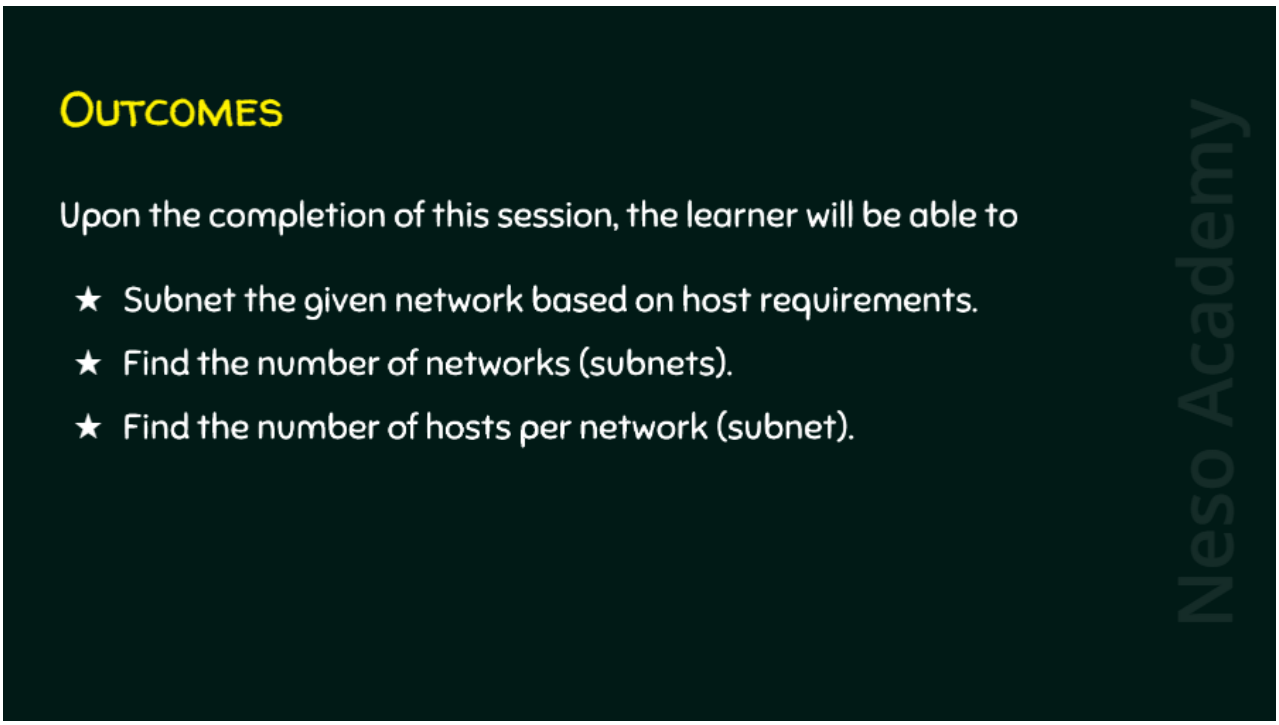
QuestionSolutionNeso Academy



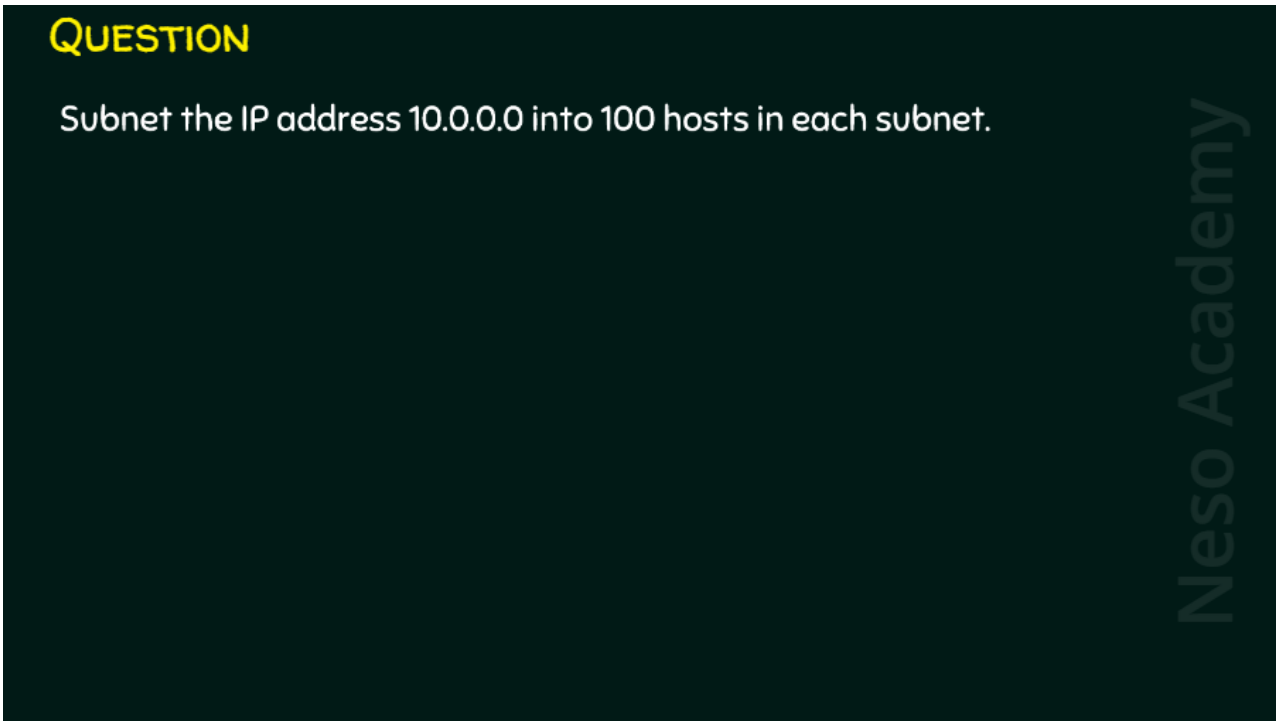
QuestionNeso Academy



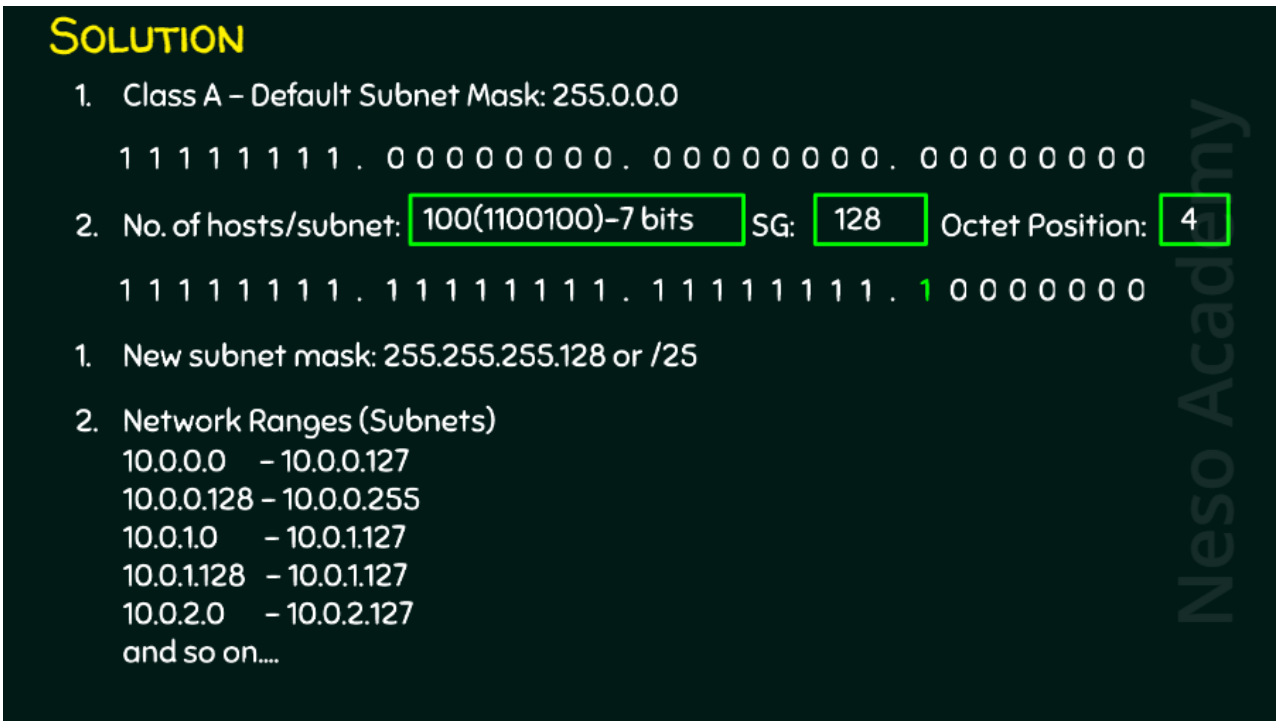
SolutionNeso Academy



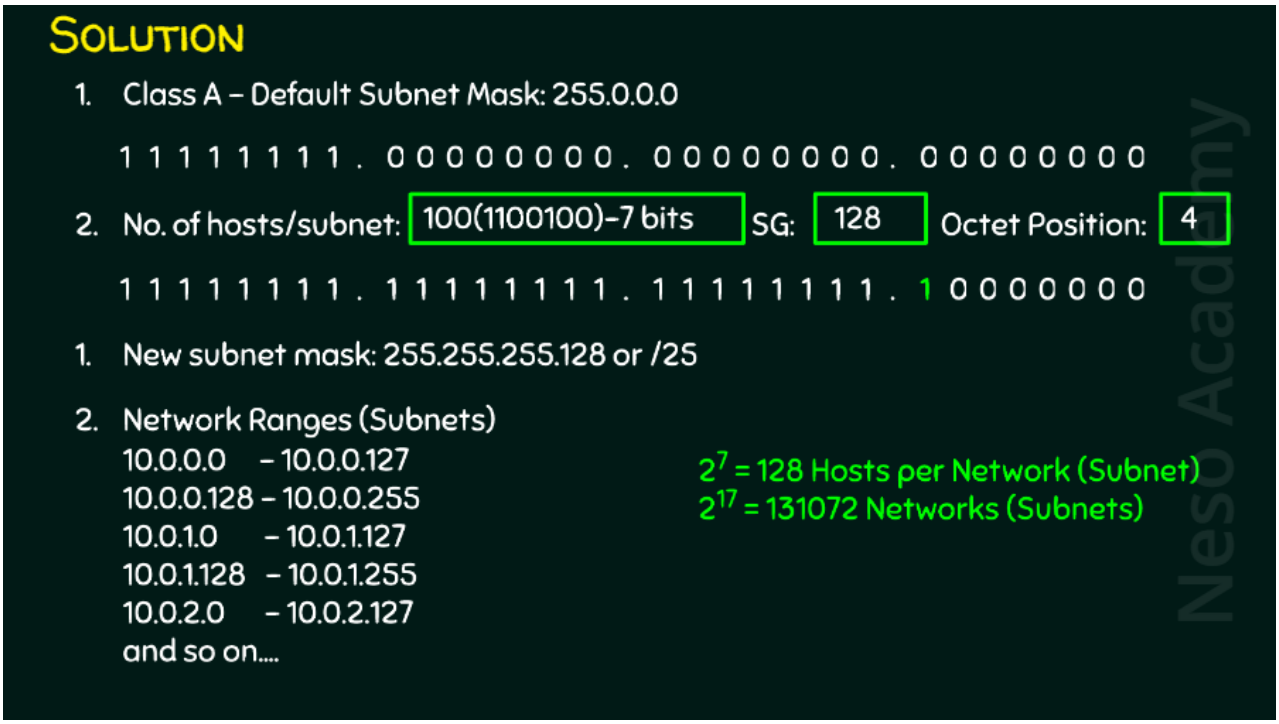
Outcomes★★★Neso Academy



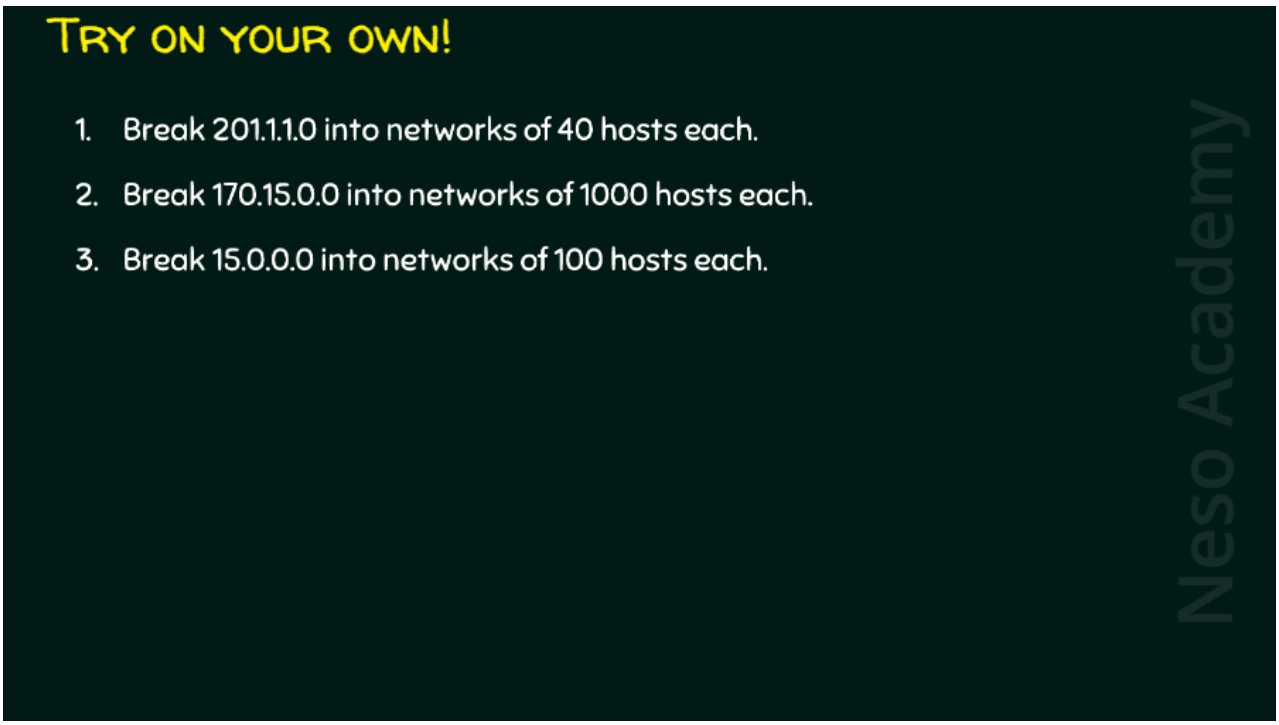
QuestionNeso Academy



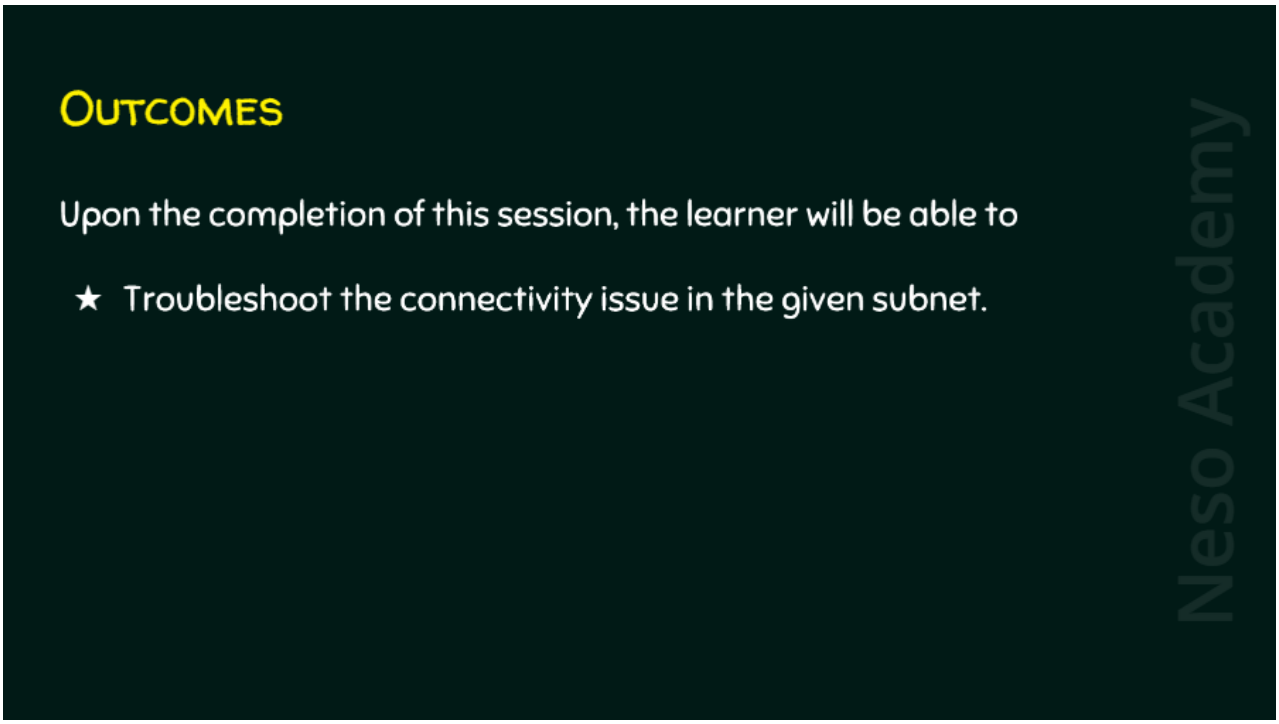
SolutionNeso Academy



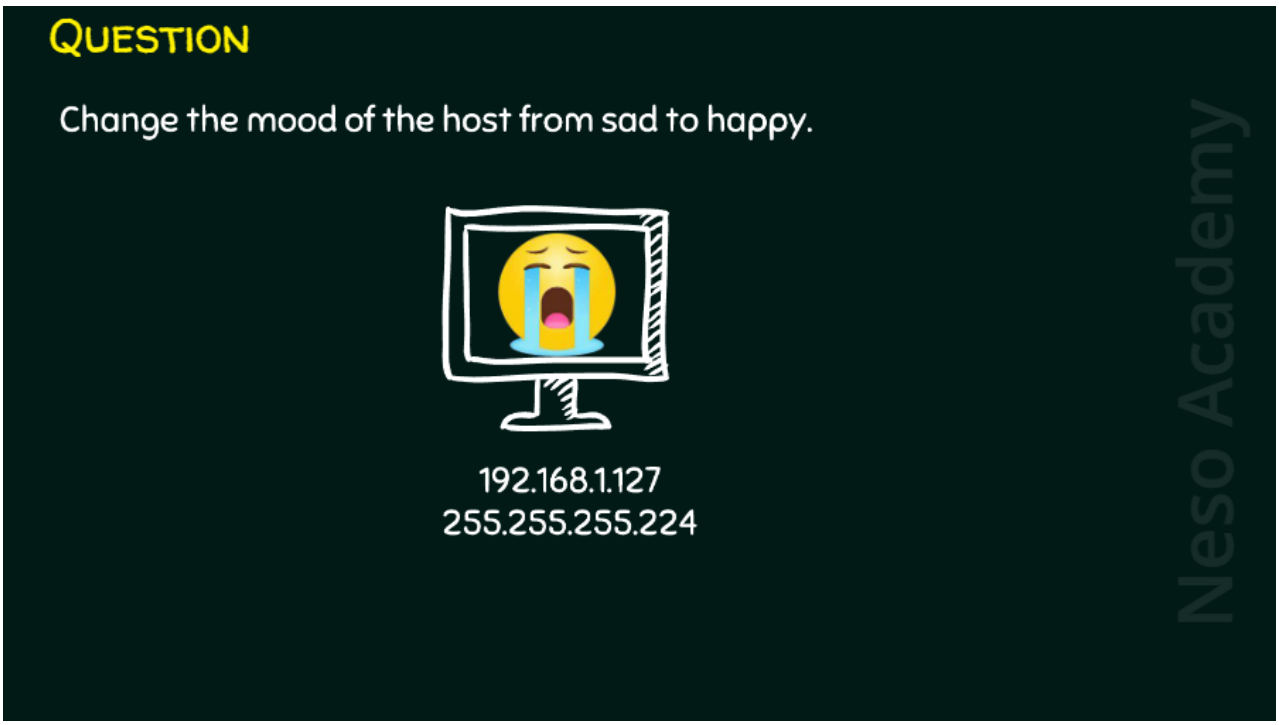
SolutionNeso Academy



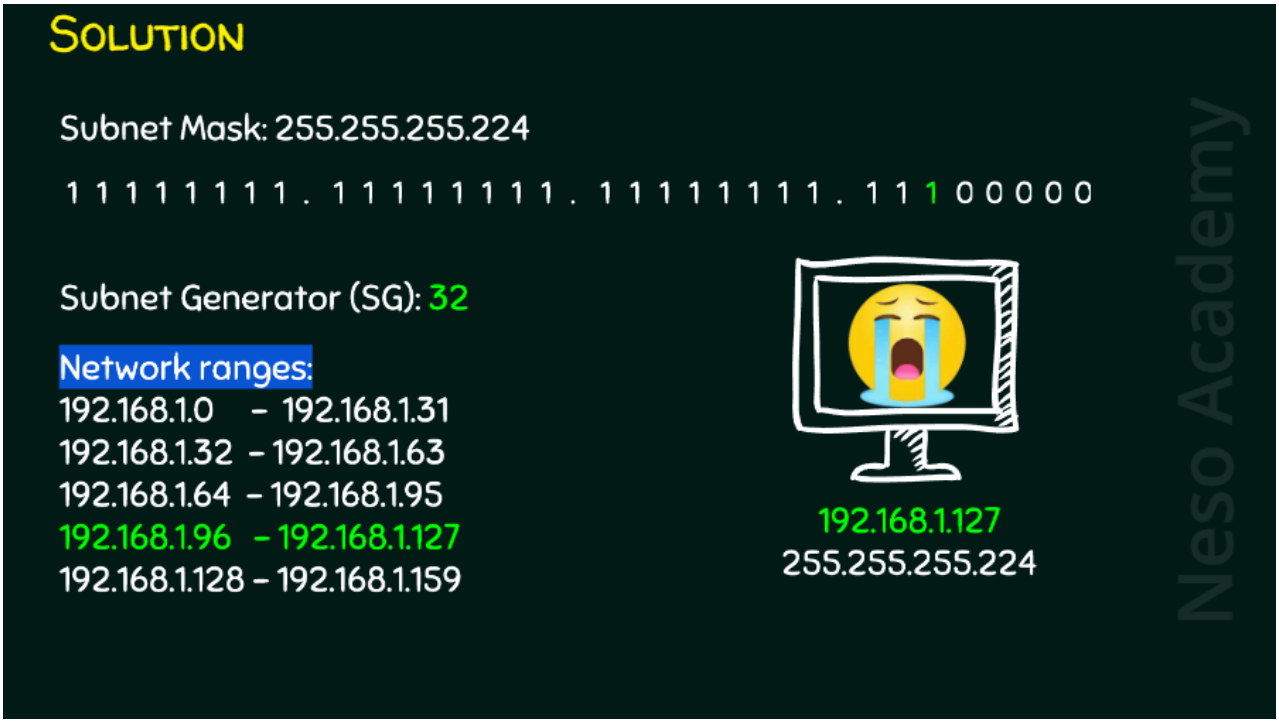
Try on your own!Neso Academy



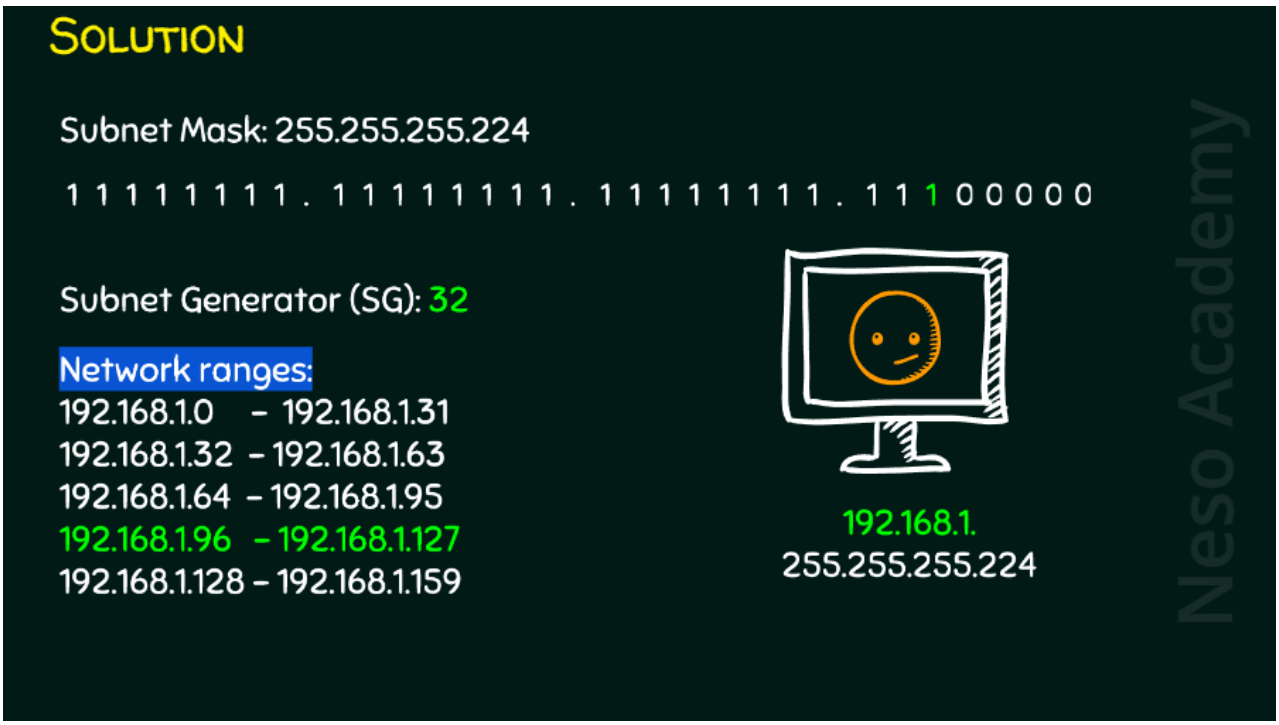
Outcomes★Neso Academy



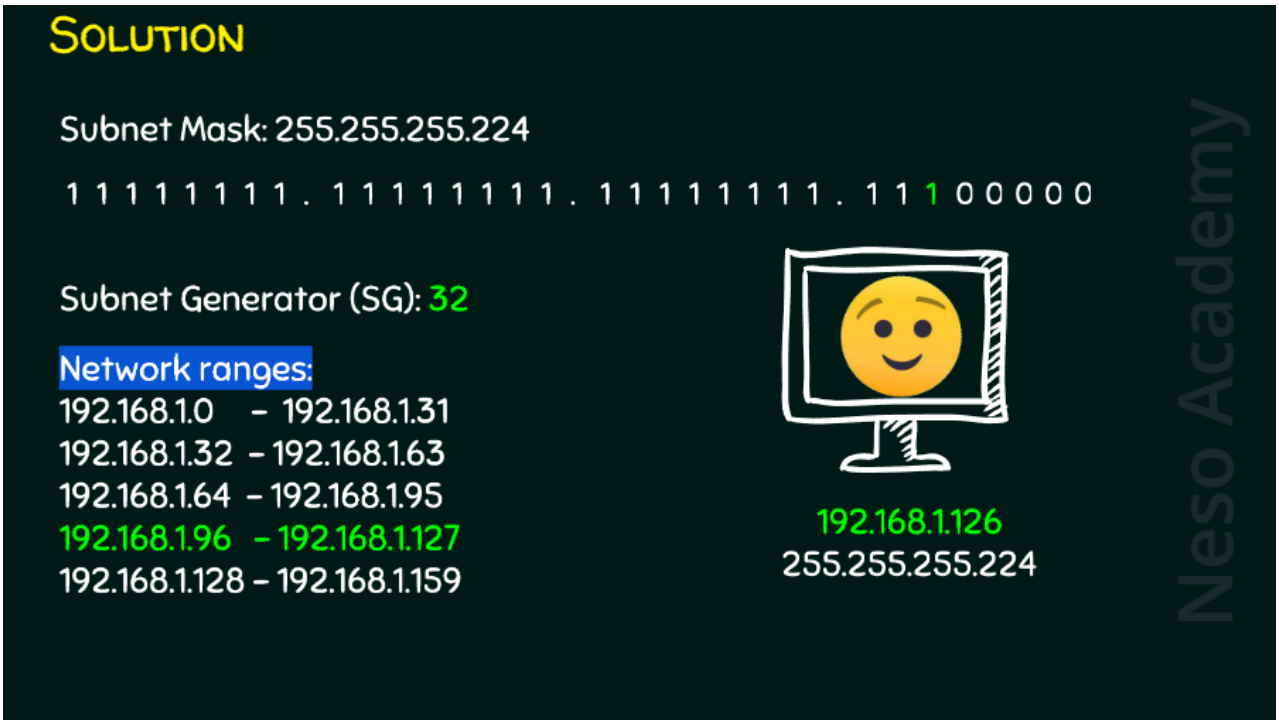
QuestionNeso Academy



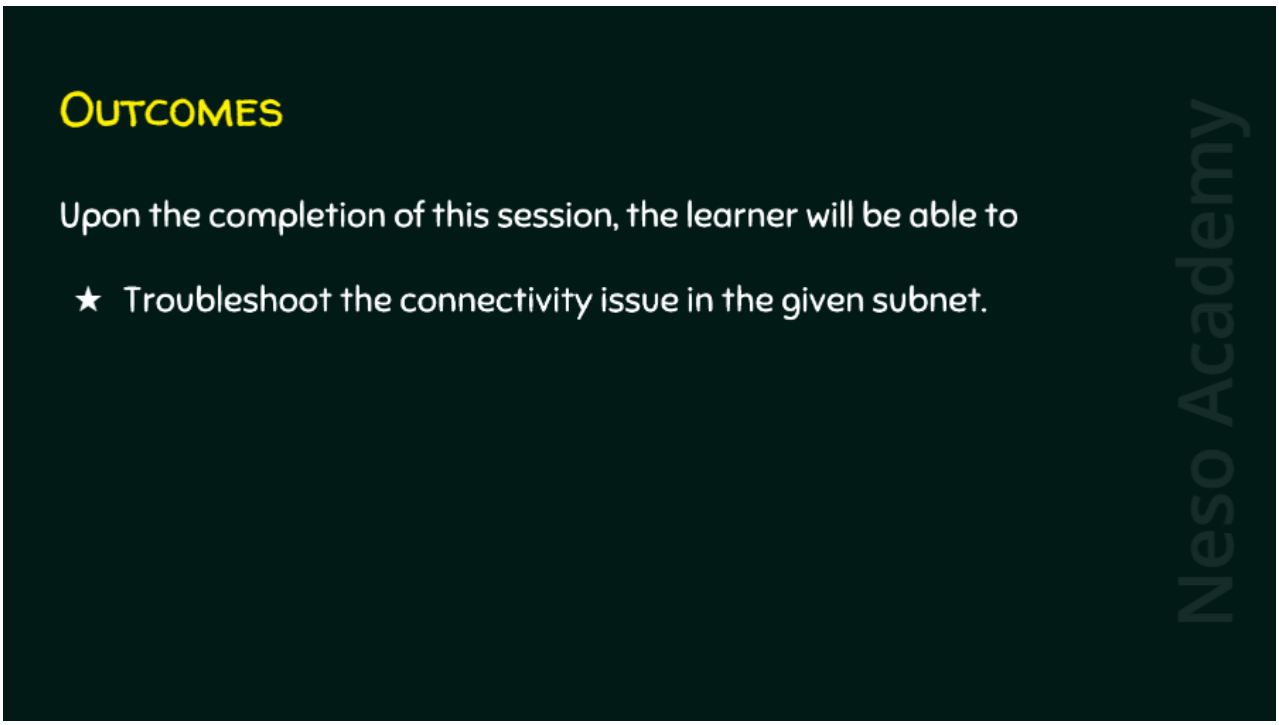
SolutionNeso Academy



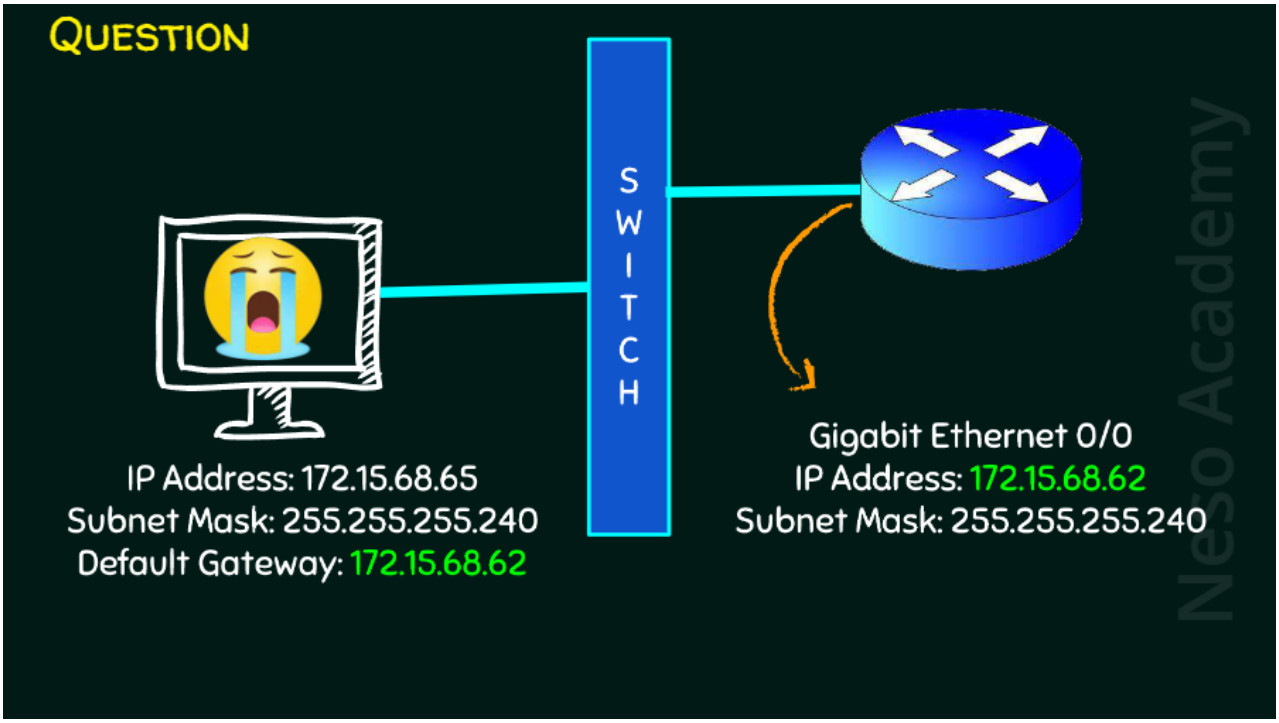
SolutionNeso Academy



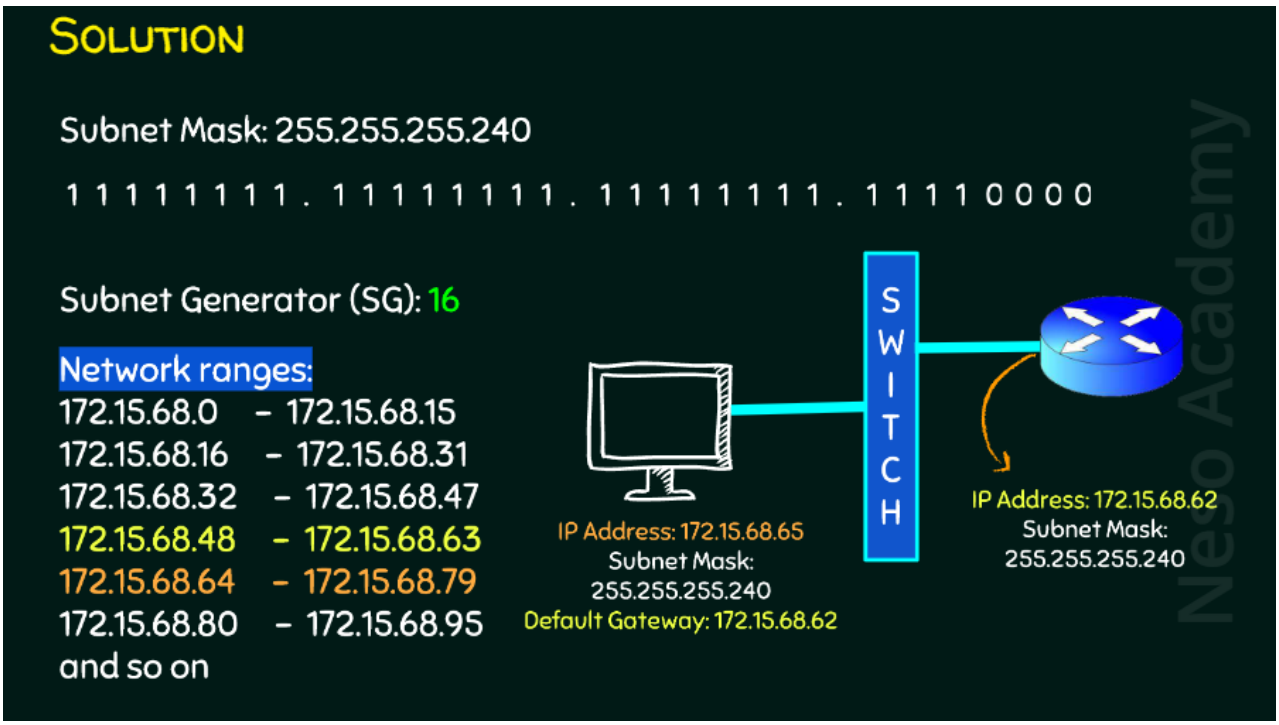
SolutionNeso Academy



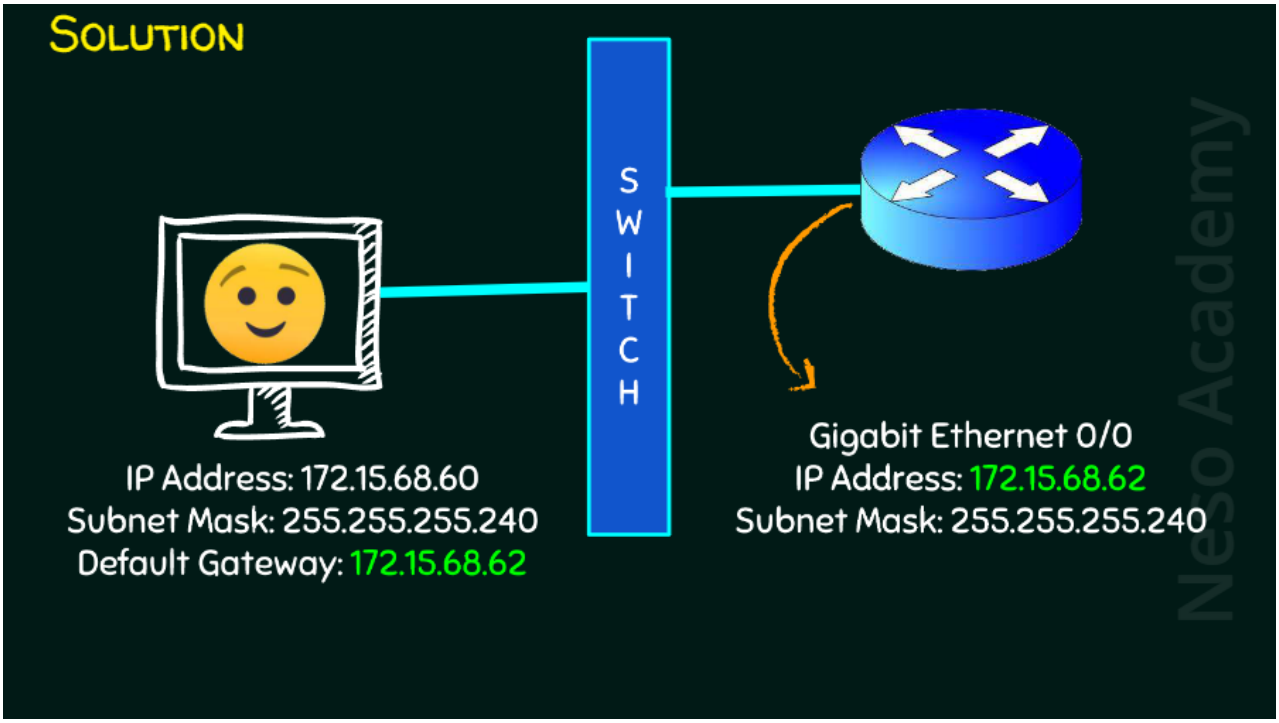
Outcomes★Neso Academy



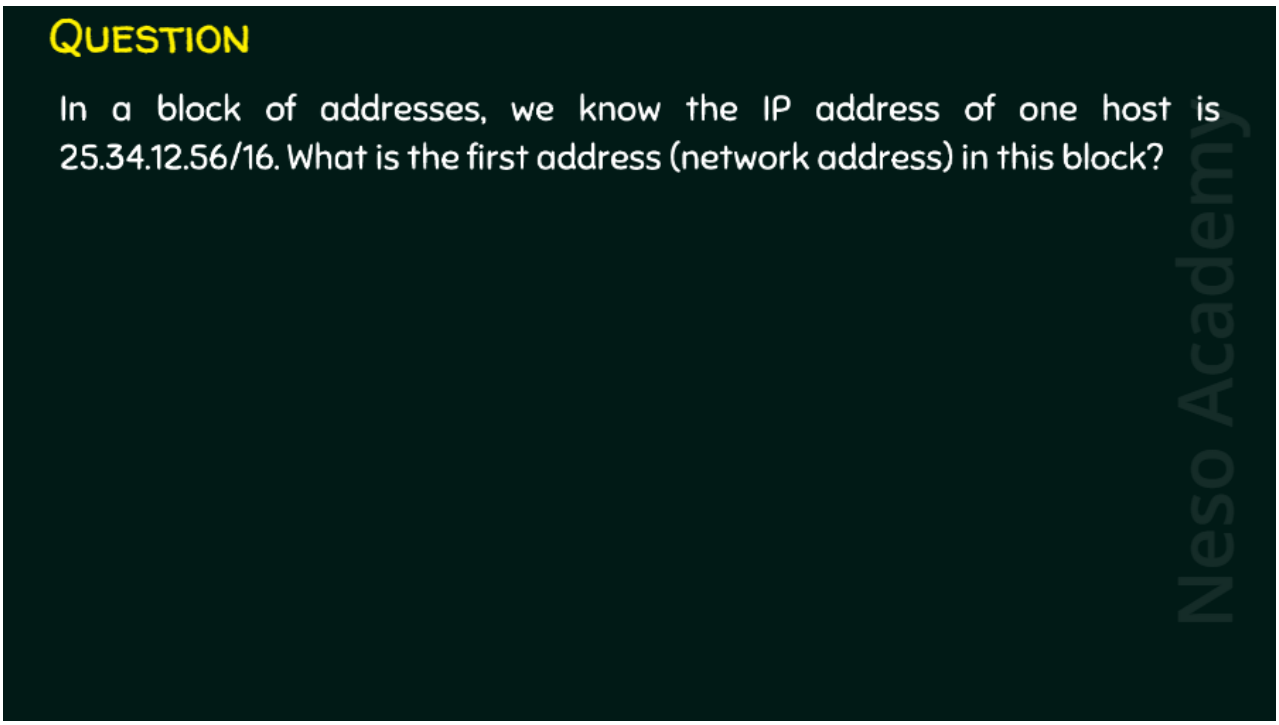
QuestionNeso Academy



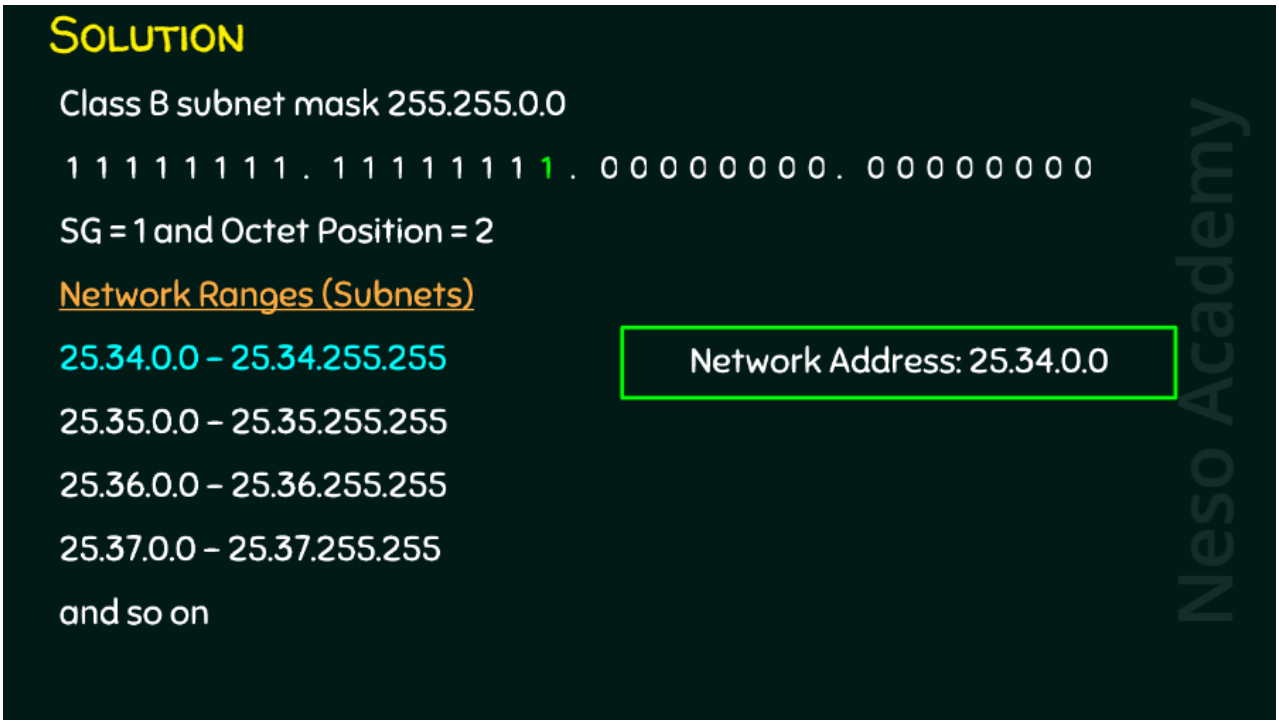
SolutionNeso Academy



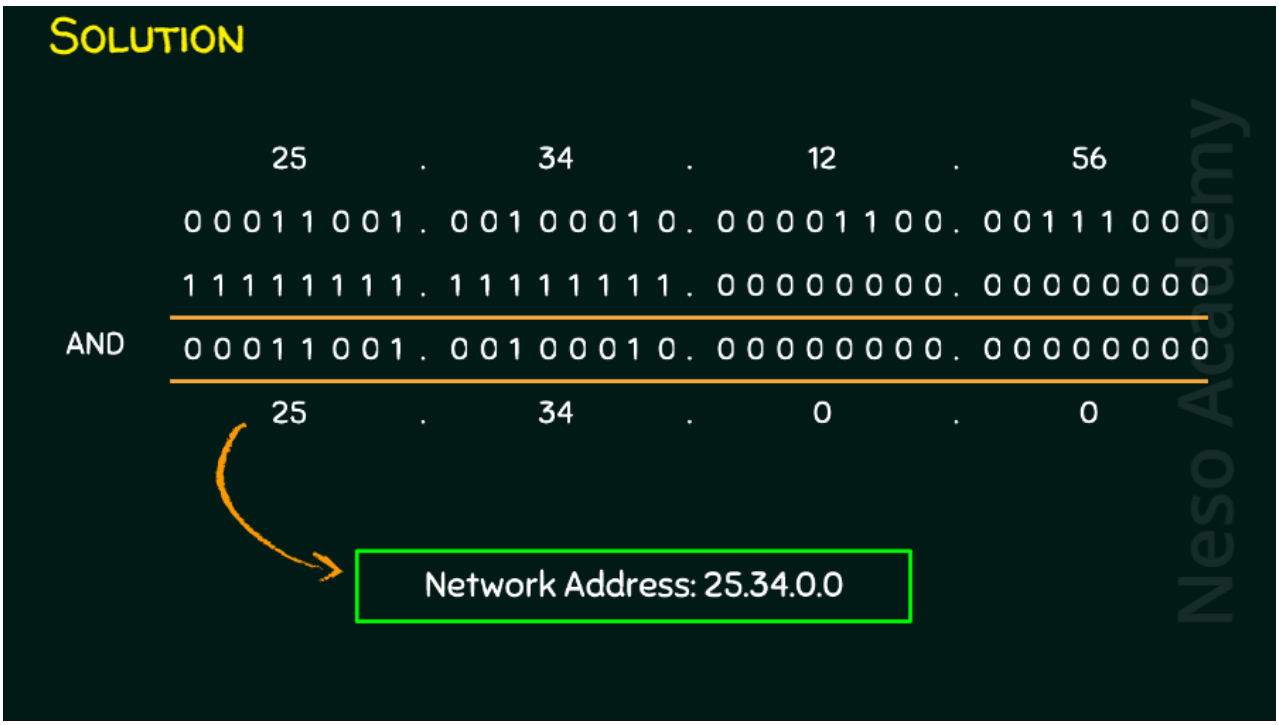
SolutionNeso Academy



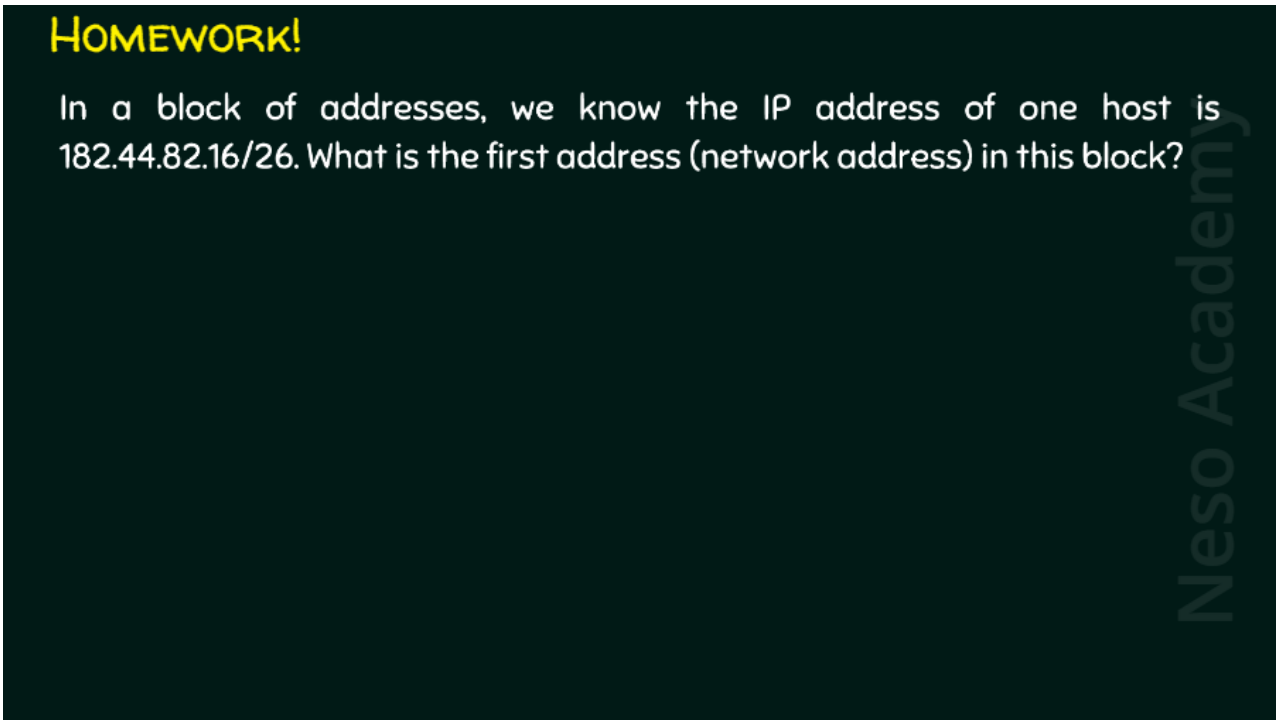
QuestionNeso Academy



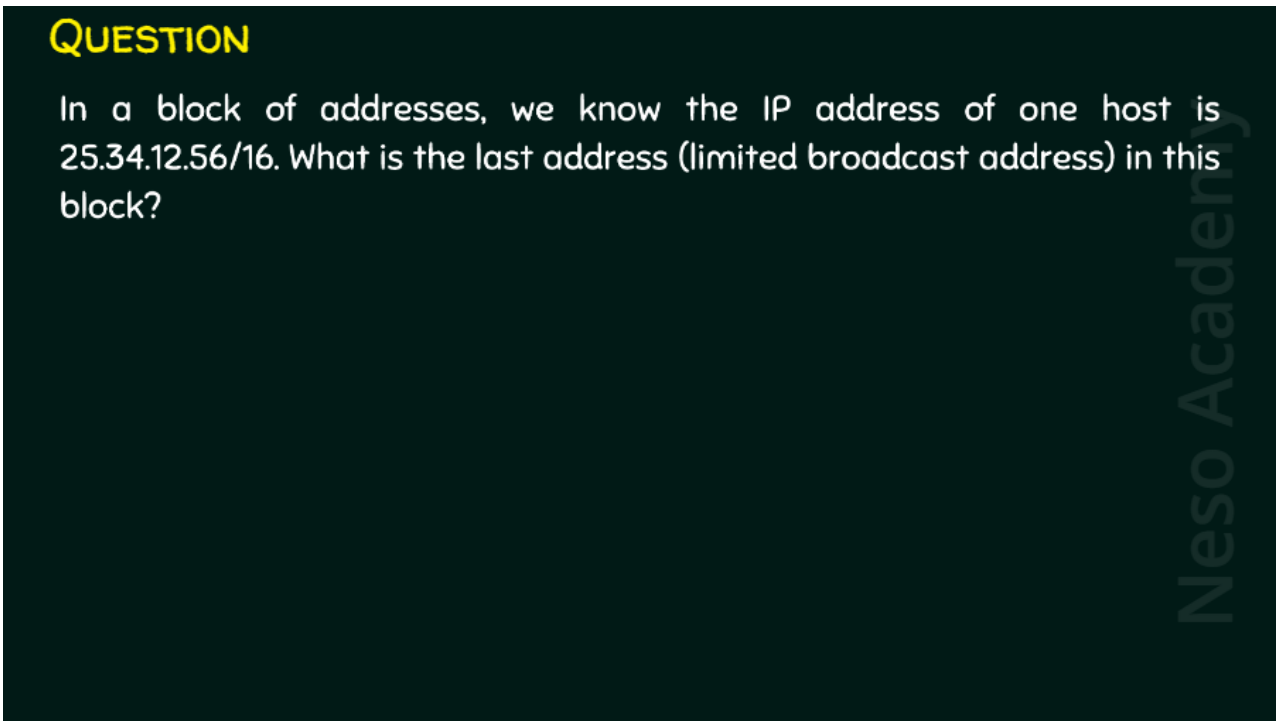
SolutionNeso Academy



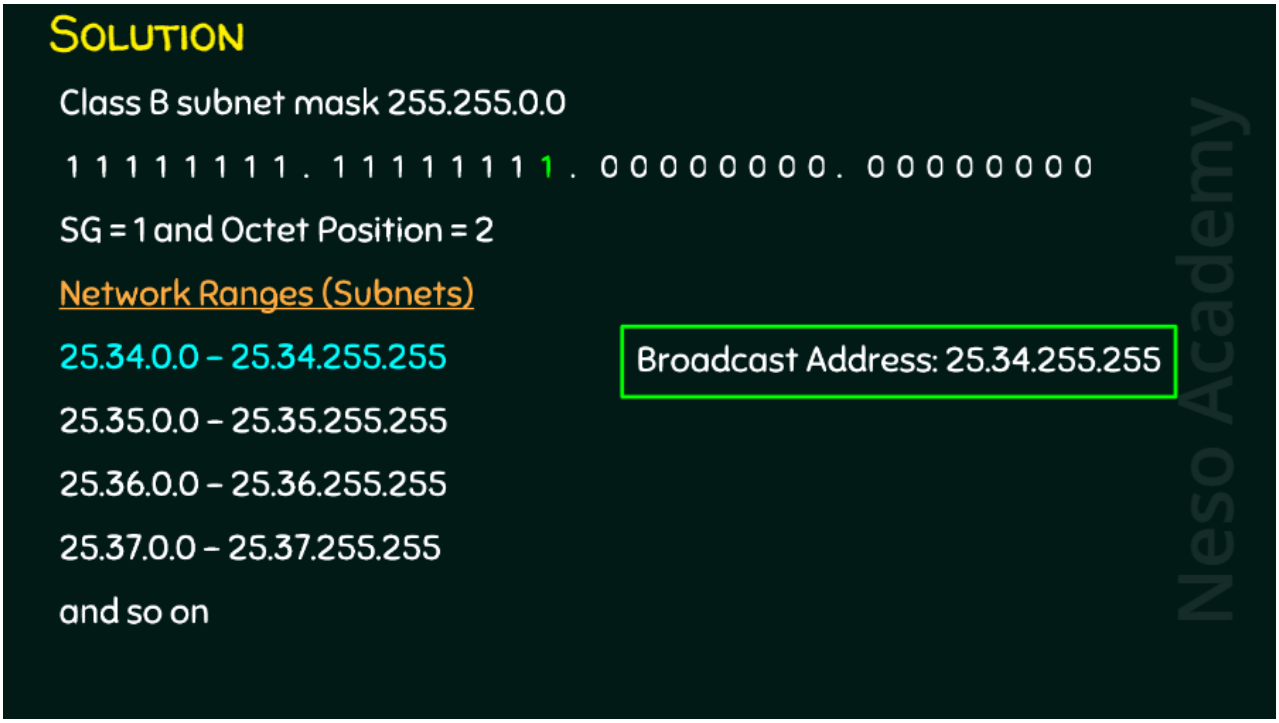
SolutionNeso Academy



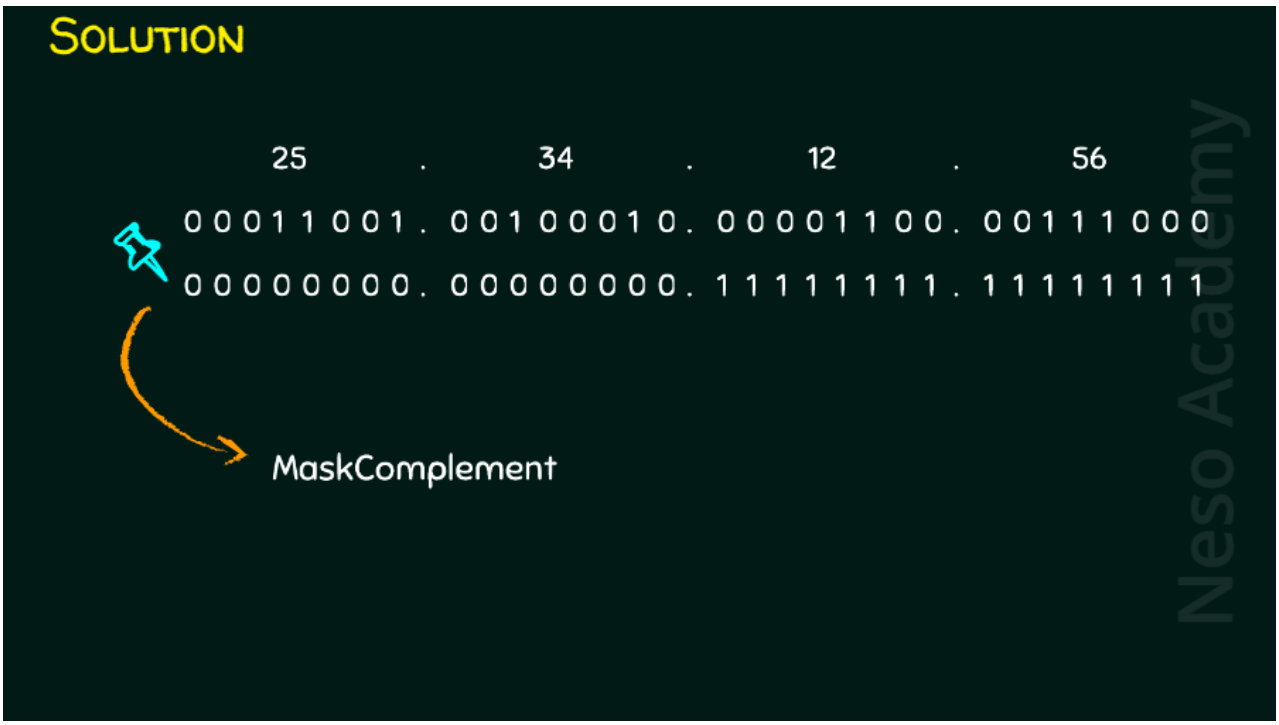
Homework!Neso Academy



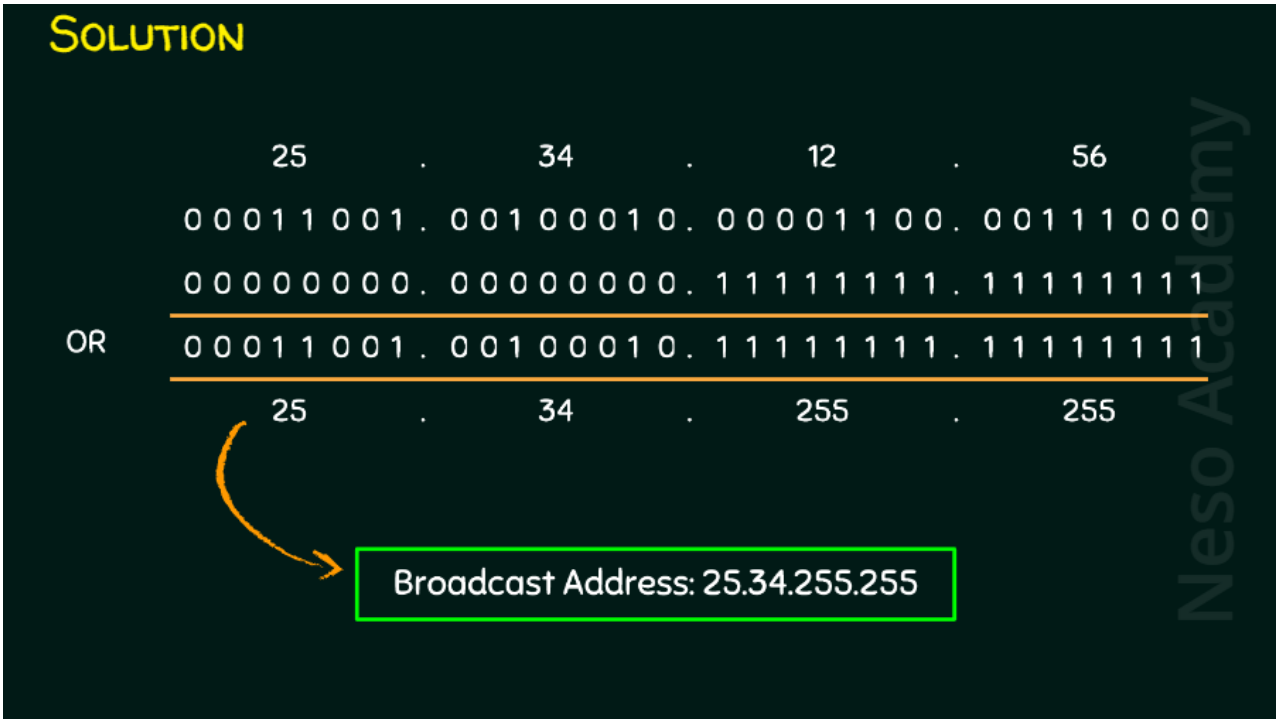
QuestionNeso Academy



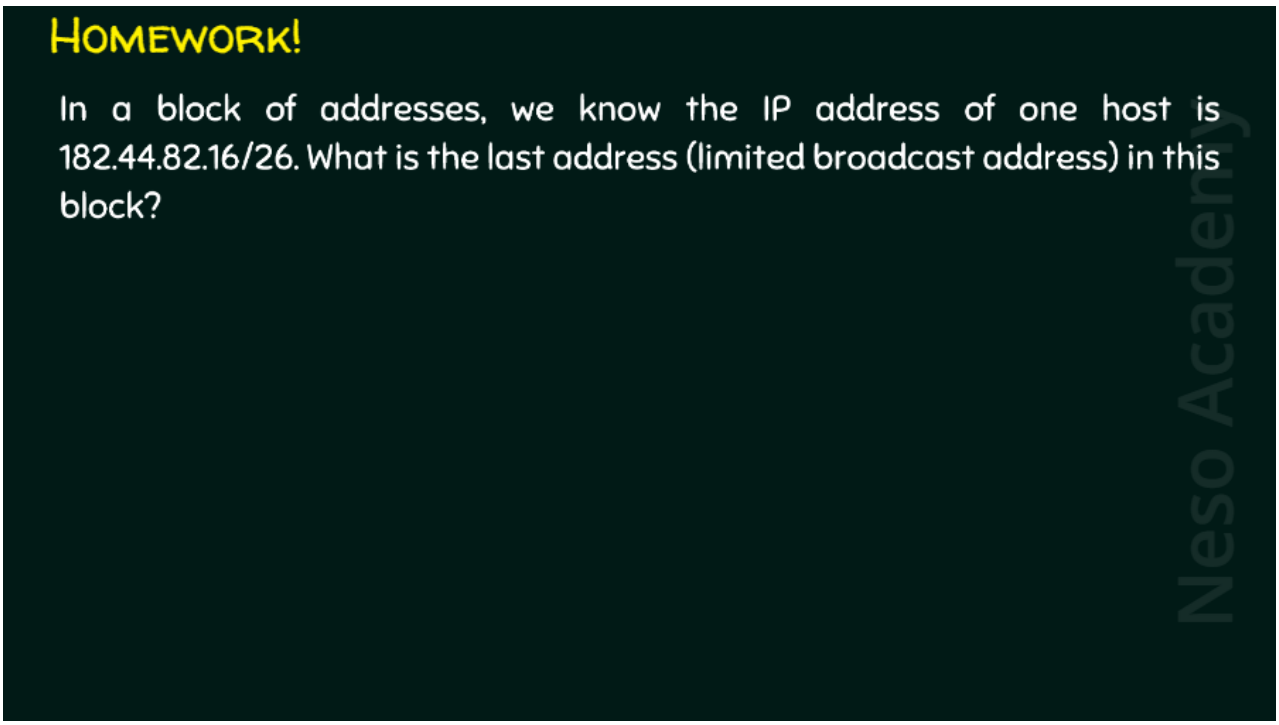
SolutionNeso Academy



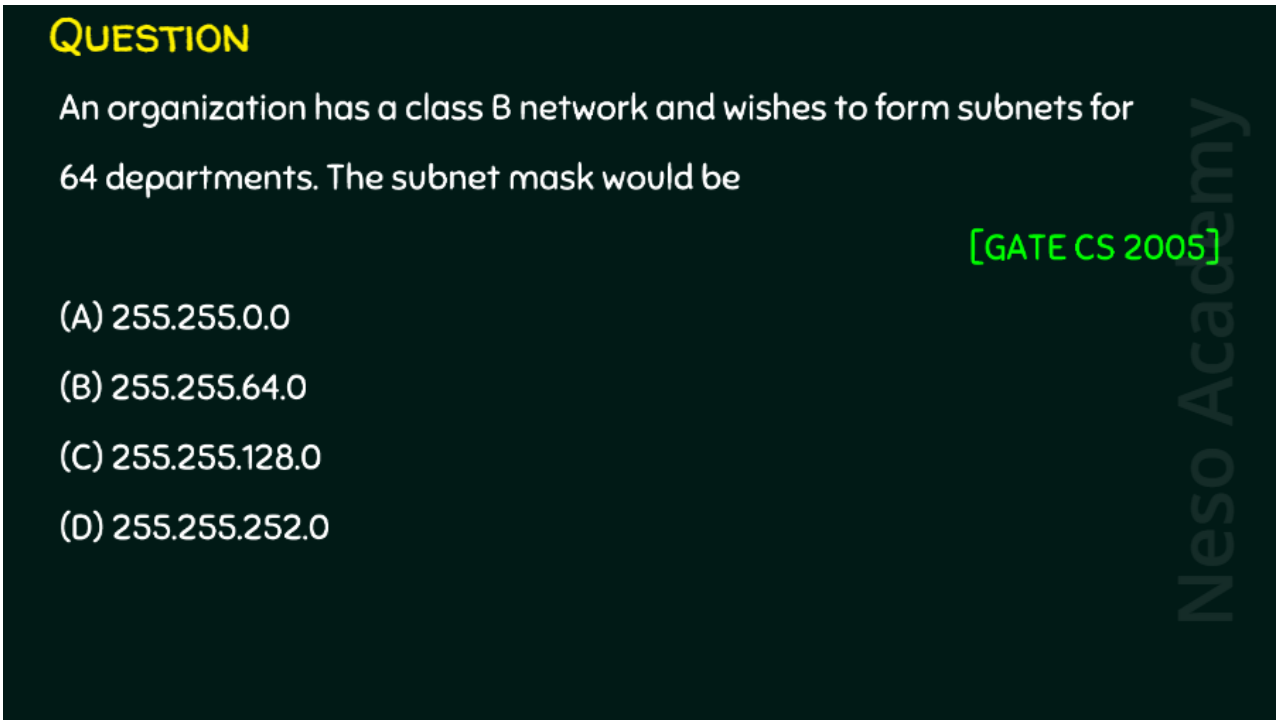
SolutionNeso Academy



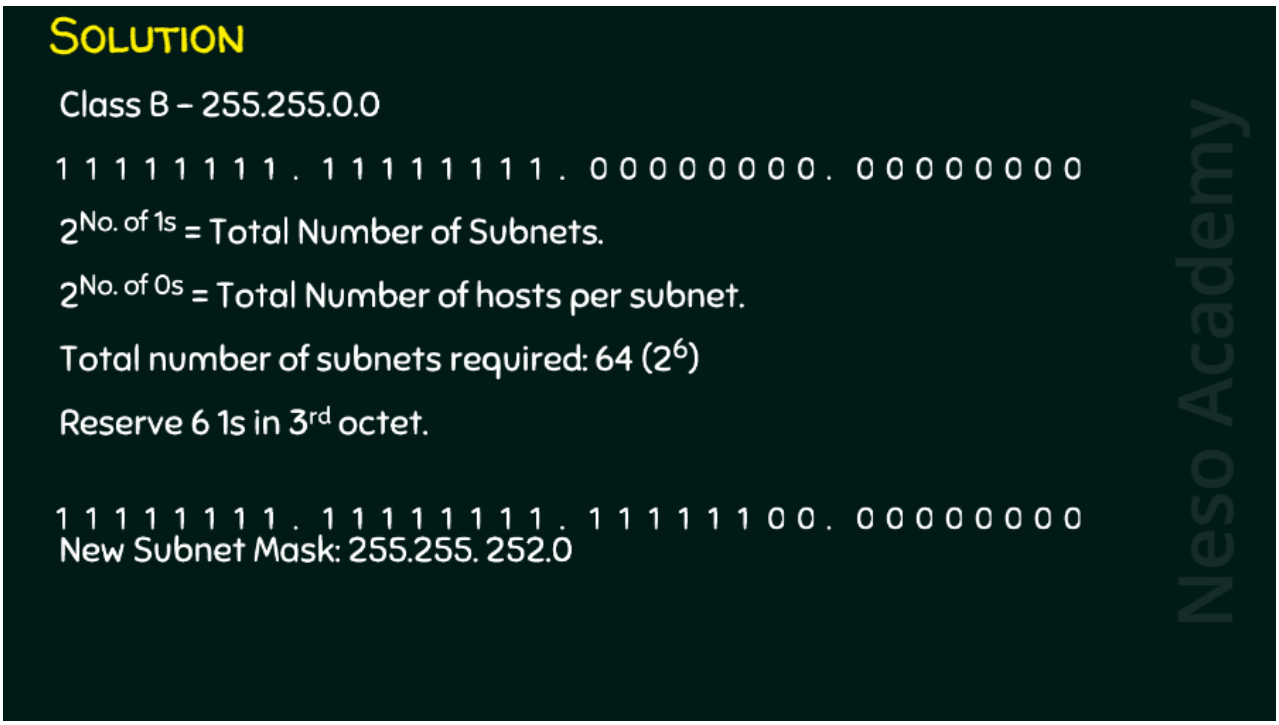
SolutionNeso Academy



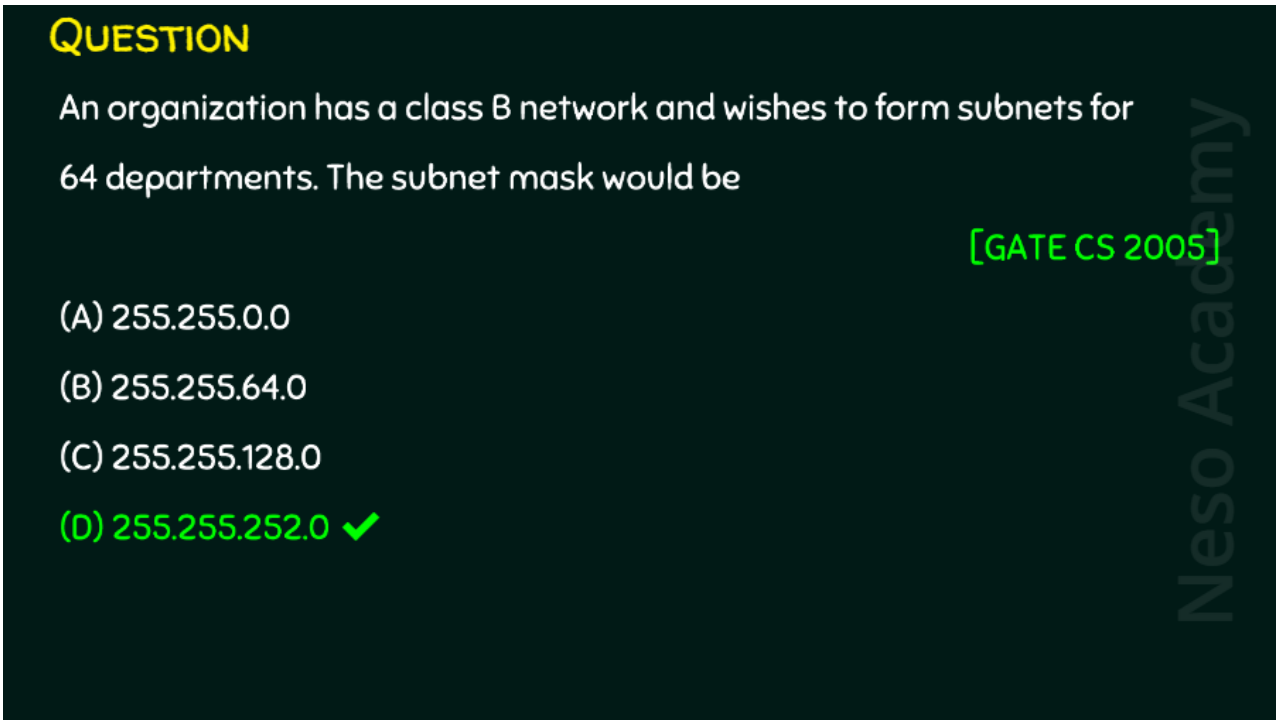
Homework!Neso Academy



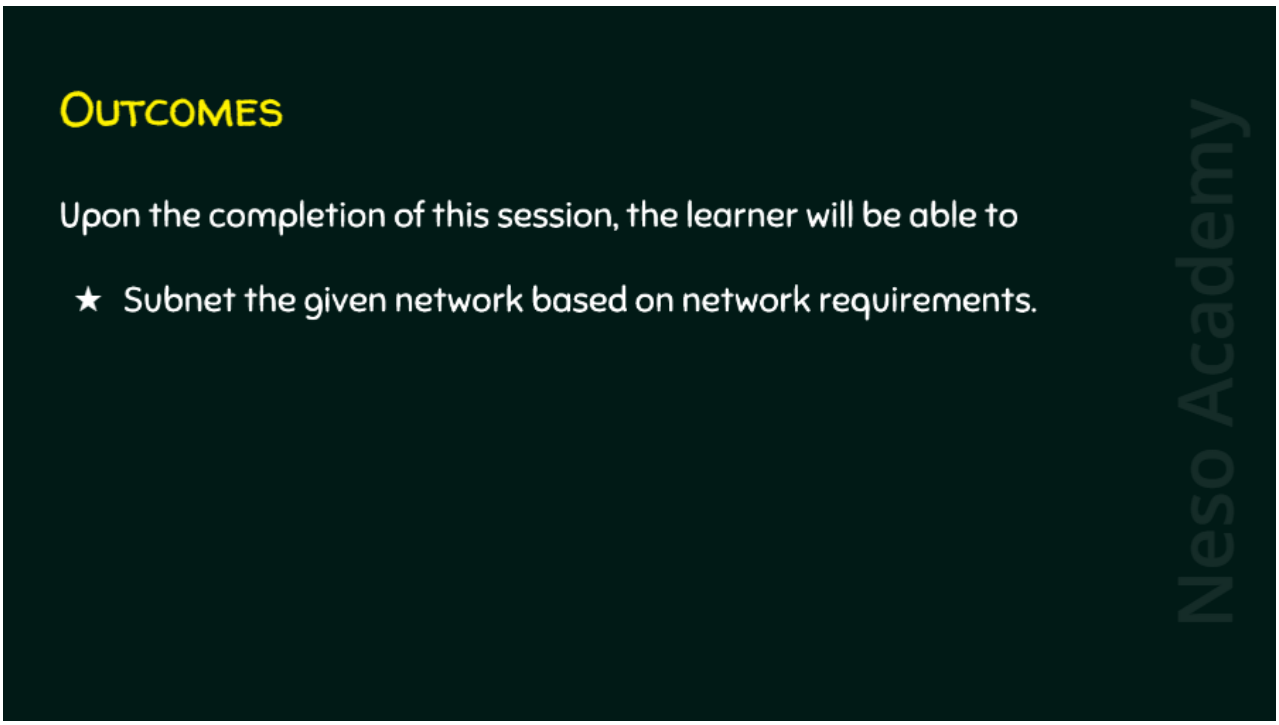
QuestionNeso Academy



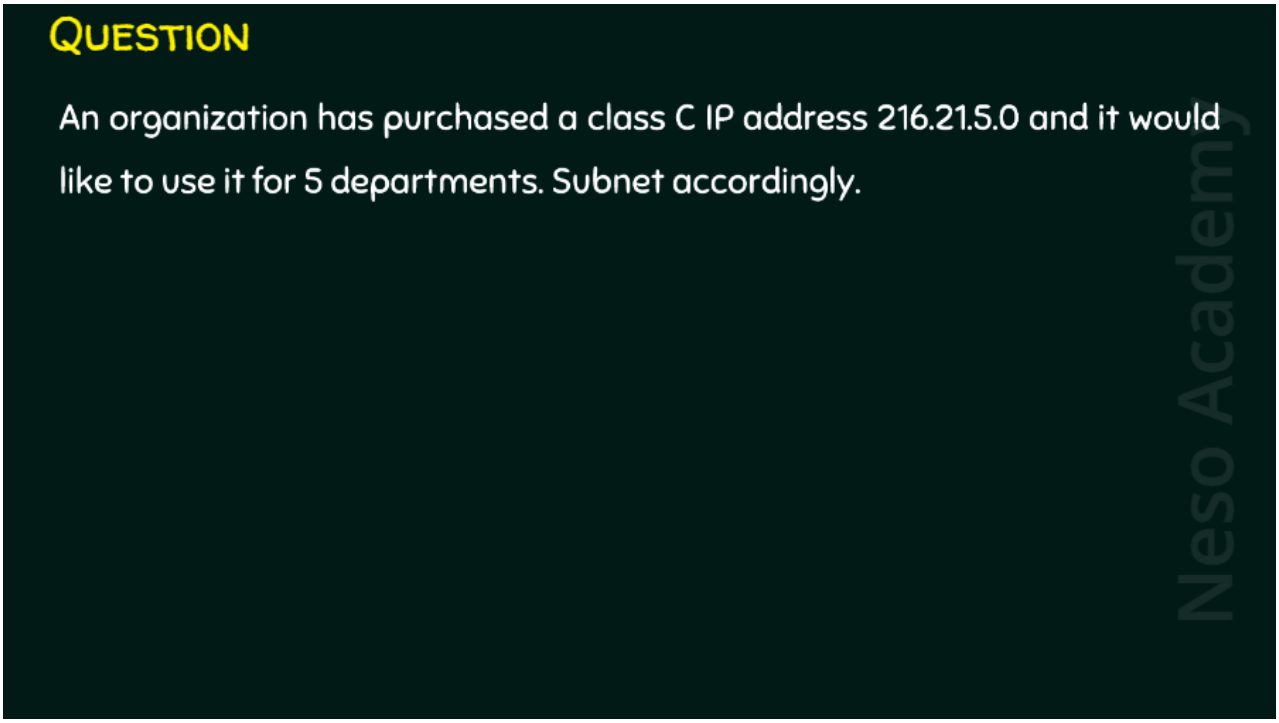
SolutionNeso Academy



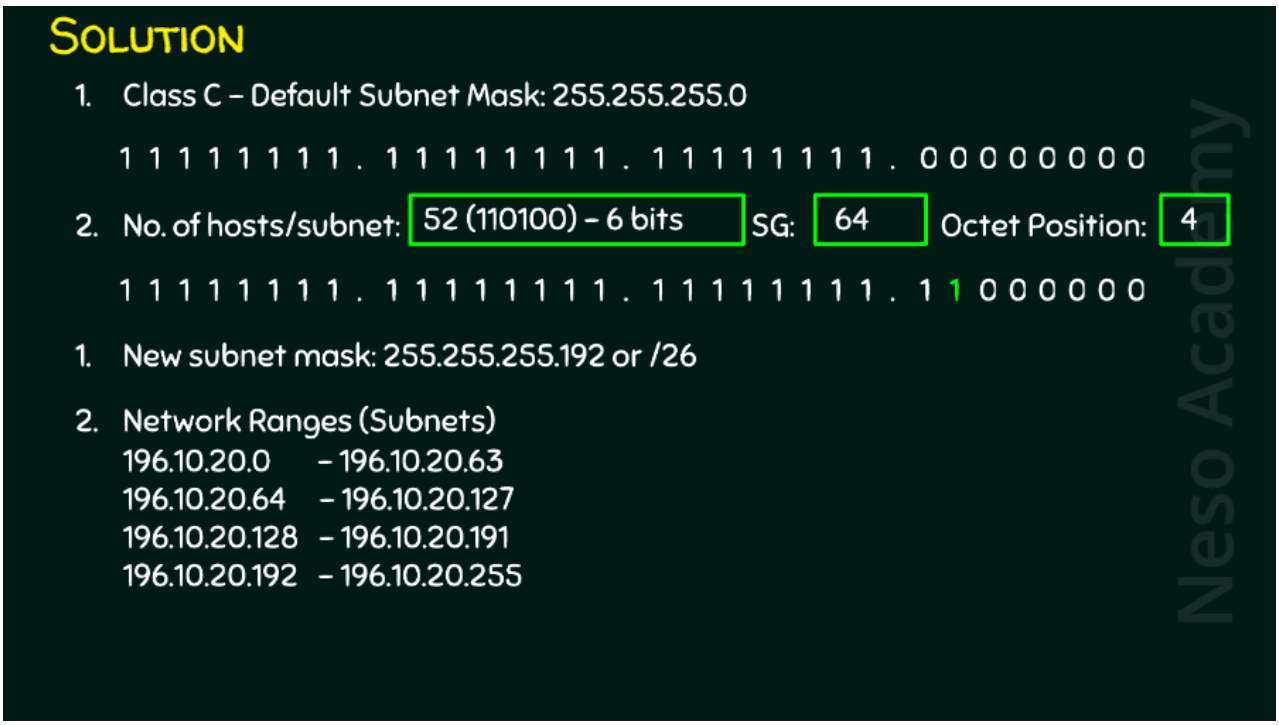
Question✓Neso Academy



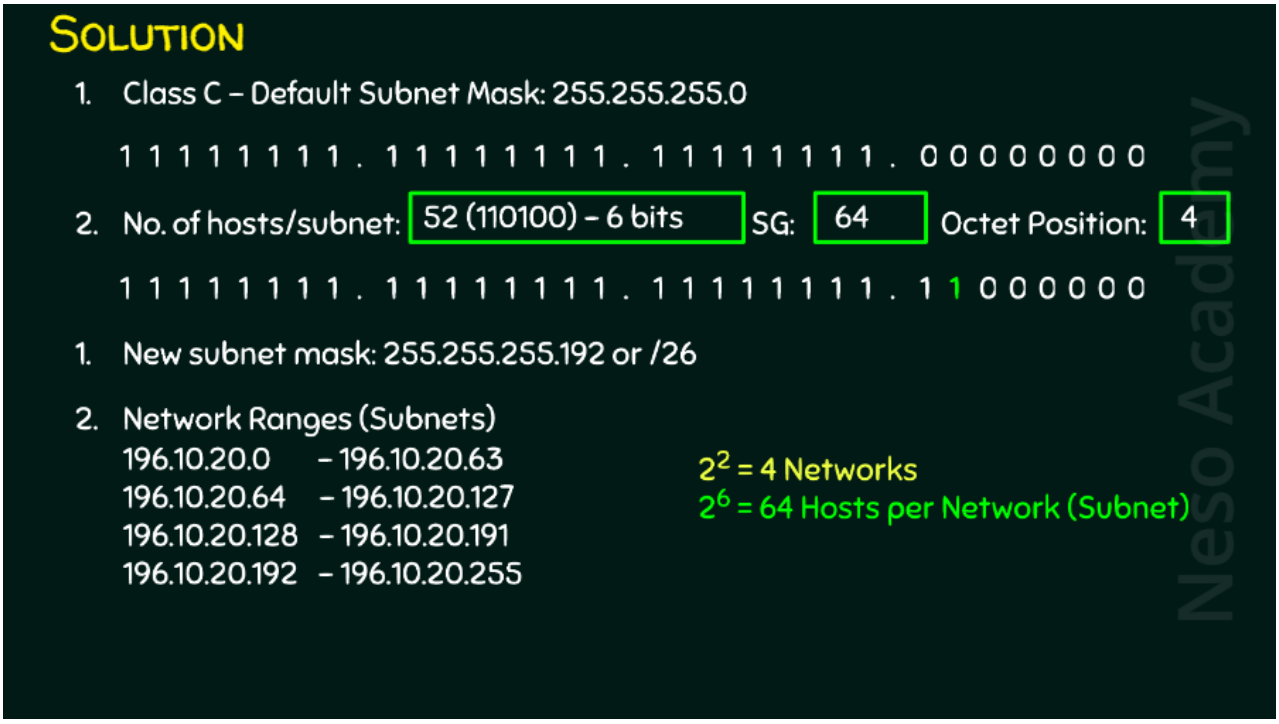
Outcomes★Neso Academy



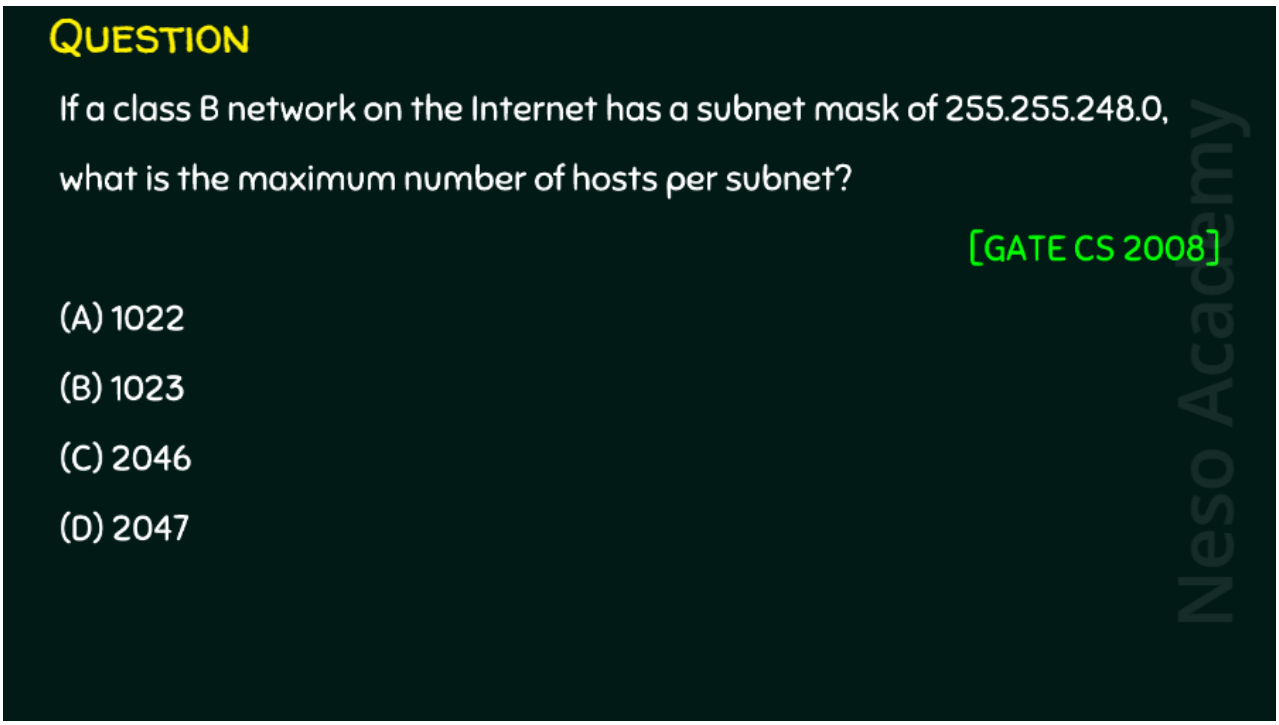
QuestionNeso Academy



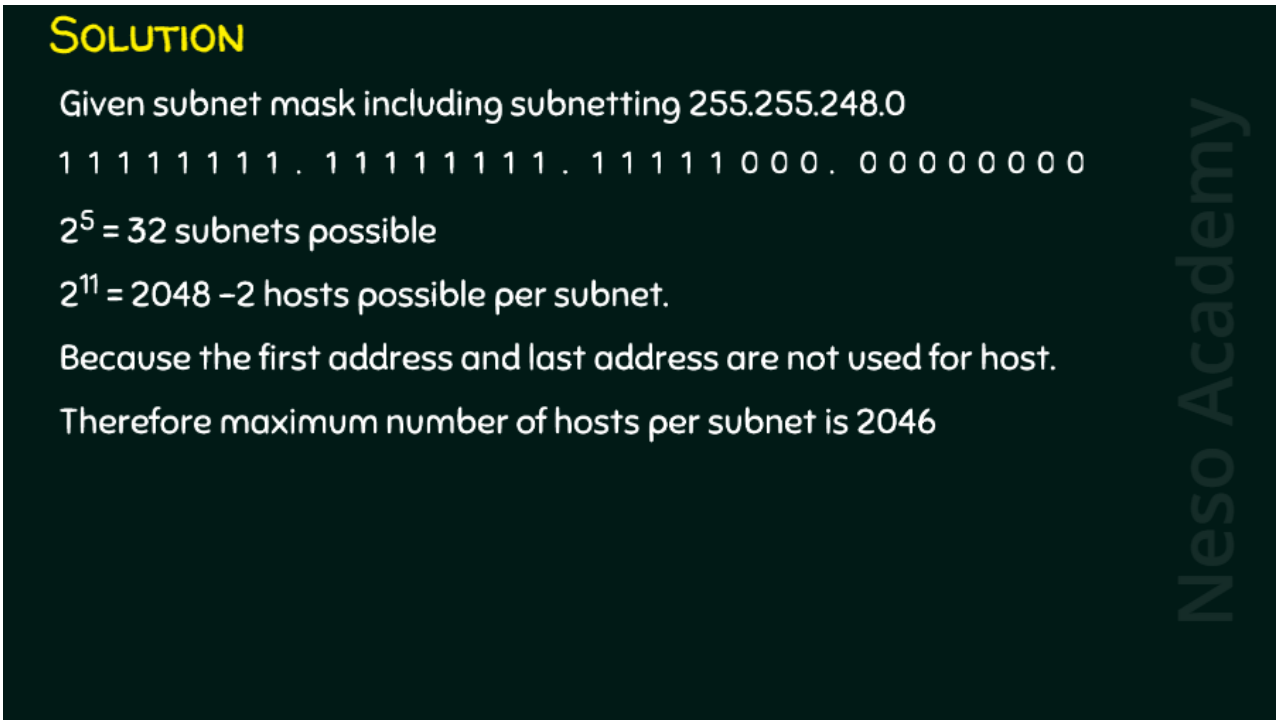
SolutionNeso Academy



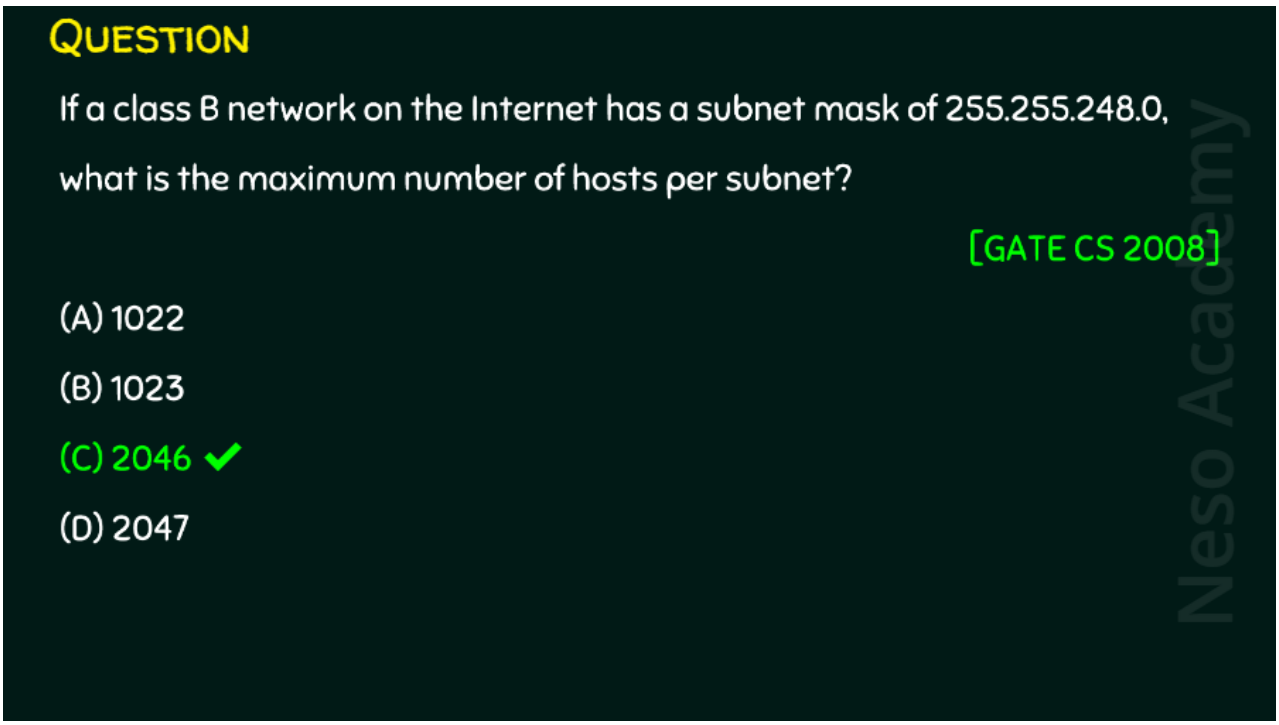
SolutionNeso Academy



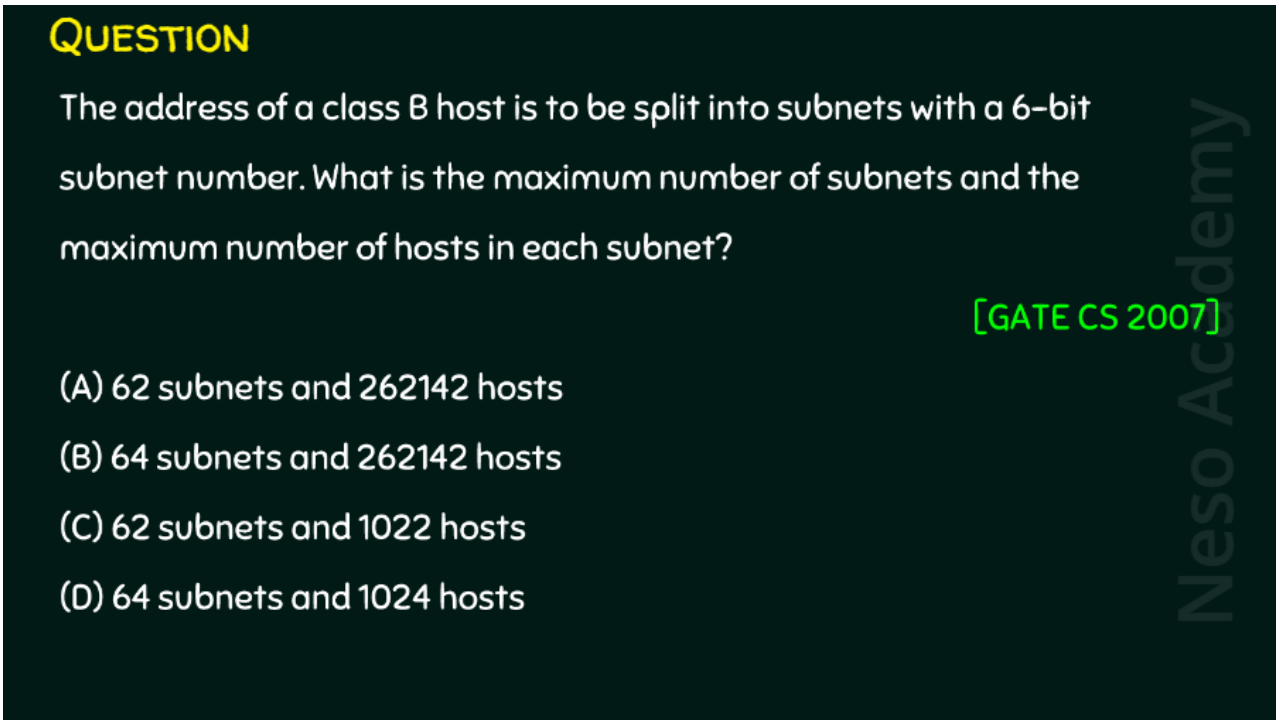
QuestionNeso Academy



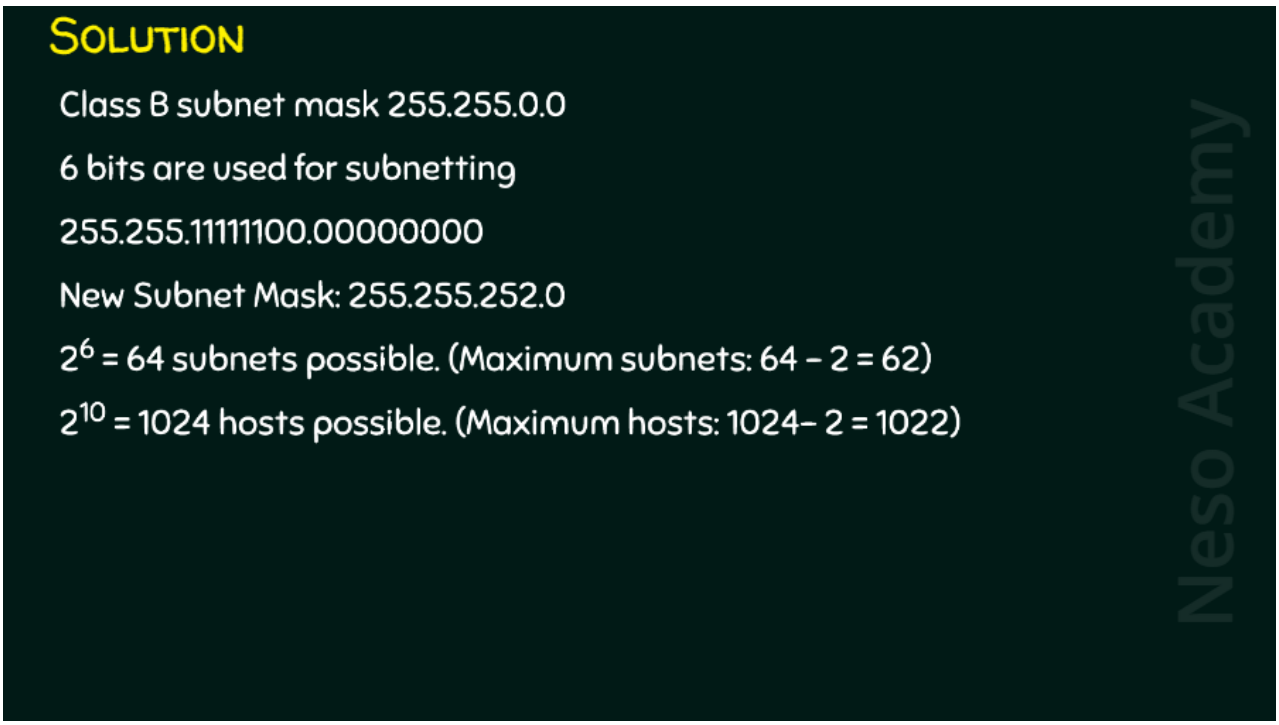
SolutionNeso Academy



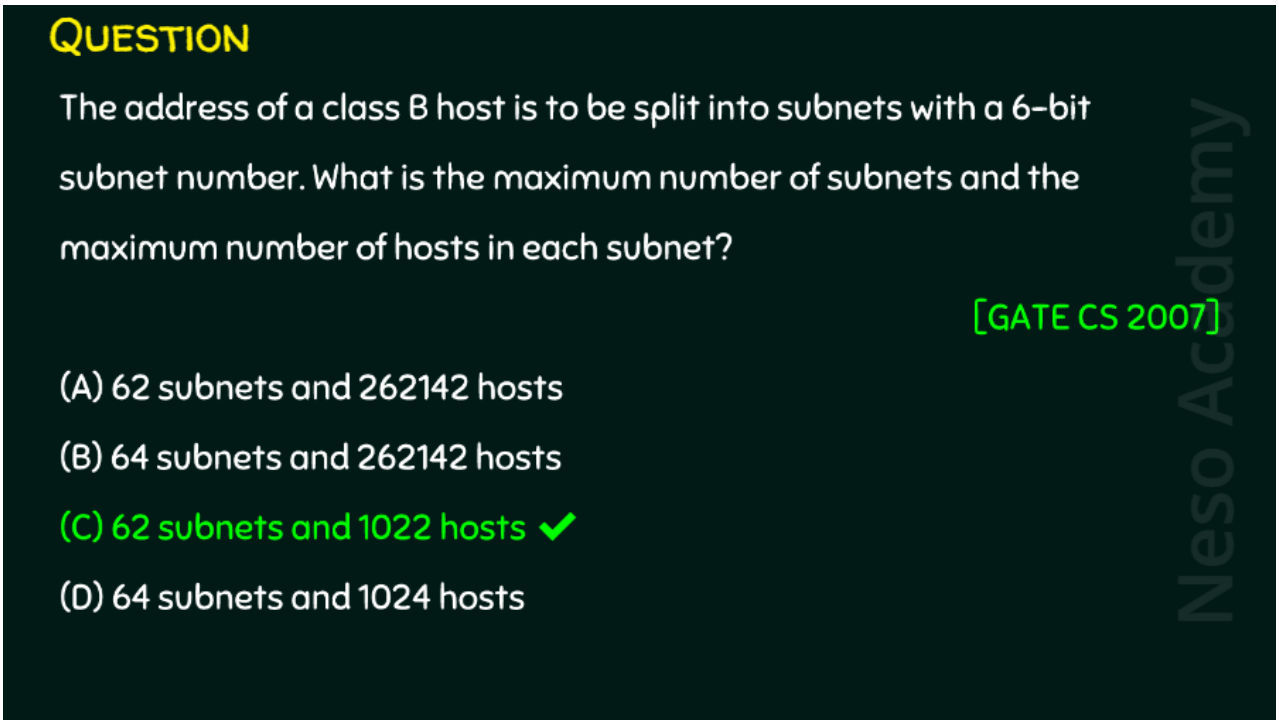
Question✓Neso Academy



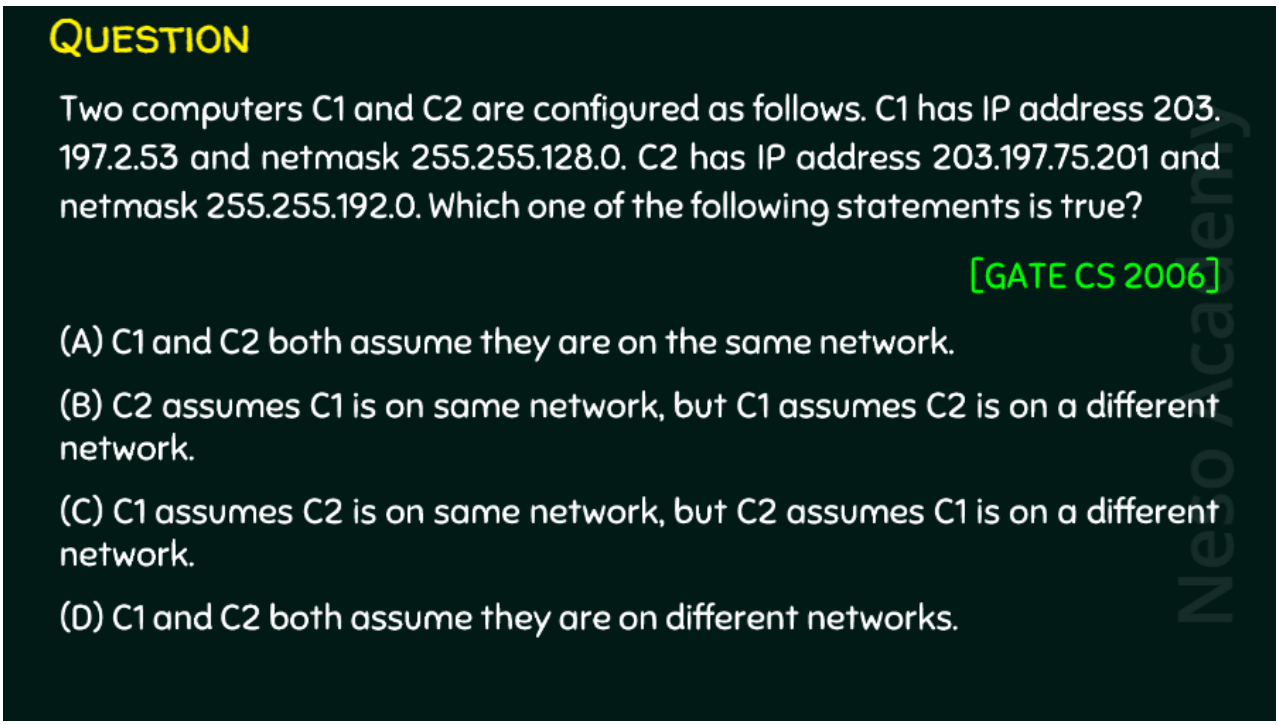
QuestionNeso Academy



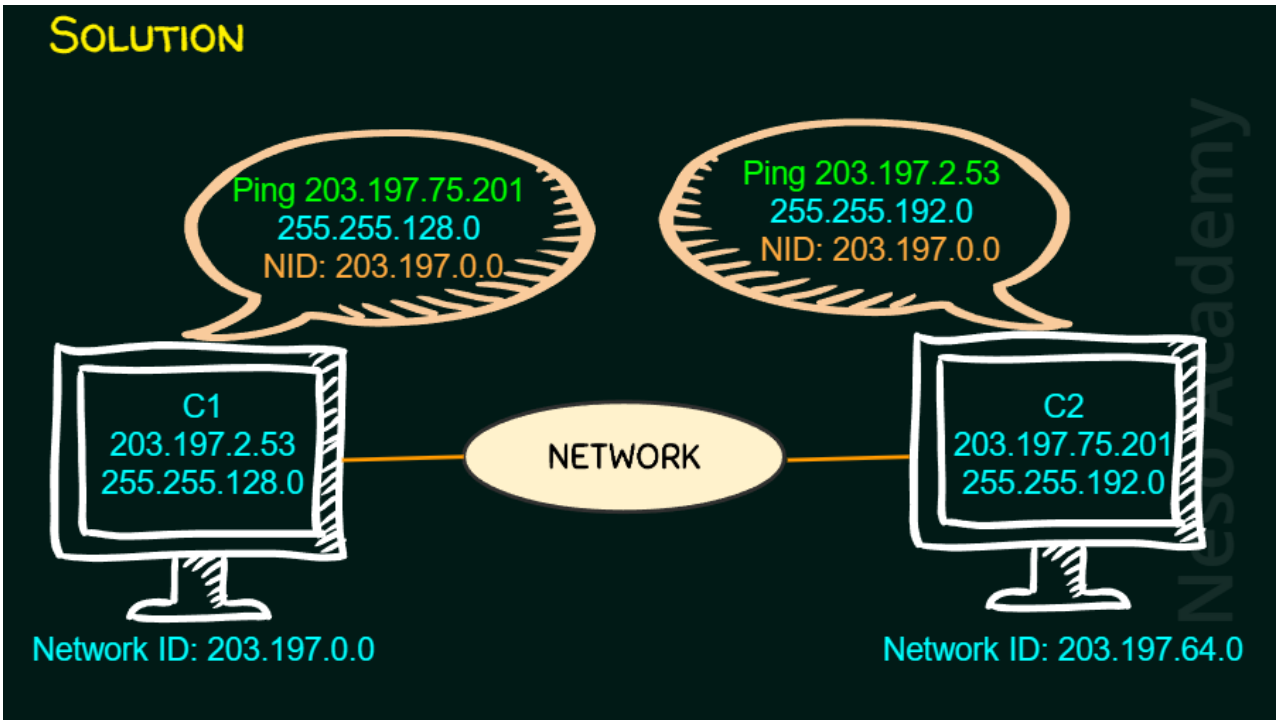
SolutionNeso Academy



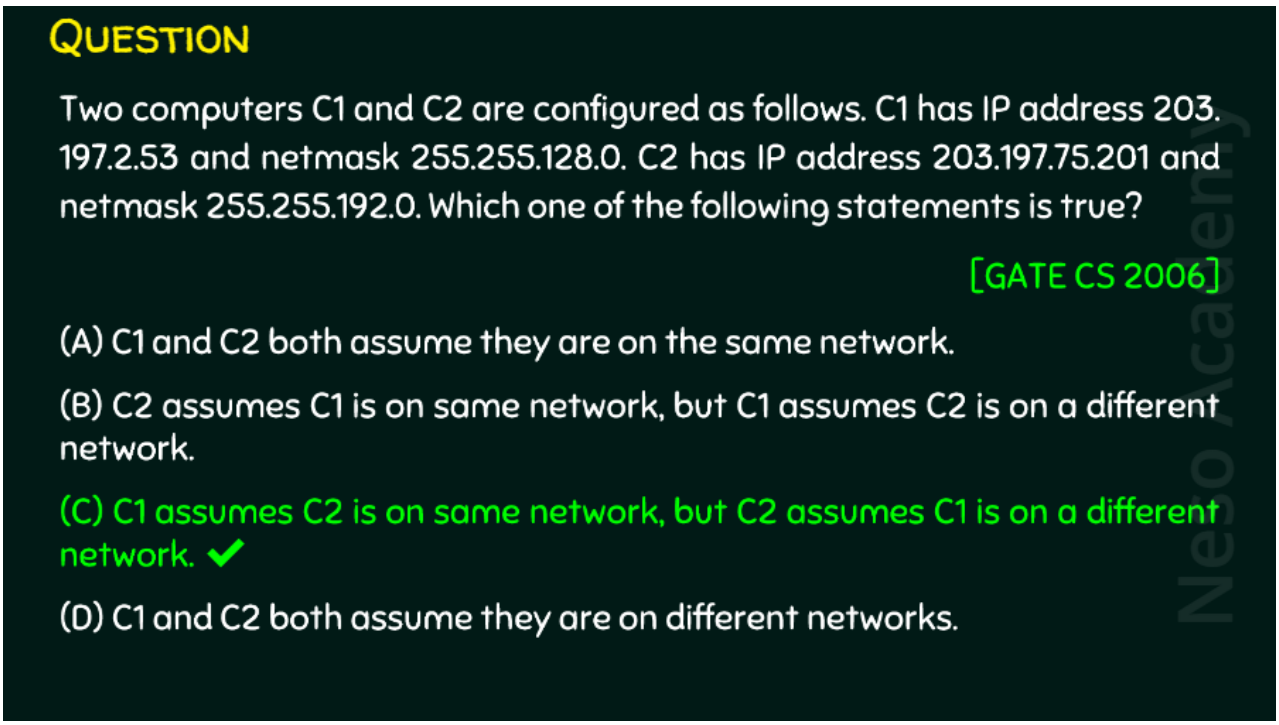
Question✓Neso Academy



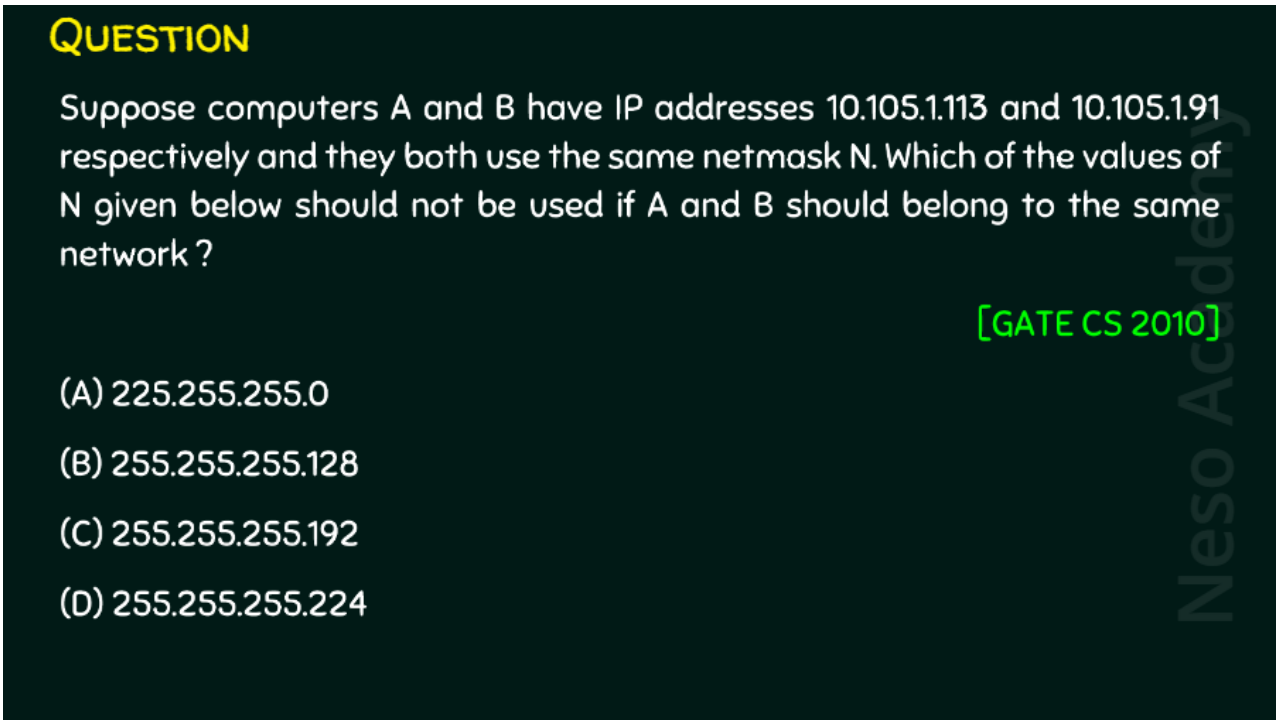
QuestionNeso Academy



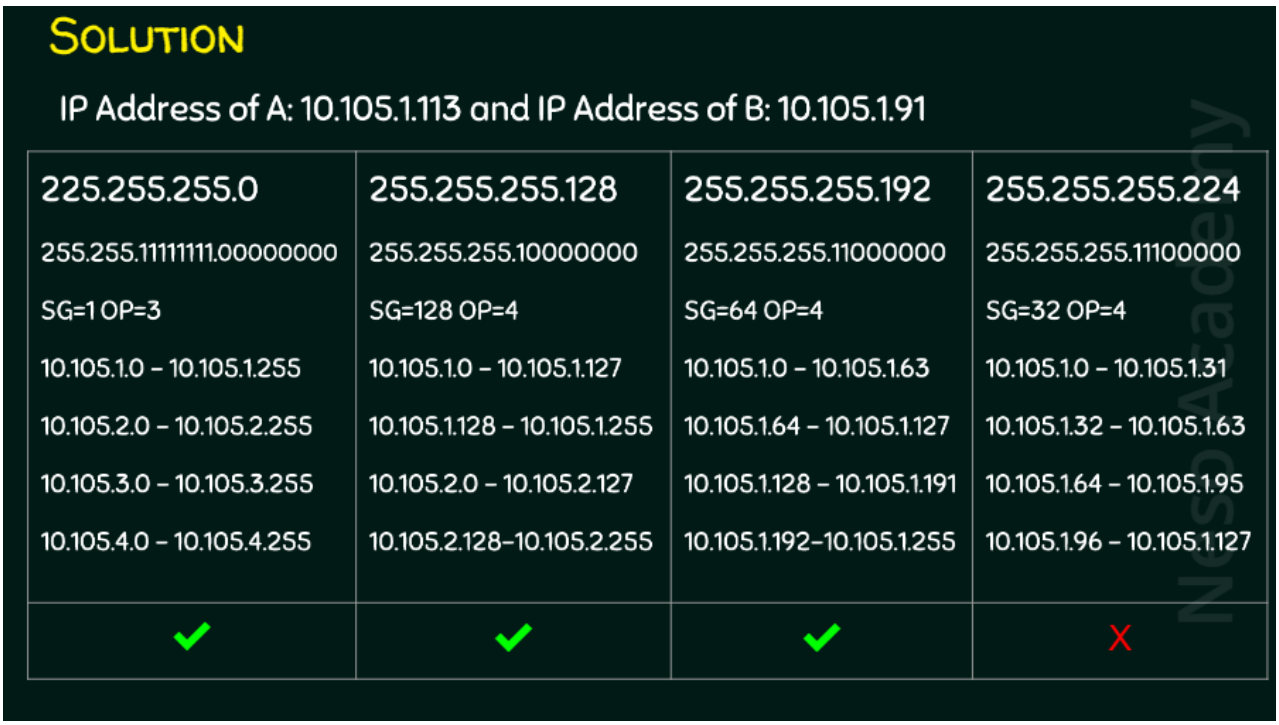
SolutionC1203.197.2.53255.255.128.0C2203.197.75.201255.255.192.0Network ID: 203.197.0.0Network ID: 203.197.64.0Ping 203.197.75.201255.255.128.0NID: 203.197.0.0Ping 203.197.2.53255.255.192.0NID: 203.197.0.0Neso Academy



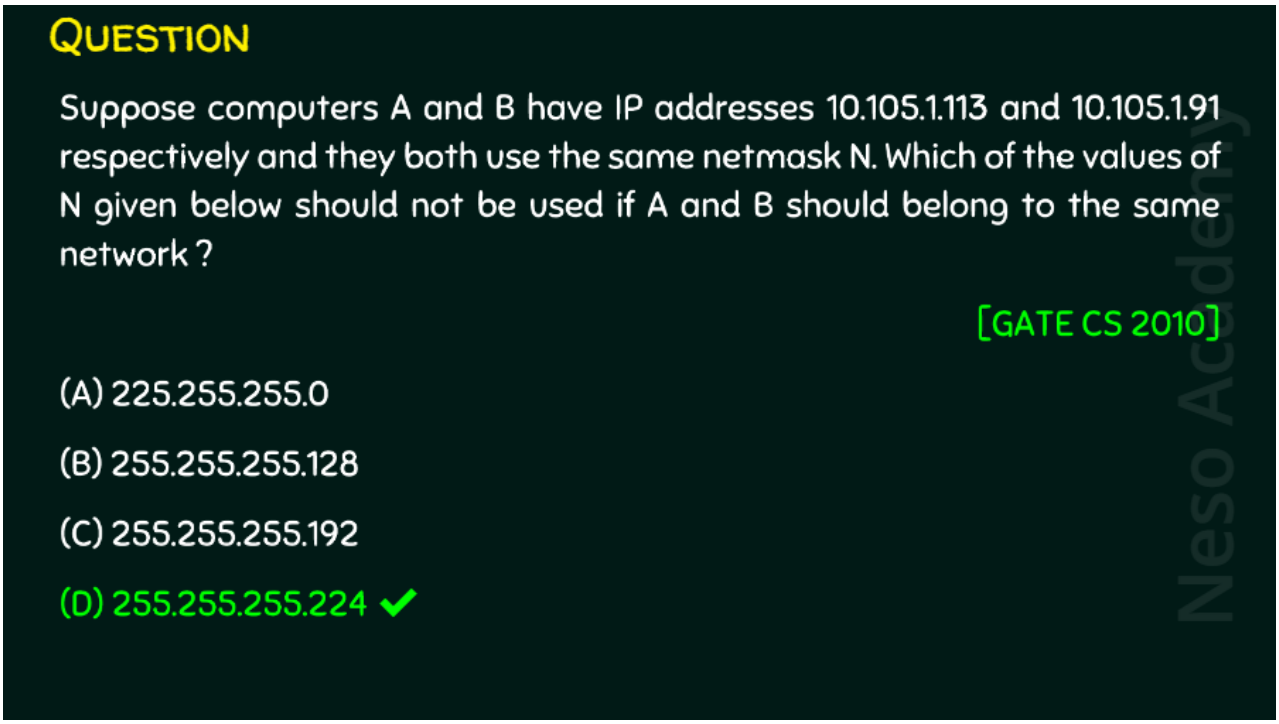
Question✓Neso Academy



QuestionNeso Academy



Solution✓✓✓XNeso Academy



Question✓Neso Academy

QUESTION

In the IPv4 addressing format, the number of networks allowed under Class C addresses is

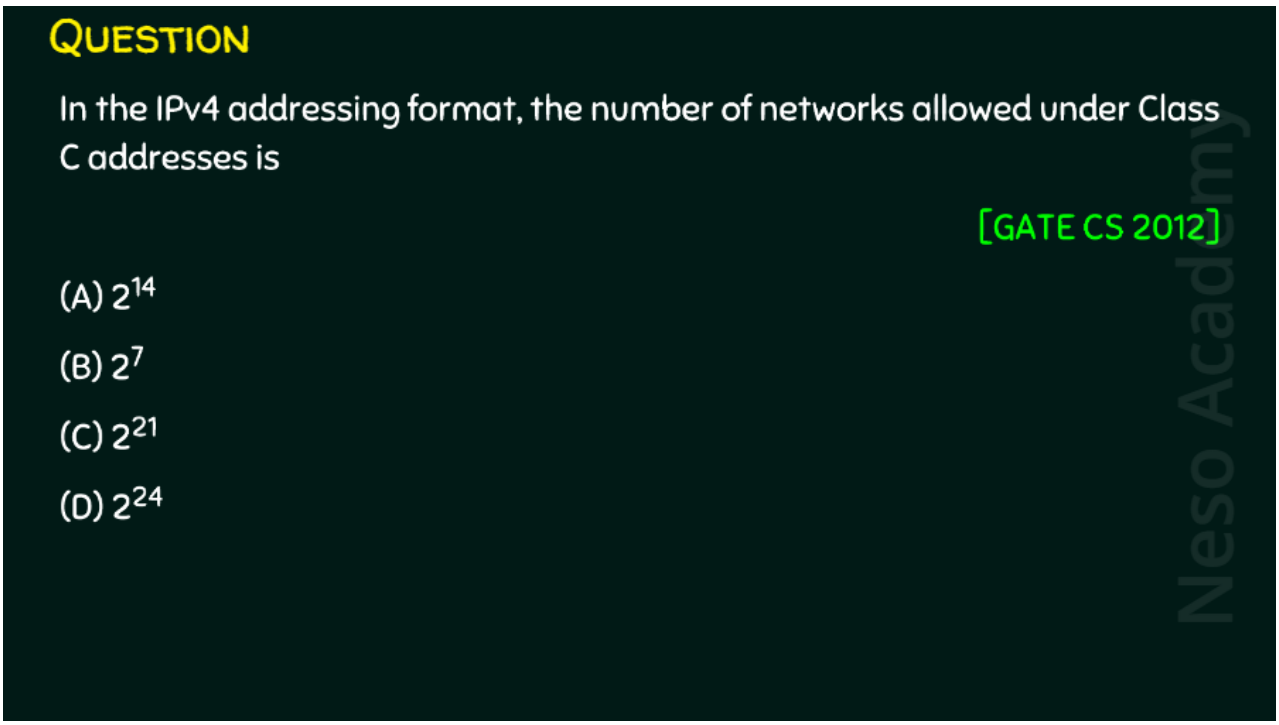
[GATE CS 2012]

(A) 2^{14}

(B) 2^{7}

(C) 2^{21}

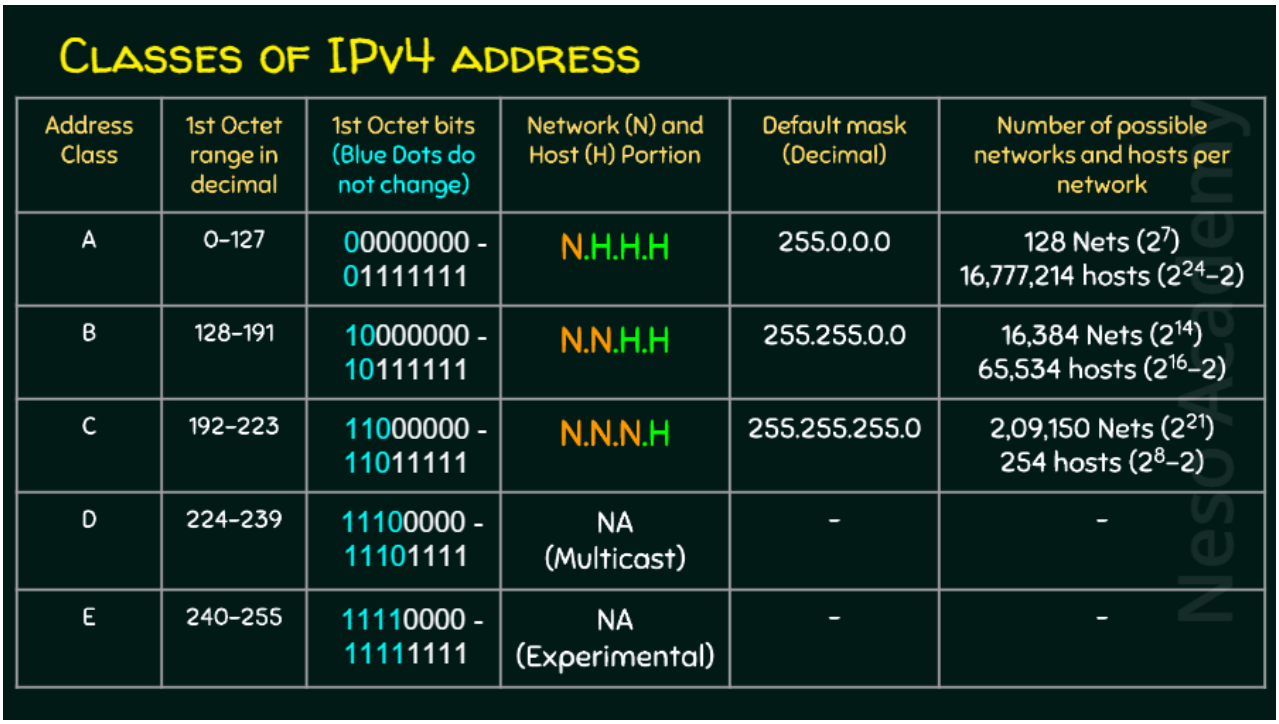
(D) 2^{24}



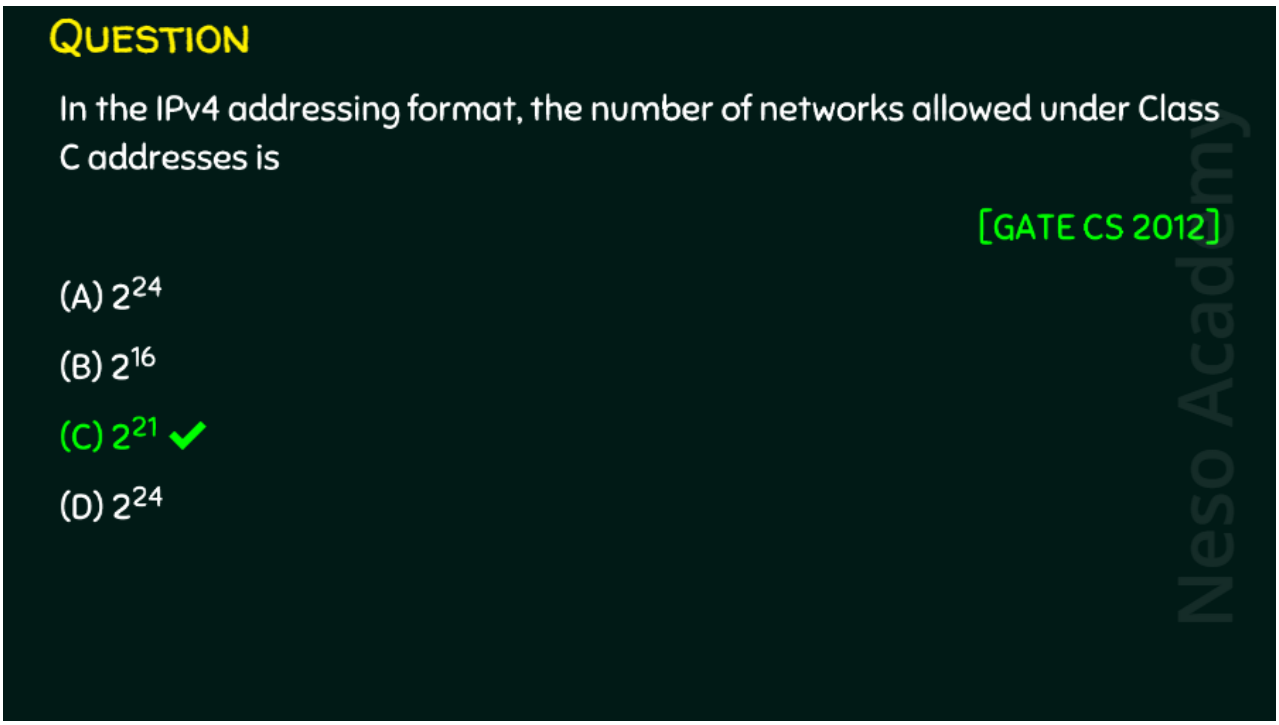
QuestionNeso Academy

CLASSES OF IPV4 ADDRESS

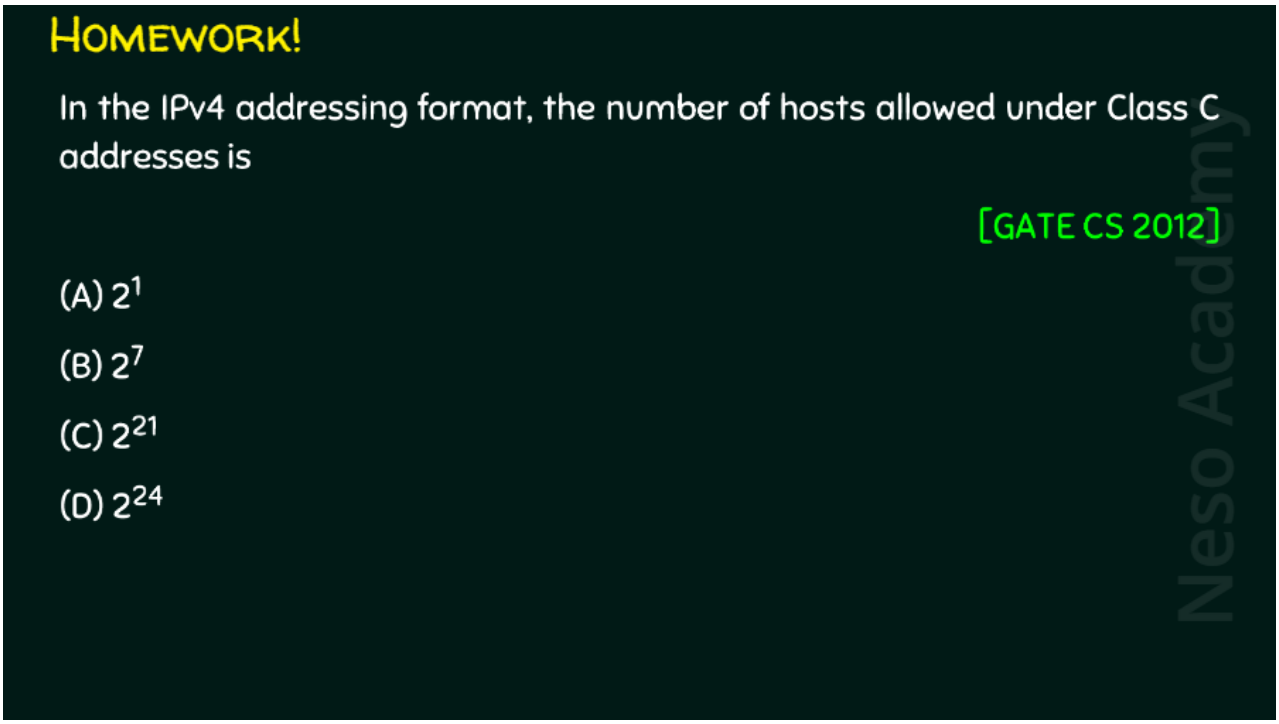
Address Class	1st Octet range in decimal	1st Octet bits (Blue Dots do not change)	Network (N) and Host (H) Portion	Default mask (Decimal)	Number of possible networks and hosts per network
A	0–127	00000000 - 01111111	N.H.H.H	255.0.0.0	128 Nets (2^7) 16,777,214 hosts (2^{24}–2)
B	128–191	10000000 - 10111111	N.N.H.H	255.255.0.0	16,384 Nets (2^{14}) 65,534 hosts (2^{16}–2)
C	192–223	11000000 - 11011111	N.N.N.H	255.255.255.0	2,09,150 Nets (2^{21}) 254 hosts (2^8–2)
D	224–239	11100000 - 11101111	NA (Multicast)	-	-
E	240–255	11110000 - 11111111	NA (Experimental)	-	-



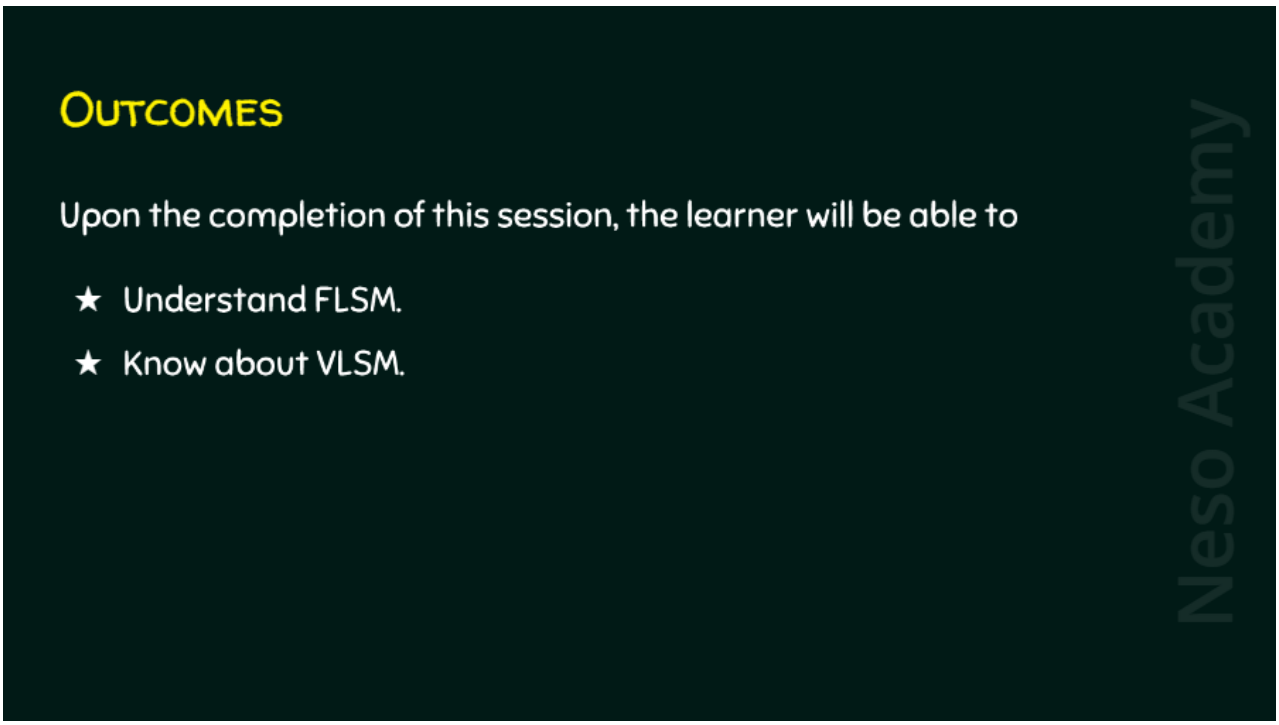
Classes of IPv4 address00000000 -0111111110000000 -1011111111000000 -1101111111100000 -1110111111110000 -11111111Neso Academy



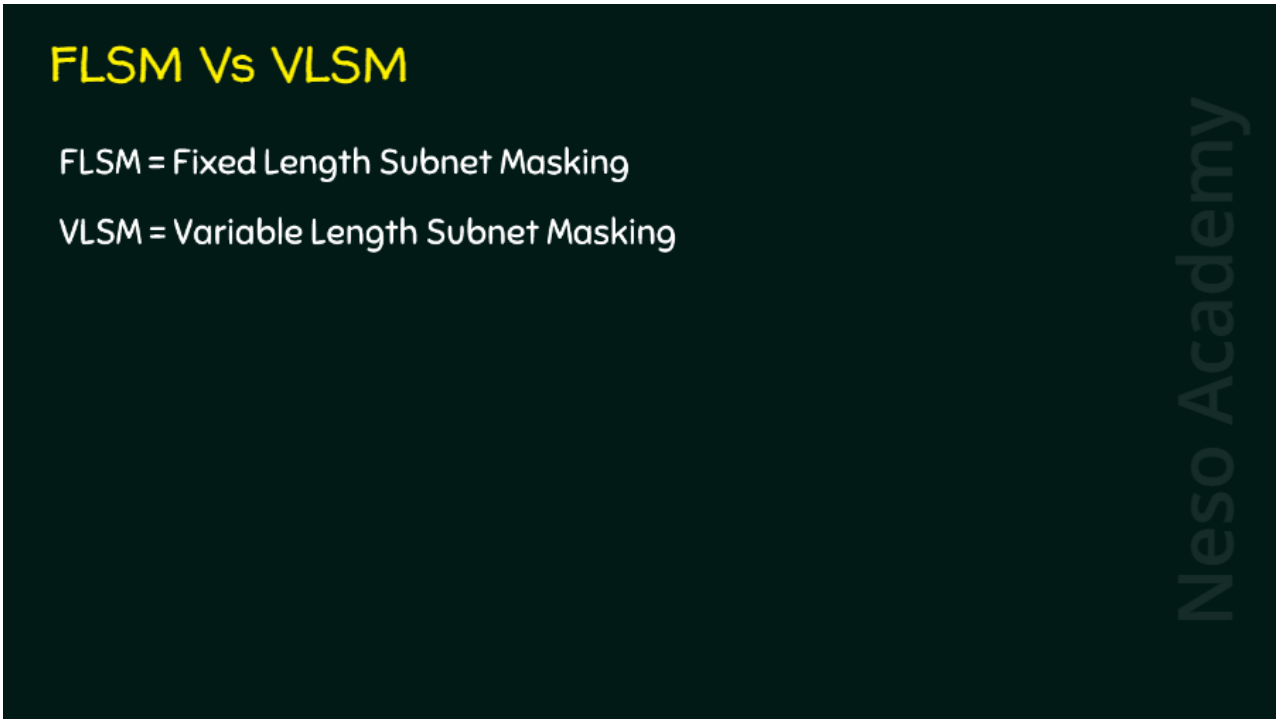
Question✓Neso Academy



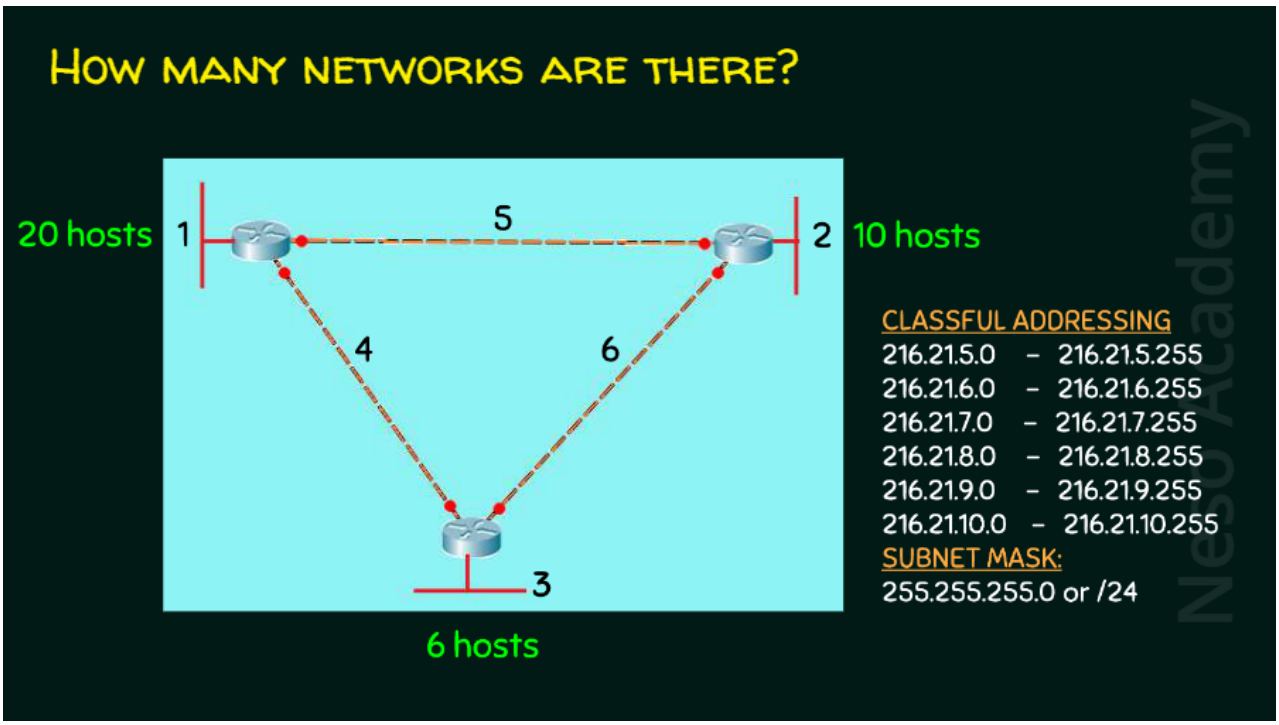
Homework!Neso Academy



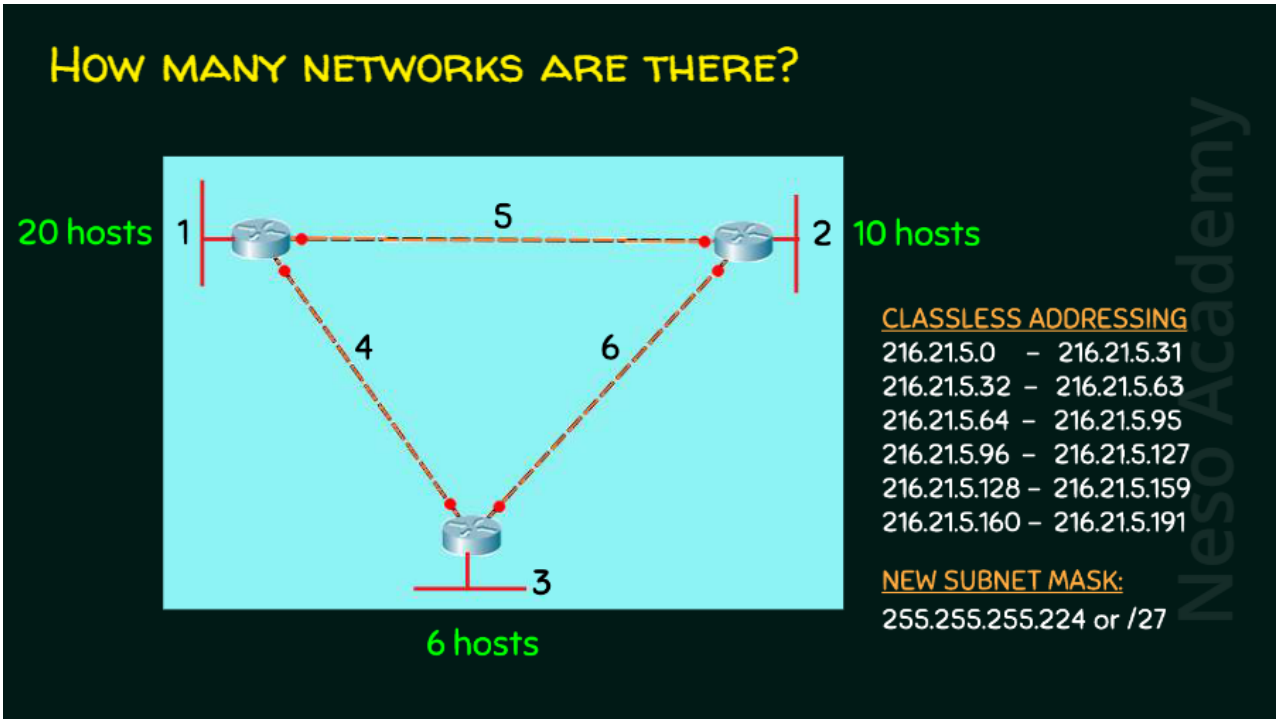
Outcomes★★Neso Academy



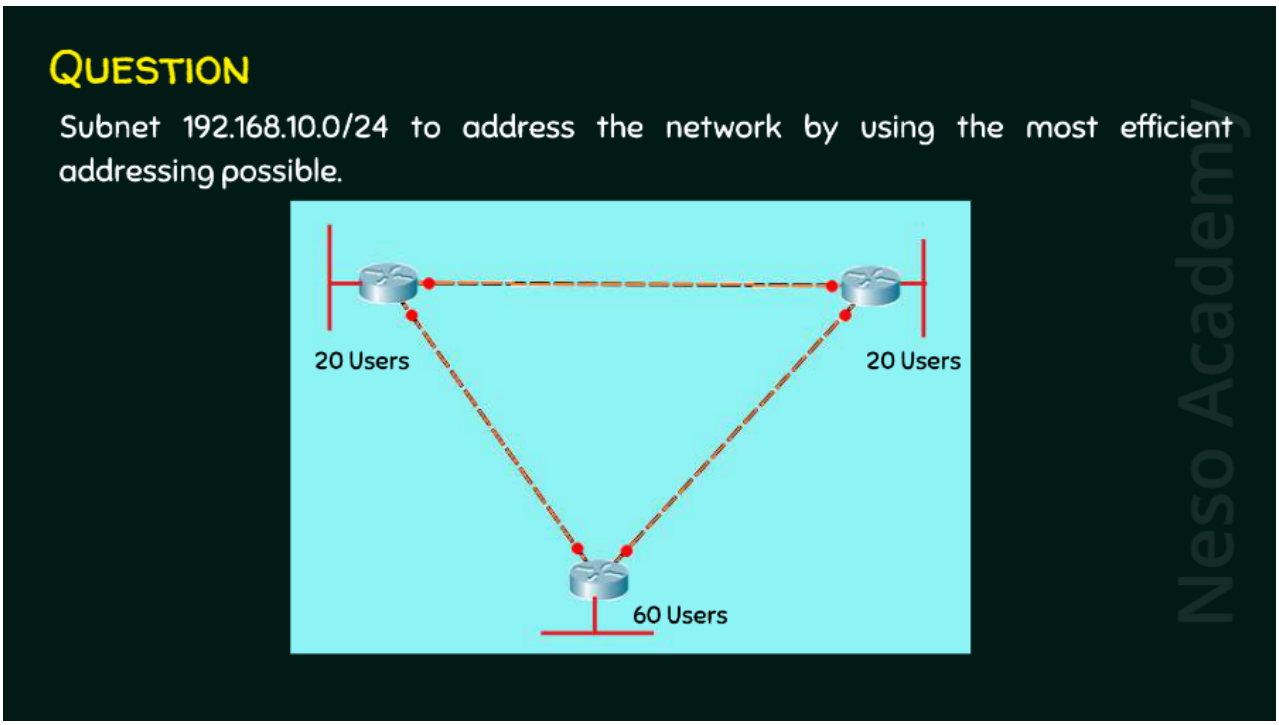
FLSM Vs VLSMNeso Academy



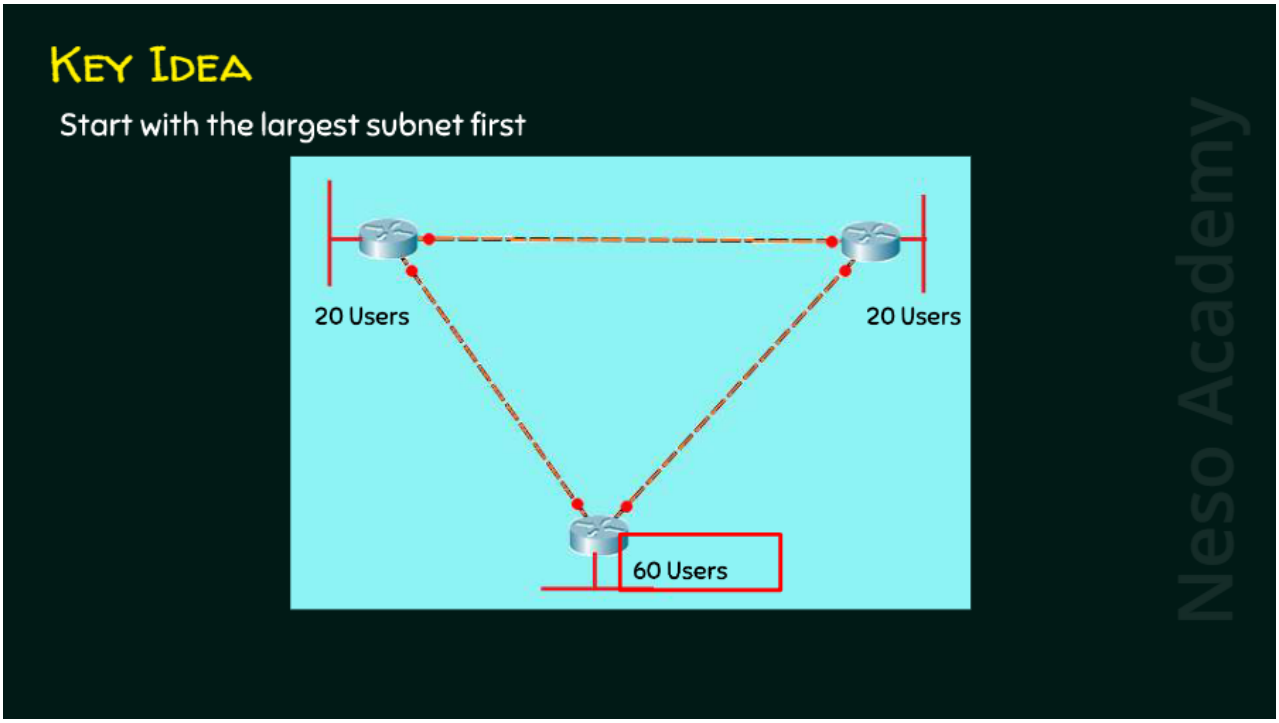
How many networks are there?Neso Academy



How many networks are there?Neso Academy



QuestionNeso Academy



Key IdeaNeso Academy

SOLUTION

1. Class C – Default Subnet Mask: 255.255.255.0

   1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 . 0 0 0 0 0 0 0 0

2. No. of hosts/subnet: 2 (10) – 2 bits SG: 4 Octet Position: 4

   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 0 0

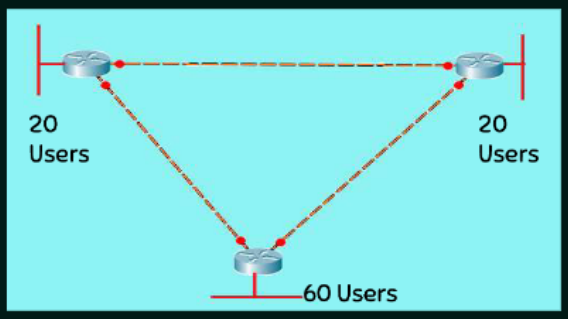
1. New subnet mask: 255.255.255.252 or /30

2. Network Ranges (Subnets)
   192.168.10.0 – 192.168.10.63 /26 (Handover this to 60 Users Network)
   192.168.10.64 – 192.168.10.95 /27 (Handover this to 20 Users Network)
   192.168.10.96 – 192.168.10.127 /27 (Handover this to another 20 Users Network)
   192.168.10.128–192.168.10.131 / 30 (Handover this to Crossover Link)
   192.168.10.132–192.168.10.135 / 30 (Handover this to Crossover Link)
   192.168.10.136 –192.168.10.139 / 30 (Handover this to Crossover Link)

SolutionNeso Academy

SOLUTION

192.168.10.0 – 192.168.10.63 /26 (Handover this to 60 Users Network)
192.168.10.64 – 192.168.10.95 /27 (Handover this to 20 Users Network)
192.168.10.96 – 192.168.10.127 /27 (Handover this to another 20 Users Network)
192.168.10.128–192.168.10.131 / 30 (Handover this to Crossover Link)
192.168.10.132–192.168.10.135 / 30 (Handover this to Crossover Link)
192.168.10.136 –192.168.10.139 / 30 (Handover this to Crossover Link)



SolutionNeso Academy

QUESTION

An Internet Service Provider (ISP) has the following chunk of CIDR-based IP addresses available with it: 245.248.128.0/20. The ISP wants to give half of this chunk of addresses to Organization A, and a quarter to Organization B, while retaining the remaining with itself. Which of the following is a valid allocation of addresses to A and B?

[GATE CS 2012]

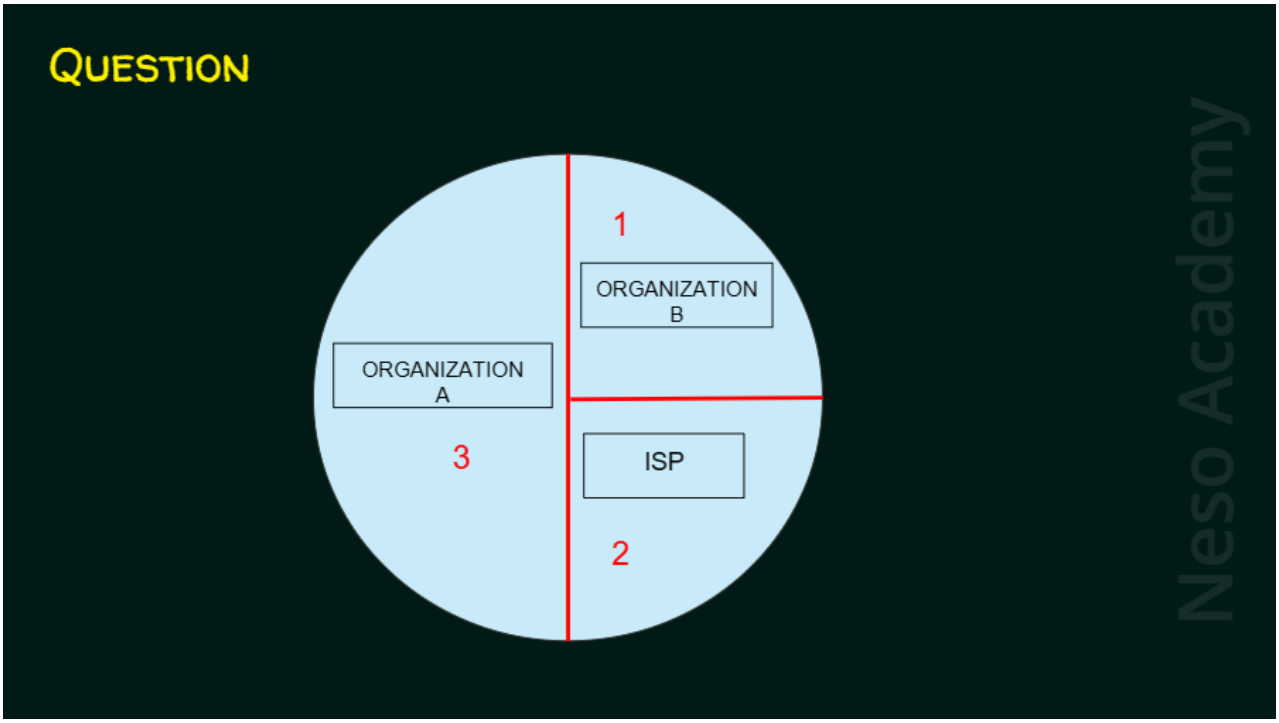
(A) 245.248.136.0/21 and 245.248.128.0/22

(B) 245.248.128.0/21 and 245.248.128.0/22

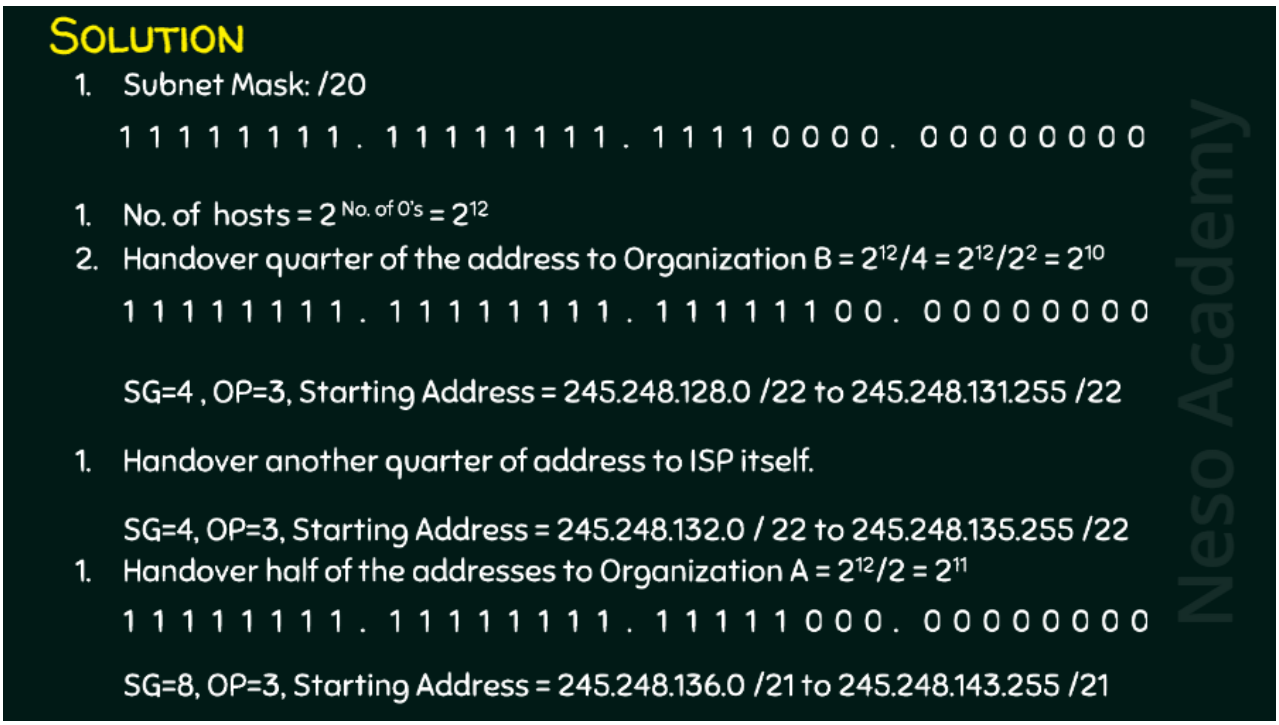
(C) 245.248.132.0/22 and 245.248.132.0/21

(D) 245.248.136.0/24 and 245.248.132.0/21

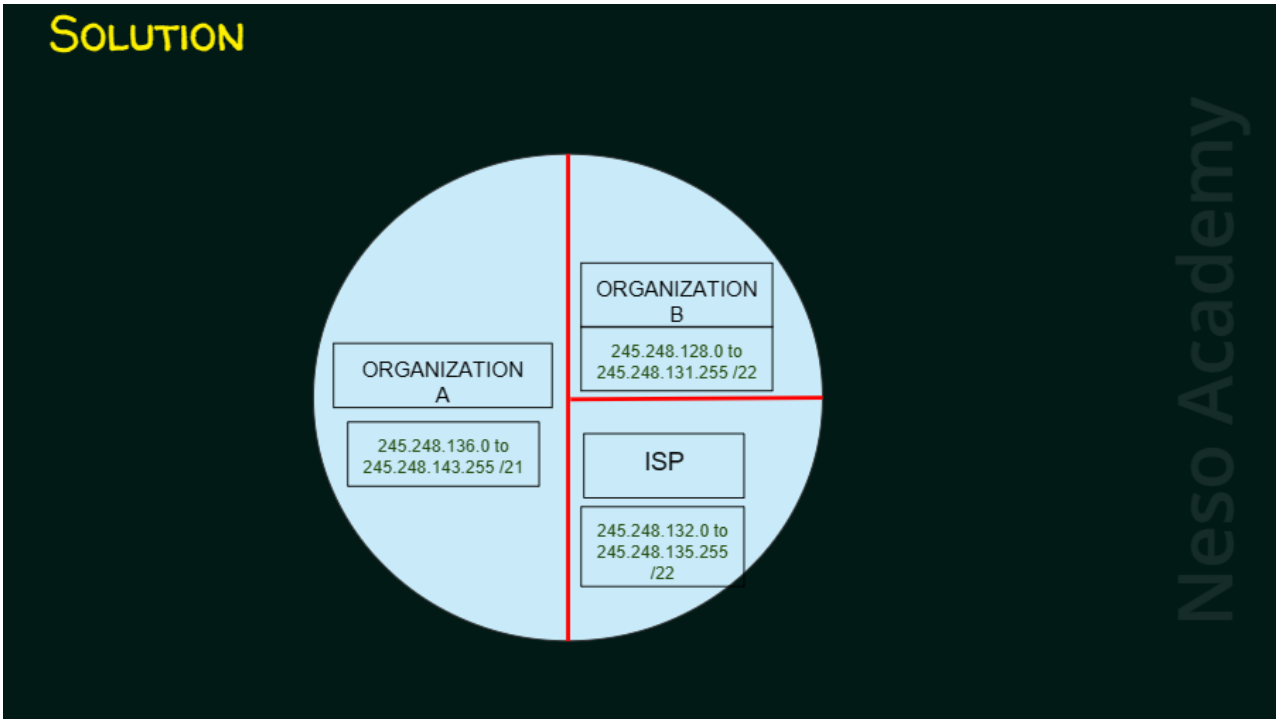
QuestionNeso Academy



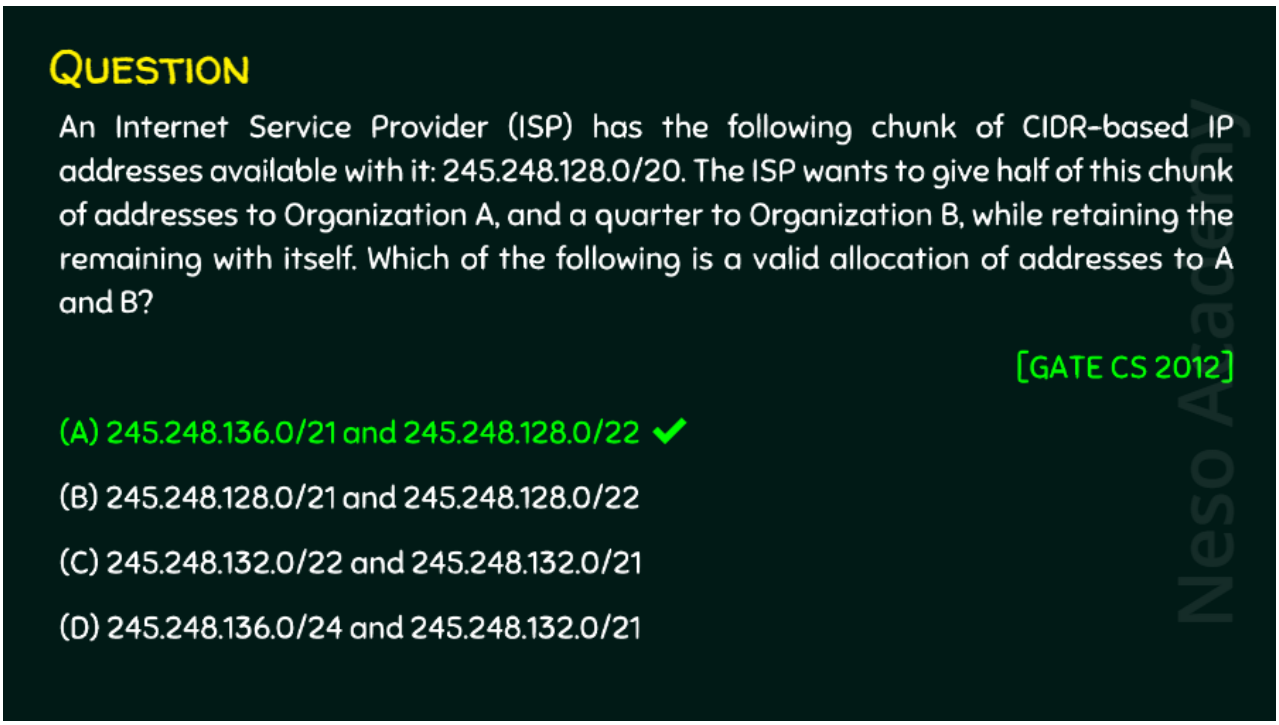
QuestionORGANIZATIONBISPORGANIZATIONA123Neso Academy



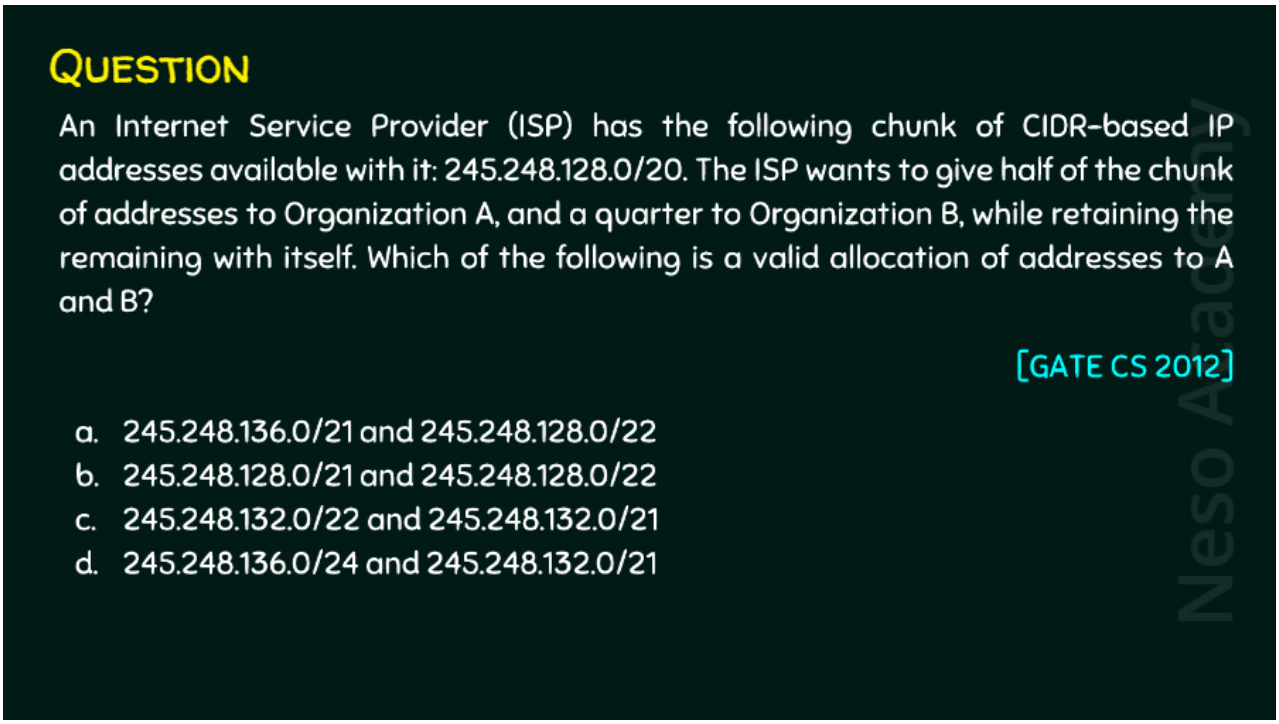
SolutionNeso Academy



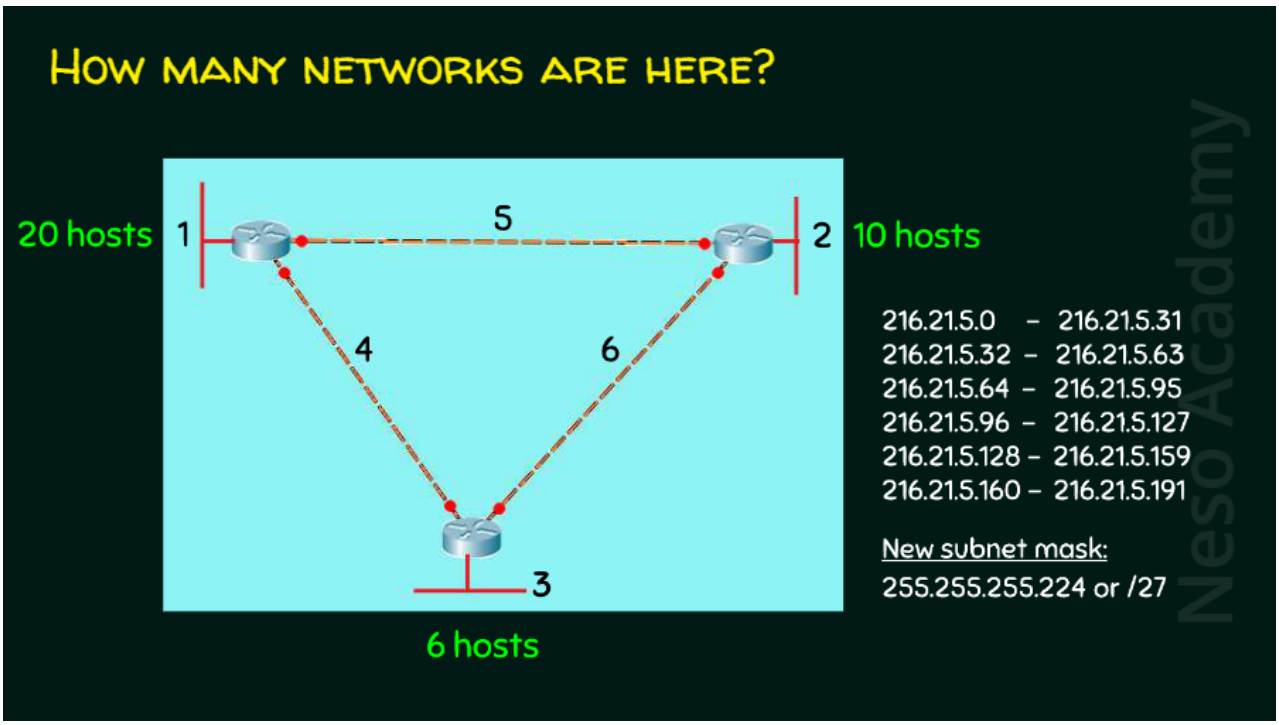
ORGANIZATIONBISPORGANIZATIONASolution245.248.128.0 to 245.248.131.255 /22245.248.132.0 to 245.248.135.255 /22245.248.136.0 to 245.248.143.255 /21Neso Academy



Question✓Neso Academy



QuestionNeso Academy



How many networks are here?Neso Academy