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Question # 2 (a)

Ans) The answer is No, there is no such protocol which can be used by the two blue armies to defeat the red army because there is no way of knowing what each blue is thinking about the attack.

- If both the blue armies attack the red army which is present in the valley in that case only the red army can be defeated.

- No proper communication between the two blue armies, so by using the unreliable communication they cannot avoid the defeat.

- If the unreliable works properly one of the blue army commander send a message of attacking the red army and waits for the acknowledgment from the second blue army commander.

- Again if the unreliable communication works and this time if the commander of one blue army receives the acknowledgment from the commander of another blue army, then both



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blue armies attack the red army simultaneously from opposite sides. then the attack can be successful.

- If the unreliable communication won't work i.e. if the order of attack from one blue army commander is missing, then the commander of another blue army commander fails to receive the acknowledgment. Hence the attack can be unsuccessful in defeating the red army because the red army can defeat either of the blue armies separately.

Question # 2 (b)

### PHYSICAL LAYER :

It connects the adjacent devices.

### NETWORK LAYER :

It provides the addressing communication through connection of internet.

### INTERNET LAYER :

It connects the different network networks together.

### TRANSPORT LAYER :

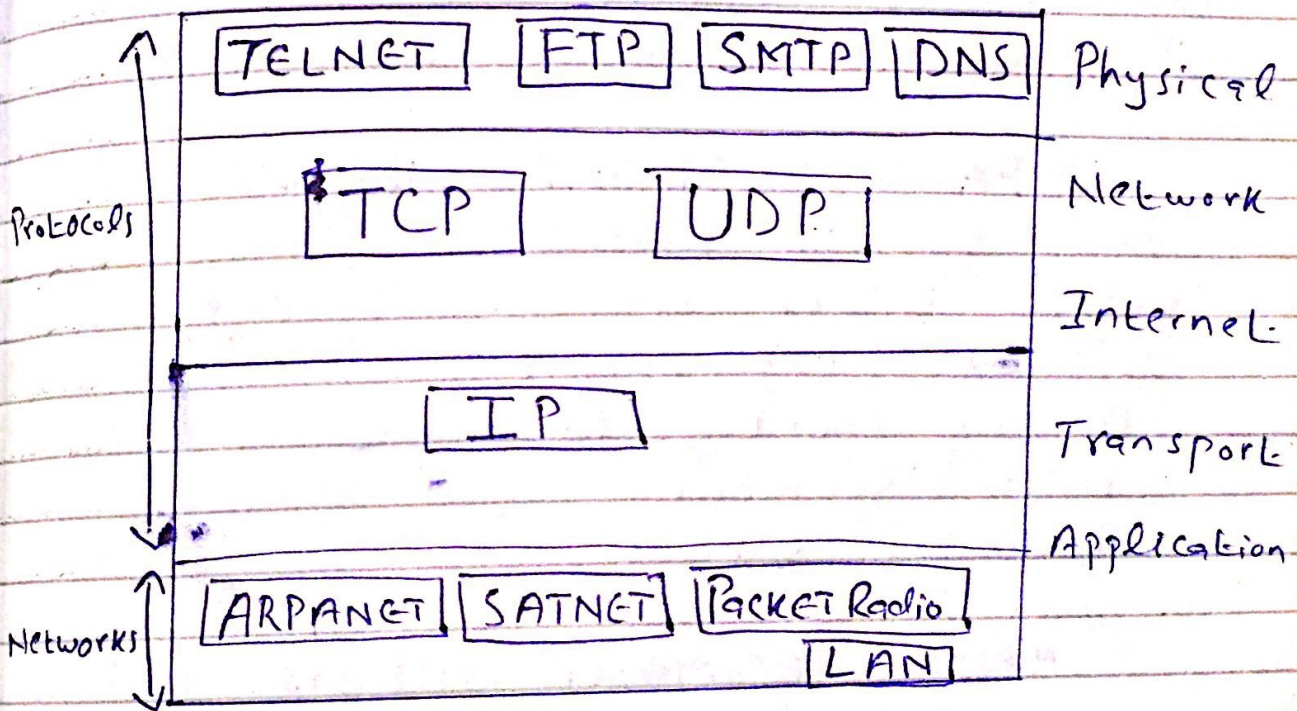
The data is checked by this layer either it is in correct form or not.



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## APPLICATION LAYER :

It Convert that Complex data into readable text.



First the data comes in physical layer and then shifted to network layer where different addressing provide, after that data comes to internet layer where different network unit, then transport layer check the data and sent to application layer where it is again converted into readable text.



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## Question # 4 (C)

There are two main type of Subsystem.

- ① Space Segment Subsystem.
- ② Earth Segment Subsystem.

### SPACE SEGMENT SUBSYSTEM:

The system present in space is called space space subsystem.

All the communication of one city or one country to other are through these segments. Many power antennas are working in space.

### EARTH SEGMENT SUBSYSTEM:

It is also called as ground segment, They transmit a signal to satellite and reception of signal from satellite.

## Question # 1 (a)

$$\text{Bandwidth } B = 600 \text{ Hz}$$

$$\text{SNR}_{\text{db}} = 600$$

We know that

$$C = B \log_2 (1 + \text{SNR})$$

Here SNR is given in db

So we know that

$$\text{SNR}_{\text{db}} = 10 \log_{10} (\text{SNR})$$

OR



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$$\text{SNR}_{\text{db}}/10 = \log_{10}(\text{SNR})$$

$$600/10 = \log_{10}(\text{SNR})$$

$$60 = \log_{10}(\text{SNR})$$

OR

$$\text{Antilog } 60 = \text{SNR}$$

$$\text{SNR} = 1 \times 10^{60}$$

$$C = 600 \log_2(1 + \text{SNR})$$

$$C = 600 \log_2(1 + 10^{60})$$

$$C = 600 \times 60$$

$$C = 3600 \text{ Hz}$$

Question # 1 (b)

$$C = 4800$$

$$\log_2 M = 8$$

We know that

$$C = 2B \log_2 M$$

$$4800 = 2B \times 8$$

$$4800/16 = B$$

$$B = 300 \text{ Hz}$$



⑥

### Question # 3 (a)

$$\begin{aligned}\text{Wavelength} &= 0.050 \\ \text{Path to satellite from earth} &= 3563 \text{ km} \\ \text{Free space loss in} \\ \text{db} &= -20 \log(\text{wavelength}) + 20 \log(\text{distance}) \\ &\quad \text{in km} + 21.98 \\ &= 20 \log(0.050) + 20 \log(3563) + 21.98 \\ &= 20(-1.30) + 20(4.55) + 21.98 \\ &= 26 + 91 + 21.98 \\ &= 138.98 \text{ db}\end{aligned}$$

### Question # 3 (b)

Particular signal system = -155 dbw  
Link transmitting 2400 bps  
Temperature 1600k

$$\begin{aligned}\text{We know that} \\ E_b/N_0 &= -155 \text{ dbw} - 10 \log(2400) - 10 \log \\ &\quad (1600) + 228.6\end{aligned}$$

$$\begin{aligned}&= -155 \text{ dbw} - 10(3.3) - 10(3.2) + \\ &\quad 228.6 \\ &= -155 \text{ dbw} - 33 - 32 + 228.6\end{aligned}$$

$$= -155 + 229.6$$

$$= 74.6$$



## Question # 4 (a)

## GEO (Geostationary Orbit) ♂

- They have the same velocity with the Earth while they orbit it at around 35000 kilometers.
- They are the biggest and largest compared to LEO and MEO Satellites hence they have the biggest footprint.
- They are efficient for they use few Satellites to have a full coverage of the Earth hence the deployment is cheaper than in LEO and MEO.
- They also have the greatest visibility among the others types of Satellites MEO and LEO.
- Have the greatest latency basic they are the furthest.
- They also have a long life compared to LEO.
- They are the least expensive to deploy.
- Orbit period is about 24 hours.



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## LEO (Low Earth Orbit) :

- They orbit the Earth at about 500 to 1500 kilometers.
- They have the lowest latency basing they are the closest to earth.
- They need a lot of satellites to cover the earth compared to GEO and MEO.
- They also have the least visibility among the others types of satellites GEO and LEO.
- They are the smallest compared to GEO and LEO.
- They are the most expensive to deploy.
- Have a short satellite life.

## MEO (Medium Earth Orbit) :

- They orbit the earth at about 5000 to 12000 kilometers.
- They orbit the earth at a duration of two to eight hours.
- They have a low Handoffs.
- Have a long life than LEO.
- Deployment of these satellites is required between eight to twenty.
- They have a medium latency compared to LEO and GEO.



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Question # 4 (b)

~~Let Satellite altitude be  $S = 36786 \text{ km}$~~

Let Satellite altitude be  $S = 36786 \text{ km}$

Uplink delay is calculated as  $T = S / c$

where  $c$  is the speed of light

$$\begin{aligned} & (36786 \times 10^3) / (3 \times 10^8) = \underline{12262} \\ & = 12262 \text{ ms} \end{aligned}$$

Round Trip delay is calculated as

$T = 2S / c$  where  $c$  is the speed

of light.

$$(36786 \times 10^3 \times 2) / (3 \times 10^8) = 24524 \text{ ms}$$