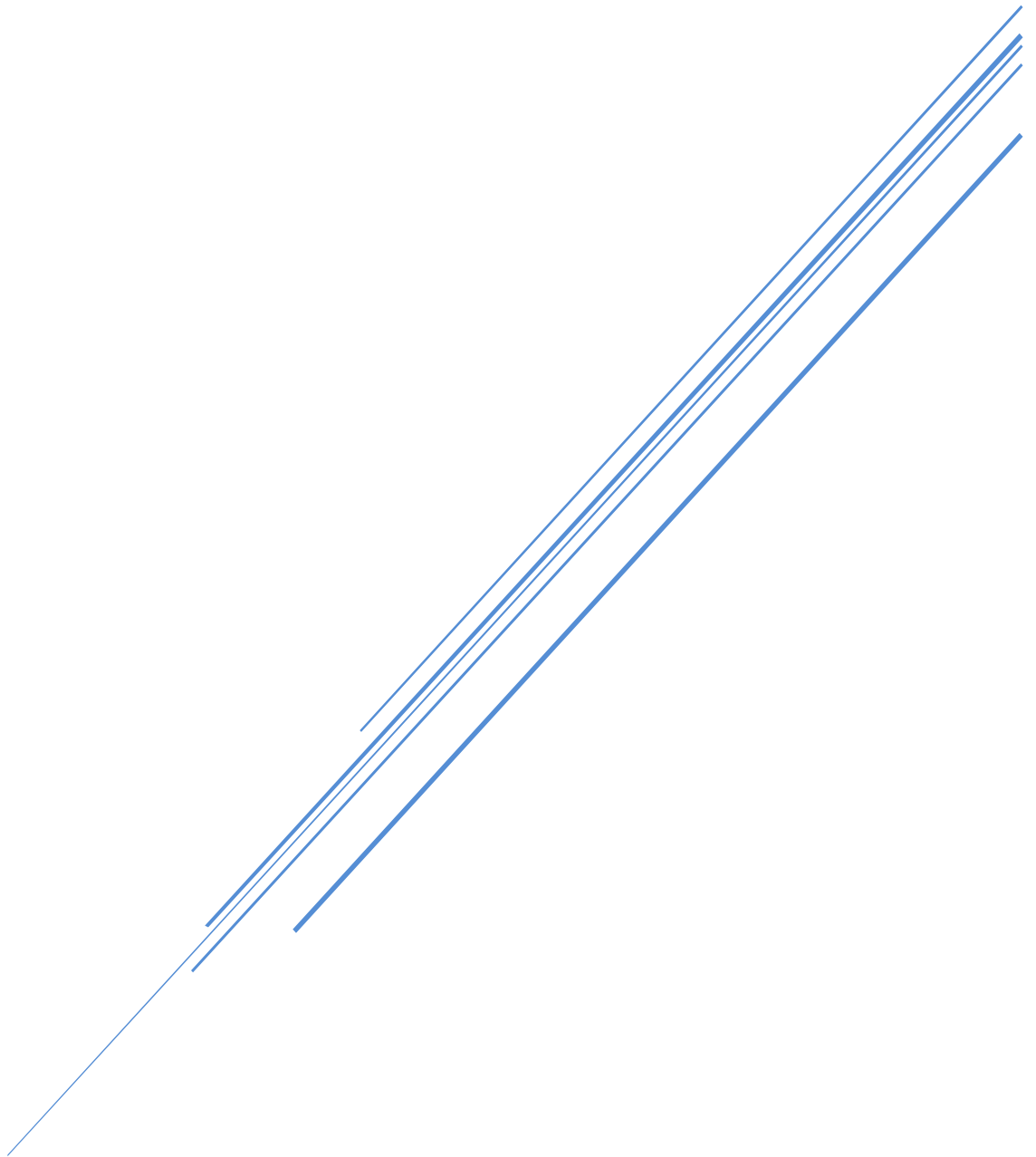


SUBNETTING EXERCISE

QUESTION ONE AND TWO



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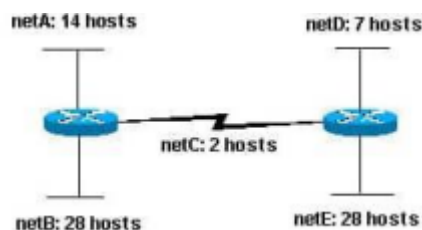
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QUESTION ONE

Complete the given subnetting exercises. First, you could start by watching the subnetting series from Practical Networking YouTube channel https://www.youtube.com/watch?v=BWZMHlhqjM&list=PLIFyRwBY_4bQUE4IB5c4VPRyDoLgOdExE

1. A company has been allocated a Class C network **192.168.5.0/24**. The physical network should be divided into 4 subnets, which will be interconnected by routers as shown in the figure below. Class C custom subnets need to be designed. Derive the subnets that would meet the requirements shown outlining the hosts per subnet, network address, first and last IP and broadcast address.



Class C network 192.168.5.0/24

Network A: 14 hosts

Network B: 28 hosts

Network C: 2 hosts

Network D: 7 hosts

Network E: 28 hosts

Subnetting table:

Hosts	256	128	64	32	16	8	4	2	1
Subnets	1	2	4	8	16	32	64	128	256
Subnet mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Number of subnet = $2^{\text{number of network borrowed bits}}$.

Number of host per subnets = $2^{\text{number of unused host bits}} - 2$

Number of host = $2^{\text{number of unused host bits}}$

Block size = $2^{\text{number of unused host bits}}$

Network A: 14 hosts

Number of subnet = $2^0 = 1$

(number of network borrowed bits = 0)

Number of host per subnets = $2^8 - 2 = 254$

(number of unused host bits = 8)

PREFIX	SUBNET MASK	BINARY	NO.OF SUBNETS	NO.OF HOST PER SUBNET
/24	255.255.255.0	11111111.11111111.11111111.0 0000000	2 ⁰ =1	2 ⁸⁻² =254
/28	255.255.255.240	11111111.11111111.11111111. 11110000	2 ⁴ =16	2 ⁴⁻² =14

Network B: 28 hosts

Number of subnet = 2⁰ = 1

(number of network borrowed bits = 3)

Number of host per subnets= 2⁵⁻² = 30

(number of unused host bits= 5)

PREFIX	SUBNET MASK	BINARY	NO.OF SUBNETS	NO.OF HOST PER SUBNET
/24	255.255.255.0	11111111.11111111.11111111.0 0000000	2 ⁰ =1	2 ⁸⁻² =254
/27	255.255.255.224	11111111.11111111.11111111. 11100000	2 ³ =8	2 ⁵⁻² =30

Network E: 28 hosts

Number of subnet = 2⁰ = 1

(number of network borrowed bits = 3)

Number of host per subnets= 2⁵⁻² = 30

(number of unused host bits= 5)

PREFIX	SUBNET MASK	BINARY	NO.OF SUBNETS	NO.OF HOST PER SUBNET
/24	255.255.255.0	11111111.11111111.11111111.0 0000000	2 ⁰ =1	2 ⁸⁻² =254
/27	255.255.255.224	11111111.11111111.11111111. 11100000	2 ³ =8	2 ⁵⁻² =30

Network A: 14 hosts

Number of subnet = 2⁴ = 16

(number of network borrowed bits = 4)

Number of host per subnets= 2⁴⁻² = 14

(number of unused host bits= 4)

PREFIX	SUBNET MASK	BINARY	NO.OF SUBNETS	NO.OF HOST PER SUBNET
/24	255.255.255.0	11111111.11111111.11111111.0 0000000	2 ⁰ =1	2 ⁸⁻² =254
/28	255.255.255.240	11111111.11111111.11111111. 11110000	2 ⁴ =16	2 ⁴⁻² =14

Network D: 7 hosts

Number of subnet = $2^5 = 32$

(number of network borrowed bits = 5)

Number of host per subnets = $2^3 - 2 = 6$

(number of unused host bits = 3)

PREFIX	SUBNET MASK	BINARY	NO.OF SUBNETS	NO.OF HOST PER SUBNET
/24	255.255.255.0	11111111.11111111.11111111.0 0000000	$2^0=1$	$2^8-2=254$
/29	255.255.255.248	11111111.11111111.11111111. 11111000	$2^5=32$	$2^3-2 = 6$

Network C: 2 hosts

Number of subnet = $2^6 = 64$

(number of network borrowed bits = 6)

Number of host per subnets = $2^2 - 2 = 2$

(number of unused host bits = 2)

PREFIX	SUBNET MASK	BINARY	NO.OF SUBNETS	NO.OF HOST PER SUBNET
/24	255.255.255.0	11111111.11111111.11111111.0 0000000	$2^0=1$	$2^8-2=254$
/30	255.255.255.252	11111111.11111111.11111111. 11111100	$2^6=64$	$2^2-2 = 2$

Full Network Subnetting Table

NETWORK	NETWORK ID	1 ST USABLE IP ADDRESS	LAST USABLE ADDRESS	BROADCAST ADDRESS	BLOCK SIZE	PREFIX	SUBNET MASK
Network B	192.168.5.0	192.168.5.1	192.168.5.14	192.168.5.31	32	/27	255.255.255.224
Network E	192.168.5.32	192.168.5.33	192.168.5.62	192.168.5.63	32	/27	255.255.255.224
Network A	192.168.5.64	192.168.5.65	192.168.5.78	192.168.5.79	16	/28	255.255.255.240
Network D	192.168.5.80	192.168.5.81	192.168.5.86	192.168.5.87	8	/29	255.255.255.248
Network C	192.168.5.88	192.168.5.89	192.168.5.94	192.168.5.95	4	/30	255.255.255.252

QUESTION TWO

For each of the following IP addresses, carry out subnetting by applying the given subnet mask and utilizing additional masking bits borrowed from the default subnet mask. Determine the number of **subnets, hosts per subnet, network address, first and last IP, broadcast address**. Create only **three subnets** for each i.e. three IP ranges only for each:

- i. 192.168.10.0/25
- ii. 192.168.10.0/28
- iii. 10.0.0.0/30
- iv. 10.0.0.0/16
- v. 172.16.0.0/30
- vi. 172.16.0.0/17

I. 192.168.10.0/25

Number of subnet = 3

Subnetting table:

Subnets	1	2	4	8	16	32	64	128	256
Hosts	256	128	64	32	16	8	4	2	1
Subnet mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Number of subnets in subnet mask * Number of subnet required or close = total number of hosts.

$$2 * 2 = 4$$

Hence;

New subnet mask = /26

Number of subnets = 4

Number of subnet = $2^{\text{number of network borrowed bits}}$.

Number of host per subnets = $2^{\text{number of unused host bits} - 2}$

Number of host = $2^{\text{number of unused host bits}}$

Number of subnet = $2^2 = 4$

(number of network borrowed bits = 2)

Number of host per subnets = $2^{6-2} = 62$

(number of unused host bits = 6)

NETWORK ID	1 ST USABLE IP ADDRESS	LAST USABLE ADDRESS	BROADCAST ADDRESS	BLOCK SIZE	PREFIX	SUBNET MASK
192.168.10.0	192.168.10.1	192.168.10.62	192.168.10.63	$2^6=64$	/26	255.255.255.192
192.168.10.64	192.168.10.65	192.168.10.126	192.168.10.127	$2^6=64$	/26	255.255.255.192
192.168.10.128	192.168.10.129	192.168.10.190	192.168.10.191	$2^6=64$	/26	255.255.255.192

II. 192.168.10.0/28

Number of subnet = 3

Subnetting table:

Subnets	1	2	4	8	16	32	64	128	256
Hosts	256	128	64	32	16	8	4	2	1
Subnet mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Number of subnets in subnet mask * Number of subnet required or close = total number of hosts.

$$16 * 4 = 64$$

Hence;

New subnet mask = /30

Number of subnets = 4

Number of subnet = $2^{\text{number of network borrowed bits}}$.

Number of host per subnets = $2^{\text{number of unused host bits} - 2}$

Number of host = $2^{\text{number of unused host bits}}$

Number of subnet = $2^2 = 4$

(number of network borrowed bits = 2)

Number of host per subnets = $2^2 - 2 = 2$

(number of unused host bits = 2)

NETWORK ID	1ST USABLE IP ADDRESS	LAST USABLE ADDRESS	BROADCAST ADDRESS	BLOCK SIZE	PREFIX	SUBNET MASK
192.168.10.0	192.168.10.1	192.168.10.2	192.168.10.3	4	/30	255.255.255.252
192.168.10.4	192.168.10.5	192.168.10.6	192.168.10.7	4	/30	255.255.255.252
192.168.10.8	192.168.10.9	192.168.10.10	192.168.10.11	4	/30	255.255.255.252

III. 10.0.0.0/30

Number of subnet = 3

Subnetting table:

Subnets	1	2	4	8	16	32	64	128	256
Hosts	256	128	64	32	16	8	4	2	1
Subnet mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Number of subnets in subnet mask * Number of subnet required or close = total number of hosts.

$$64$$

Hence;

New subnet mask = /30

Number of subnets = 4

Number of subnet = $2^{\text{number of network borrowed bits}}$.

Number of host per subnets = $2^{\text{number of unused host bits}} - 2$

Number of host = $2^{\text{number of unused host bits}}$

Number of subnet = $2^2 = 4$

(number of network borrowed bits = 2)

Number of host per subnets = $2^2 - 2 = 2$

(number of unused host bits = 2)

NETWORK ID	1 ST USABLE IP ADDRESS	LAST USABLE ADDRESS	BROADCAST ADDRESS	BLOCK SIZE	PREFIX	SUBNET MASK
10.0.0.0	10.0.0.1	10.0.0.2	10.0.0.3	4	/30	255.255.255.252
10.0.0.4	10.0.0.5	10.0.0.6	10.0.0.7	4	/30	255.255.255.252
10.0.0.8	10.0.0.9	10.0.0.10	10.0.0.11	4	/30	255.255.255.252

IV. 10.0.0.0/16

Number of subnet = 3

Subnetting table:

Subnets	1	2	4	8	16	32	64	128	256	512	1024	2048	4096	8192	16384	32768
Hosts	65536	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2
Subnet mask	/16	/17	/18	/19	/20	/21	/22	/23	/24	/25	/26	/27	/28	/29	/30	/31

Number of subnets in subnet mask * Number of subnet required or close = total number of hosts.

$2 * 2 = 4$

Hence;

New subnet mask = /18

Number of subnets = 4

Number of subnet = $2^{\text{number of network borrowed bits}}$.

Number of host per subnets = $2^{\text{number of unused host bits}} - 2$

Number of host = $2^{\text{number of unused host bits}}$

Number of subnet = $2^2 = 4$

Number of host per subnets= $65536 - 2 = 65534$

NETWORK ID	1 ST USABLE IP ADDRESS	LAST USABLE ADDRESS	BROADCAST ADDRESS	PREFIX	SUBNET MASK
10.0.0.0	10.0.0.1	10.0.255.254	10.0.255.255	/18	255.255..192.0
10.1.0.0	10.1.0.1	10.1.255.254	10.1.255.255	/18	255.255..192.0
10.2.0.0	10.2.0.1	10.2.255.254	10.2.255.255	/18	255.255..192.0

V. 172.16.0.0/30

Number of subnet = 3

Subnetting table:

Subnets	1	2	4	8	16	32	64	128	256
Hosts	256	128	64	32	16	8	4	2	1
Subnet mask	/24	/25	/26	/27	/28	/29	/30	/31	/32

Number of subnets in subnet mask * Number of subnet required or close = total number of hosts.

64

Hence;

New subnet mask = /30

Number of subnets = 4

Number of subnet = $2^{\text{number of network borrowed bits}}$.

Number of host per subnets= $2^{\text{number of unused host bits}} - 2$

Number of host = $2^{\text{number of unused host bits}}$

Number of subnet = $2^2 = 4$

(number of network borrowed bits = 2)

Number of host per subnets= $2^2 - 2 = 2$

(number of unused host bits= 2)

NETWORK ID	1 ST USABLE IP ADDRESS	LAST USABLE ADDRESS	BROADCAST ADDRESS	BLOCK SIZE	PREFIX
172.16.0.0	172.16.0.1	172.16.0.2	172.16.0.3	4	/30
172.16.0.4	172.16.0.5	172.16.0.6	172.16.0.7	4	/30
172.16.0.8	172.16.0.9	172.16.0.10	172.16.0.11	4	/30

VI. 172.16.0.0/17

Number of subnet = 3

Subnetting table:

Subnets	1	2	4	8	16	32	64	128	256	512	1024	2048	4096	8192	16384	32768
Hosts	65536	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2
Subnet mask	/16	/17	/18	/19	/20	/21	/22	/23	/24	/25	/26	/27	/28	/29	/30	/31

Number of subnets in subnet mask * Number of subnet required or close = total number of hosts.

$$2 * 2 = 4$$

Hence;

New subnet mask = /18

Number of subnets = 4

Number of subnet = $2^{\text{number of network borrowed bits}}$.

Number of host per subnets = $2^{\text{number of unused host bits}} - 2$

Number of host = $2^{\text{number of unused host bits}}$

Number of subnet = $2^2 = 4$

Number of host per subnets = $32768 - 2 = 32766$

NETWORK ID	1 ST USABLE IP ADDRESS	LAST USABLE ADDRESS	BROADCAST ADDRESS	PREFIX	SUBNET MASK
172.16.0.0	172.16.0.1	172.16.63.254	172.16.63.255	/18	255.255..192.0
172.16.64.0	172.16.64.1	172.16.127.254	172.16.127.255	/18	255.255..192.0
172.16.128.0	172.16.128.1	172.16.191.254	172.16.191.255	/18	255.255..192.0