Name: Raghav Maheshwari
Roll No: 53
Panel: A
Batch: A4

Theory Assignment - 1 (CN)

Q1 Identify following functions and map it to one or more layers of OSI model.

Ans 1. Transmission of bit stream across physical medium:
This function can be mapped to physical layer of OSI model.

2. Define frames
Defining of frame is a function which can be mapped to data link layer. as it is protocol data unit.

3. Error correction and retransmission.
If receiver detects an error in incoming frame it requests sender to retransmit the frame. This function can be mapped to layer 4 i.e. transport of OSI Model and Data link layer i.e. layer 2 of OSI model.

4. Reliable Process to process message delivery:
This function can be mapped to transport model.

Q2 Demonstrate working of Error Control protocol (using Hamming Code) at Sender Side DLL and Receiver Side DLL while transmission of bit stream "1000001" (for error correction Intentionally Consider Received Codeword Erroneous [with single bit error]).

Ans No. of data bits = m = 7
Input data = 1000001

The value of r must satisfy following relation

$$2^r \geq m+r+1$$

$\therefore$ No. of redundant bit will be 4 as $16 = 2^4 \geq 7+4+1 = 12$
The transmitted data will be : $n = 7+4 = 11$ data bits

d	d	d	r_8	d	d	d	r_4	d	r_2	r_1
11	10	9	8	7	6	5	4	3	2	1

Here parity bit R_1, R_2, R_4 & R_8 are redundant bits
$R_1 = d_3, d_5, d_7, d_9, d_{11}$

R_2 is responsible for $\Rightarrow d_3, d_6, d_7, d_{10}, d_{11}$
$\Rightarrow$ Alternate 2 bit including r_2 itself

$R_4 = d_5, d_6, d_7$ (Alternate 4 bits including R_4)

$R_8 = d_9, d_{10}, d_{11}$ (Alternate 8 bits including R_8)

The value of redundant bit will be decided by even parity

1	0	0	R8	0	0	0	R4	1	R2	R1

$R_1 = 1 \oplus 0 \oplus 0 \oplus 0 \oplus 0 \oplus 1 = 0$

$R_2 = 1 \oplus 0 \oplus 0 \oplus 0 \oplus 0 \oplus 1 = 0$

$R_4 = 0 \oplus 0 \oplus 0 = 0$

$R_8 = 0 \oplus 0 \oplus 1 = 1$

The final transmitted code ⇒

1	0	0	1	0	0	0	0	1	0	0

Let us consider received codeword be

D11	D10	D9	R8	D7	D6	D5	R4	D3	R2	R1
1	0	0	1	1	0	0	0	1	0	0
11	10	9	8	7	6	5	4	3	2	1

When this stream is received on receiver same process is repeated.

$R_1 = R_1 ; D_3, D_5, D_7, D_9, D_{11}$ ⇒

$R_2 = R_2, D_3, D_6, D_7, D_{10}, D_{11}$

$R_4 = R_4, D_5, D_6, D_7$

$R_8 = R_8, D_9, D_{10}, D_{11}$

$\therefore R_1 = 0 \oplus 1 \oplus 0 \oplus 1 \oplus 0 \oplus 1 = 1$
$R_2 = 0 \oplus 1 \oplus 0 \oplus 1 \oplus 0 \oplus 1 = 1$
$R_4 = 0 \oplus 0 \oplus 0 \oplus 1 = 1$
$R_8 = 1 \oplus 0 \oplus 0 \oplus 1 = 0$

Now to get corrupted bit $= (R_8, R_4, R_2, R_1)$
$= (0111)_2$
$= (7)_{10}$

Hence bit on 7^{th} position is corrupted so correct code to be transmitted is

1	0	0	1	0	0	0	0	1	0	0
11	10	9	8	7	6	5	4	3	2	1

3. Solve the following:
Given the following IP address: 192.16.5.133/29.
How many total bits are being used to identify the network and how many total bits identify the host? Create 2 Subnets and write subnetwork IP address ranges for each subnetwork.

Ans Here in given IP address /29 notation indicates that the leftmost 29 bits of 32 bit quantity define subnet address. So, 29 bits are being used to identify network. The total bits identify hosts per subnet are three.

11111111 . 11111111 . 11111111111111000

255 255 255 248

Total Subnets $= 2^5 = 32$

Total hosts per Subnet $= 2^3 = 8$

For creating two Subnet we will need to mask 1 bit as network bit as $2^1 = 2$

$\therefore$ Total numbered of bits identify network will be 25.
and total hosts per Subnet will be $2^7 = 128$.
So Subnet IP range will be as follows:

1) 192.16.5.0 --- to --- 192.16.5.127
2) 192.16.5.128 --- to --- 192.16.5.255

Q4 Explain classful addressing for different classes of IPV4 addresses with one example of each Class.

Ans Classful addressing is a concept that divides the available address space of IPV4 into five classes namely A, B, C, D and E.
IPV4 address are represented using 32 bits. The classful addressing dividing the address space into fixed number of blocks and each block has fixed number of hosts.
In class A, B and C the first part of address is considered as net-ID (Network-ID) and second part as host ID.

For Class A: usually assigned to networks with large number of hosts.

The network ID bits are 8 bits long.

HOST ID is 24 bit long.

Higher order bit of first octet in class A is always set to 0. Remaining 7 bits are used to determine network IDs.

Default subnet mask for class A is 255.

Class A has total $(2^7 - 2) = 126$ usable network IDs and $2^{24} - 2 = 16777214$ host IDs.

Class B

IP addresses belonging to class B are assigned to network's that ranges from medium to the network ID is 16 bits long and host ID is 16 bits long. The higher order of first octet is 10. So 14 bits determine network ID.

1	0	Network	HOST

→ Class B

Class C

Network ID is 24 bits long and host ID is 8 bits long.

There are 2^{21} - 2097152 network addresses while $2^8 - 2 = 254$ hosts addresses are present per network.

1	1	0	Network	HOST

= Class C

Class D.

IP addresses are reserved for multicasting. The higher order bits of first octet of IP address belonging to class D

are set to 1110.
IP address range from 224.0.0.0 – 239.255.255.255

Class D =

1	1	1	0	HOST

Class E

IP addresses are reserved for experimental and research ~~paper~~ propose.

class E =

1	1	1	1	HOST

Class E ranges from 240.0.0.0 – 255.255.255.254