

**Department of Computer Systems Engineering  
Mehran University of Engineering and Technology, Jamshoro**

**Course: Computer Communication and Network(CS-403)**

<b>Instructor</b>	Engr. Unzela Talpur	<b>Assignment Type</b>	Complex Engineering Problem
<b>Semester</b>	7 <sup>th</sup>	<b>Year</b>	4 <sup>nd</sup>
<b>Submission Deadline</b>	13-04-2024	<b>Assessment Score</b>	10

**Complex Engineering Problem - Characteristics**

1	Depth of knowledge Required	<input checked="" type="checkbox"/>
2	Range of Conflicting Requirements	<input type="checkbox"/>
3	Depth of Analysis Required	<input checked="" type="checkbox"/>
4	Infrequently Encountered Issues Involved	<input checked="" type="checkbox"/>
5	Beyond codes/standards of practice	<input type="checkbox"/>
6	Diverse groups of stakeholders with widely varying needs involved	<input type="checkbox"/>
7	Interdependence (high-level problems including many component parts/sub-problems)	<input checked="" type="checkbox"/>
8	Have significant consequences in a range of contexts	<input checked="" type="checkbox"/>
9	Judgment (Require judgment in decision making)	<input checked="" type="checkbox"/>

**Problem Description**

- You are working as an IP network engineer in an organization with a single network having the IP address range 192.168.x.0/24, where 'x' should be replaced by your roll number. The task is to divide this network into 8 equal subnets. Determine the following IP address information for each subnet.
  - ✓ Subnet ID with CIDR notation: What is the subnet ID for each subnet with CIDR notation?
  - ✓ Broadcast address: What is the broadcast address for each subnet?
  - ✓ Total number of IP addresses: How many IP addresses are there in each subnet?
  - ✓ Range of IP addresses: What is the range of IP addresses for each subnet?
  - ✓ Total number of hosts: How many hosts are there in each subnet?
  - ✓ First and last usable IP addresses for each subnet: What are the first and last usable IP addresses for each subnet?

**Justify your calculations by explaining the following terms and concepts:**

- ✓ Subnet ID
- ✓ What is the concept of Borrowing bits from the host portion
- ✓ Broadcast address
- ✓ Total number of IP addresses
- ✓ Range of IP addresses
- ✓ Total number of hosts
- ✓ First and last usable IP addresses for each subnet

Instructions:

**Provide your calculations and answers in a clear and organized manner. This CEP must be handwritten to be accepted.**

Roll No. 20CS067

For Roll No. 67, the given ip address

range will be

$\therefore 192.168.67.0/24$

1) Submit IP with CIDR notation:-

Since we are dividing the networks

into 8 equal Subnet 3 bits will be  
borrowed from host for subnetting ( $2^3 = 8$ ),

So the CIDR notation for each Subnet

will be  $27$  ( $24 + 3 = 27$ ).

Subnet ID for Each Subnet:-

The Subnet ID for the network address

for Subnet, where all host bits are set  
to zero. <sup>address</sup> the lowest bit of the

Subnet is  $192.168.67.0$ .

To find the Subnet ID of each Subnet

Set the host bit to zero & increment

offset 3 bit by 1.

- \* Subnet 1: 192.168.67. 0/27 (00000000)
- \* Subnet 2: 192.168.67. 32/27 (00100000)
- \* Subnet 3: 192.168.67. 64/27 (01000000)
- \* Subnet 4: 192.168.67. 96/27 (01100000)
- \* Subnet 5: 192.168.67. 128/27 (10000000)
- \* Subnet 6: 192.168.67. 160/27 (10100000)
- \* Subnet 7: 192.168.67. 196/27 (11000000)
- \* Subnet 8: 192.168.67. 224/27 (11100000)

## 2. Broadcast address:-

The Broadcast address is the highest address in each subnet.

with host all bits set to 1.

-, Broadcast address for each Subnet:-

- \* Subnet 1: 192.168.67. 32/27 (In all binary all host bits are set to 1 as follows  
(00011111) the last 5 bits are the host bits.)

\* Subnet 2: 192.168.67.63 • 127 (0011111)

Subnet 3: 192.168.67.127 • 127 (0111111)

Subnet 4: 192.168.67.159 • 127 (10011111)

Subnet 5: 192.168.67.191 • 127 (10111111)

Subnet 6: 192.168.67.223 • 127 (11011111)

Subnet 7: 192.168.67.255 • 127 (11111111)

Subnet 8: 192.168.67.255 (01011111)

3- Total no. of Ip address:-

There are 5 host bit in each subnet  
therefore total no. of Ip address in Subnet  
is given by  $(2^5 - 2) = 30$  for networks  
address from 2 addresses are reserved  
for networks. & broadcast, total  
usable address will be  $(32 - 2) = 30$ .

4- Range of IP addresses :-

The Range of IP address for each Subnet starts from Subnet ID and ends at broadcast address.

The range of act. IP addresses in each Subnet :-

Subnet 1: 192.168.67.0 to 192.168.67.31

Subnet 2: 192.168.67.32 to 19.168.67.63

Subnet 3: 192.168.67.64 to 19.168.67.95

Subnet 4: 192.168.67.96 to 192.168.67.127

Subnet 5: 19.2.168.67.128 to 192.168.67.159

Subnet 6: 160.192.168.67.160 to 192.168.67.191

Subnet 7: 192.168.67.192 to 192.168.67.223

Subnet 8: 192.168.67.224 to 192.168.67.255

5. Total no. of hosts:-
- The total no. of hosts in a Subnet is calculated by subtracting 2 bits from the total address ( $32 - 2 = 30$ ) 30 is the total no. of host.

- (1) First and Last usable IP address for each Subnet:-

Subnet 1:

Subnet 1: First 192.168.67.1 Last: 192.168.67.

Subnet 2: First 192.168.67.33 Last: 192.168.67.62

Subnet 3: first 192.168.67.65 last: 192.168.67.98

Subnet 4: first 192.168.67.97 last: 192.168.67.126

Subnet 5: first 192.168.67.129 last: 192.168.67.158

Subnet 6: first 192.168.67.161 last: 192.168.67.190

Subnet 7: first 192.168.67.193 last 192.168.67.222

Subnet 8: first 192.168.67.225 last: 192.168.67.254

## Punification of Calculations :-

### \* Subnet ID:-

The is the identifier for a Specific Subnet and includes the CIDR notation which denotes the size of the Subnet.

### \* Borrowing Bits:- Since a /24 network has 8 bits for host addresses, borrowing 3 bits for subnetting creates 8 subnets ( $2^3$ ) and leaves 5 bits for host addresses for each subnet.

### \* Broadcast address:-

The last address in subnet used to send a message to all hosts in that subnet.

\* Total No. of Ip addresses:- In a /27

Subnet there are  $2^{(32-27)} = 32$  Ip addresses.

\* Range of Ip addresses:-

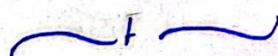
The is 1 is the Span from the Subnet ID to the broadcast address.

\* Total No. of hosts:-

The number of Usable Ip addresses within a Subnet which is the total no. of Ip addresses minus 2 (for the network and the broadcast addresses).

\* First and Last Ip address:-

These are the first and last Ip addresses in the Subnet range that can be assigned to host.



Rubrics	Assessment					Marks
	Unacceptable (0)	Poor (.5)	Acceptable (1.5)	Adequate (2)	Proficient (2.5)	
R1 Identification of constraints/requirements/demands/research gap or challenges well defined	<input type="checkbox"/>					
R2 Engineering knowledge (standards)	<input type="checkbox"/>					
R3 Efficiency of the solution	<input type="checkbox"/>					
R4 Technical Writing	<input type="checkbox"/>					
						<b>Total Marks =</b>

### Rubrics

	Unacceptable	Poor	Acceptable	Adequate	Proficient	Score
R1 Problem/Requirement Identification	Problem not identified	Problem poorly identified	Problem is identified	Problem is defined adequately.	Problem is identified and analyzed in a well-defined manner.	
R2 Engineering knowledge (standards)	Can not apply engineering knowledge to the solution.	Has difficulty applying mathematics to the solution of complex engineering problems	Correctly applies basic sciences to the solution of complex engineering problems	Correctly applies engineering fundamentals to the solution of complex engineering problems	Correctly applies engineering specialization to the solution of complex engineering problems.	
R3 Efficiency of the solution	Solution does not meet requirements.	A difficult and inefficient solution.	A logical solution that is easy to follow but it is not the most efficient.	Solution is adequately efficient.	Solution is efficient, easy to understand, and maintain.	
R4 Technical Writing	The report is submitted but lacks solutions to major requirements.	The report submitted but not according to the requirements.	The requirements of report writing are not properly addressed.	Reports meets all prescribed requirements.	Reports meets all requirements, and it is prepared in original and corrective way to engage readers.	