ICS-432 Review Questions

Choose the correct option from the following:

1. **Which of the following can be determined from a frequency-domain graph of a signal?**

   A. Bandwidth
   B. Phase
   C. Power
   D. All the above

2. **If the bandwidth of a signal is 5 KHz and the lowest frequency is 52 KHz, what is the highest frequency?**

   A. 5 KHz
   B. 10 Khz
   C. 47 Khz
   D. 57 Khz

3. **The physical layer is responsible for movements of individual _____from one hop (node) to the next.**

   A. Message
   B. Frames
   C. Bits
   D. Packets

4. **The session layer is responsible for_____**

   A. Dialog
   B. Synchronization
   C. Control
   D. all of above

5. **_____of addresses are used in an internet employing the TCP/IP protocols.**

   A. Three levels
   B. Four levels
   C. Five levels
   D. Six levels

6. **_____is responsible for moving frames from one hop (node) to the next.**

   A. The data link layer
   B. The physical layer
   C. The transport layer
   D. The session layer

7. **_____ Address is necessary for universal communication**

   A. Logical
   B. Physical
   C. Port
   D. Specific

Define the following terms

- ***Data communications***

The exchange of data between two devices via some form of transmission medium such as a wire cable.

- ***Protocols***

A set of rules that govern data communications. It represents an agreement between the communicating devices.

Write True/False for the given statements.

1. In a time-domain plot, the vertical axis measures the Amplitude
2. As frequency increases, the period increases
3. Routing is the responsibility of network layer.
4. A port address is a 28-bit address represented by one decimal number.
5. Logical address and port remain the same from hope to hope.
6. The bandwidth-delay product defines the number of bits that can fill the link
7. The presentation layer is responsible for the delivery of a message from one process to another.

Write your answer here:

1	2	3	4	5	6	7
T	F	T	F	T	T	F

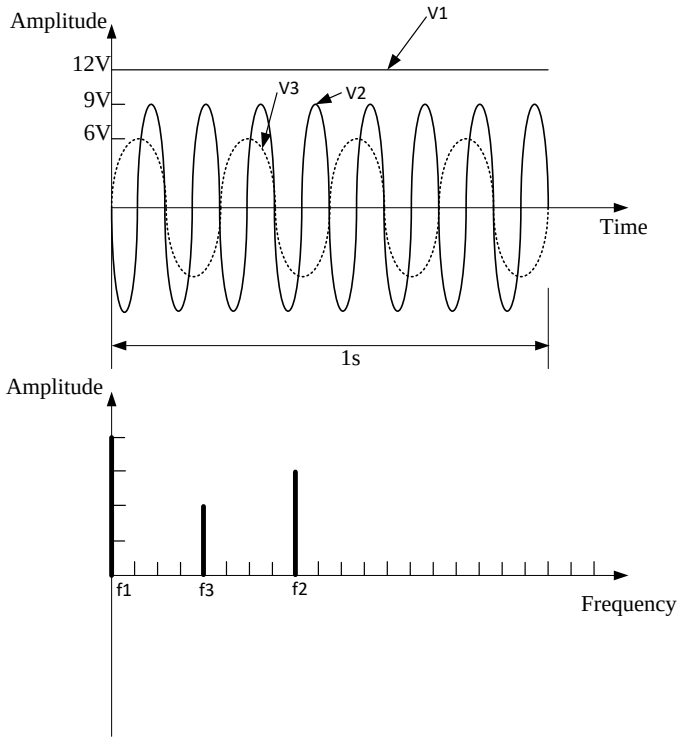
Question

A. A sine wave is offset 1/4 cycle with respect to time 0. What is its phase in degrees and radians?

$$\frac{1}{4} \times 360^0 = 90^0$$

$$90^0 \times \frac{2\pi}{360} rad = \frac{\pi}{2} rad$$

B. Convert the time domain plot to frequency domain for three sine waves



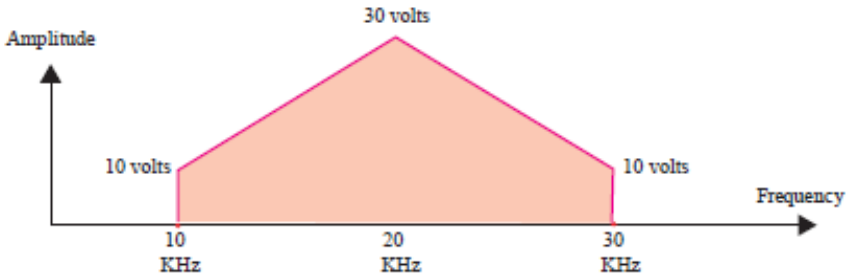
C. The period of a signal is 2000 µs. What is its frequency in kilohertz?

First we change 2000 µs to seconds, and then we calculate the frequency from the period (1 Hz = 10^{-3} kHz).

$$2000\mu s = 2000 \times 10^{-6} s = 2 \times 10^{-3} s$$

$$f = \frac{1}{T} = \frac{1}{2 \times 10^{-3} s} = 500hz = 0.5Khz$$

D. A non-periodic composite signal contains frequencies from 10 to 30 KHz. The amplitude is 10 V for the extreme (min and max) frequencies and 30 V for middle frequency. Assuming that the amplitudes change gradually from the minimum to the maximum. Draw the frequency spectrum of the signal.

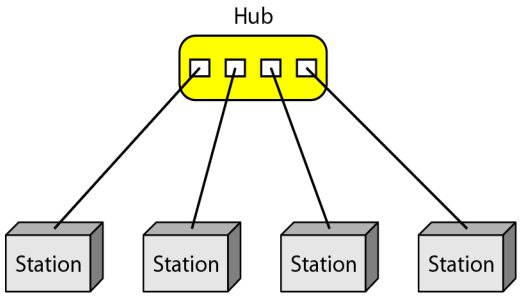


E. Consider a noiseless channel with a bandwidth of 1000 Hz transmitting a signal with six signal levels, calculate the maximum bit rate.

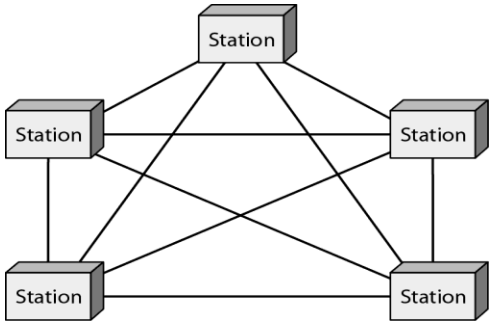
$$\text{bit rate} = 2 \times \text{bandwidth} \times \log_2 L = 2 \times 1000 \times \log_2 6$$

Name the following type of Physical network topologies:

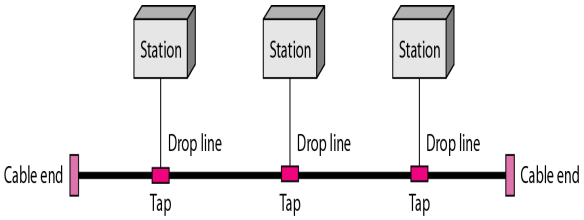
A. _ start Topolgy _____



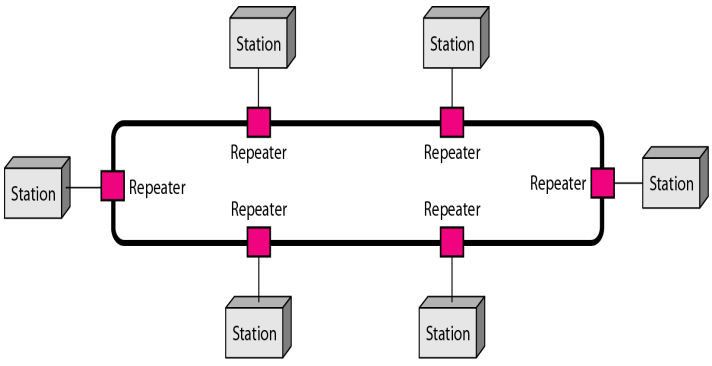
B. __ Mesh Topolgy _____



C. _ Bus Tipology _____



D. _ Ring Topolgy _____



Question

Write True/False for the given statements.

1. In data communications, we commonly use periodic analog signals and no periodic digital signals

2. As frequency increases, the period decreases

3. Increasing the levels of a signal may increase the reliability of the system.

4. A port address is a 28-bit address represented by one decimal number.

5. Logical address and port remain the same from hope to hope.

6. If a signal changes instantaneously, its frequency is zero.

7. Analog signals can have an infinite number of values in a range.

Write your answer here:

1	2	3	4	5	6	7
T	T	F	F	T	F	T

Question

A. Consider a noiseless channel with a bandwidth of 1000 Hz transmitting a signal with two signal levels. Calculate maximum bit rate using Nyquist formula?

Bit rate = 2 * bandwidth * $\log_2 L$

= $2*1000*\log_2 2 = 2000$ bps

B. If a periodic composite signal is decomposed into three sine waves with frequencies of 200, 400, 600 HZ. What is its Bandwidth?

Bandwidth = $f_h - f_l$ = 600-200 = 400 Hz

c. A digital signal has 32 levels. How many bits are needed per level?

= $\log_2 (32) = 5$

D. If for a simple analog signal , Value of period is 0.5 s. What is value of frequency?

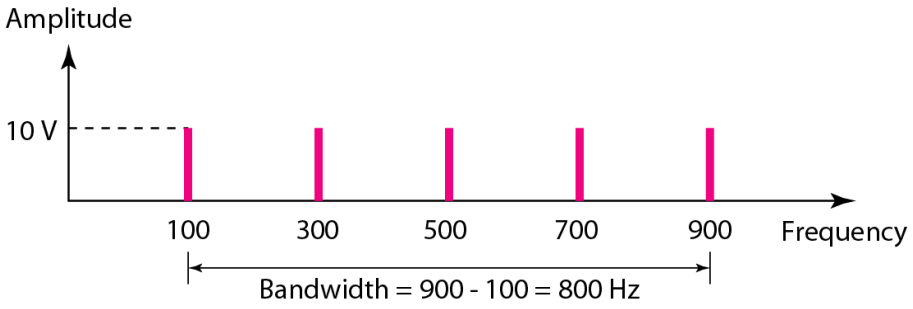
f = 1 / T = 1/0.5 = 2 Hz

E. A sine wave is offset 1/4 cycle with respect to time 0. What is its phase in degrees and radians?

$$\frac{1}{4} \times 360^0 = 90^0$$

$$90^0 \times \frac{2\pi}{360} rad = \frac{\pi}{2} rad$$

F. If a periodic signal is decomposed into five sine waves with frequencies of 100, 300, 500, 700, and 900 Hz. Draw the spectrum, assuming all components have a maximum amplitude of 10 V.



1) "_____ are the exchange of data between two devices via some form of transmission medium such as a wire cable.

(a) Data communications. (b) Protocol.

(c) Router. (d) cable.

2) In the communication, TCP/IP model contain _____ layers.

(a) 5. (b) 9.

(c) 7. (d) 3.

3) 07:01:02:01:2C:4B is an example for type of address called _____.

(a) Logical address. (b) Physical address.

(c) Port address. (d) Specific address.

4) The term analog data refers to information that is _____.

(a) discrete (b) Constant

(c) none of above (d) continuous

5) _____ describes the position of the wave form relative to time 0.

(a) Phase. (b) Time.

(c) Period. (d) Frequency.

6) The physical layer concerns with_____.

(a) A. bit-by-bit delivery. (b) process to process delivery.

(c) application to application delivery. (d) none of the mentioned.

7) Wireless transmission can be done via _____.

(a) radio waves. (b)microwaves

(c) infrared. (d)all of the mentioned

8) The 4-byte IP address consists of _____

(a)network address. (b)host address

(c)both network address & host address. (d)none of the mentioned

9) The network layer concerns with

(a) Bits (b) frames

(c) Packets. (d)none of the mentioned

10) This layer is an addition to OSI model when compared with TCP IP model

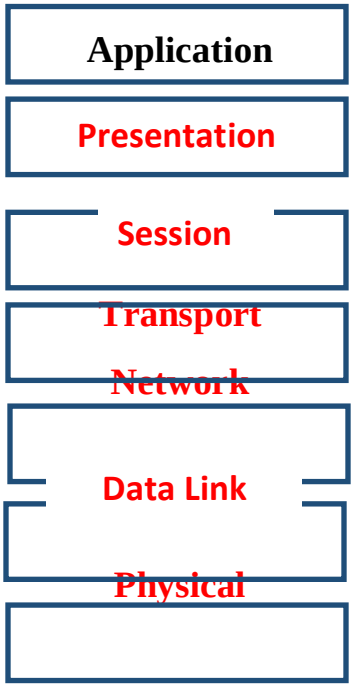
(a)Application layer (b)Presentation layer

(c)Session layer (d)Both Session and Presentation layer

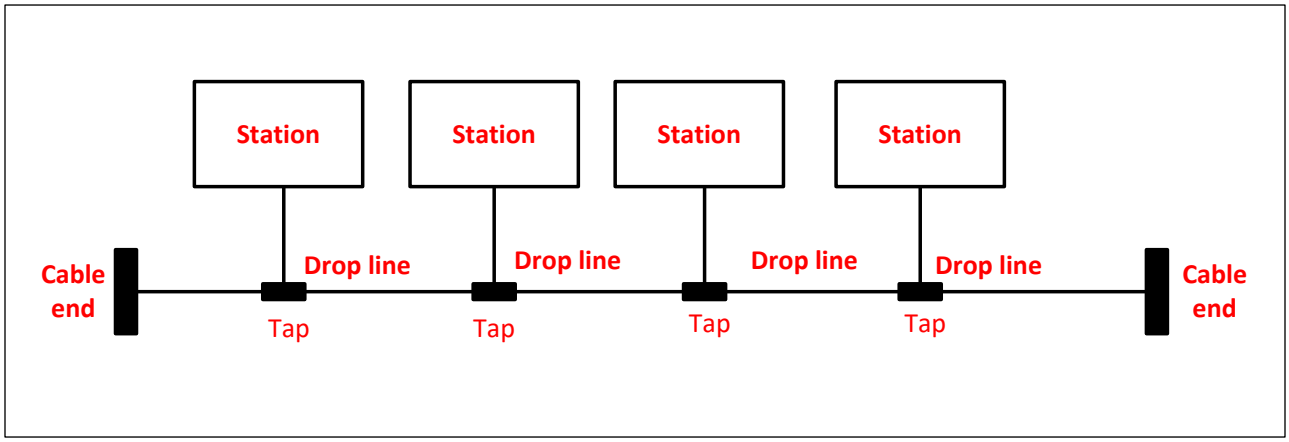
Question 2: Indicate True/False Statement? And correct the wrong sentence

No	Questions	True/False
1	The physical layer is responsible for movements of individual bits from one hop (node) to the next node. The correction: ……	(True)
2	A network is a set of devices connected by communication links The correction: ……	(true)
3	Digital signals can have only a limited number of values. The correction: ……	(true)
4	The application layer is not responsible for providing services to the user. The correction: The application layer is responsible for providing services to the user	(False)
5	Data communication system within a building or campus is WAN. The correction: Data communication system within a building or campus is LAN.	(False)

Question 3: **Consider the following diagram for OSI model and fill it with the right layer name and right sequence.**



Question 4: **Draw a network where a *Bus* or *Linear* topology is used to connecting four stations.**



Question 5: **Match the item in column A with a correct item in column B**

Column A	*Column B*
1. The required bandwidth is proportional to	**a. uses a routing table that is based on the destination address.**
2. Increasing the levels of a signal	**b. how many signal levels we need.**
3. The most important responsibilities of the data link layer	**c. flow control and error control.**
4. A switch in a datagram network	**d. may reduce the reliability of the system**
5.Provide access to the end user	**e. the bit rate.**
6. Nyquist formula tells us	**f. Application layer**

Write your answer here:

1	2	3	4	5	6
e	**d**	**c**	**a**	**f**	**b**

Question 6: **Choose two from the following scenarios**

A) If we assume that SNR_{dB} = 36 and the channel bandwidth is 2 MHz. What is the theoretical channel capacity?

Solution

we can use two methods

1) $\begin{cases} SNR_{dB} = 10\log_{10} SNR \\ then\ SNR = 10^{SNR_{dB}/10} = 10^{3.6} = 3981 \end{cases}$

$C = B\log_2(1+SNR)$

$$C = 2 \times 10^6 \times \log_2 3982 = 24\ Mbps$$

2) ***For practical purposes, when the SNR is very high, we can assume that SNR + 1 is almost the same as SNR. In these cases, the theoretical channel capacity can be simplified to***

$$C = B \times \frac{SNR_{dB}}{3}$$

$$C = 2MHz \times \frac{36}{3} = 24\ Mbps$$

B) Assume a network with bandwidth of 10 Mbps can pass only an average of 12,000 frames per minute with each frame carrying an average of 10,000 bits. What is the <u>throughput</u> of this network?

Solution

We can calculate the throughput as

$$Throughput = \frac{12000 \times 10000}{60}$$

$$= 2Mbps$$

The throughput is almost one-fifth of the bandwidth in this case.

C) What is the <u>propagation time</u> if the distance between the two points is 12,000 km? Assume the propagation speed to be 2.4×10^8 m/s in cable?

solution:

We can calculate the propagation time as

$$\text{Propagation time} = \frac{12000 \times 1000}{2.4 \times 10^8}$$

$$= 50\ ms$$

Choose the correct option from the following:

1. **Framing is the responsibility of _____Layer.**
   A. Physical.
   B. Network
   C. Data Link
   D. all of above

2. **In Single point connection, channel is _____**
   A. Shared Spatially
   B. Shared Partially
   C. Spatially or partially
   D. Not shared

3. **In _____, there is no direct traffic between devices.**
   A. Mesh topology
   B. Star topology.
   C. Ring topology.
   D. Bus topology

4. **For process to process communication, _____ address is used.**
   A. Logical
   B. Port
   C. Physical
   D. Specific

5. **_____ Address will be changed from hop-to-hop.**
   A. Logical
   B. Physical
   C. Port
   D. Specific

Write your answer here:

1	2	3	4	5
C	D	B	B	B

Write True/False for the given statements.

1. **Physical address is added at the network layer.**
2. **A Logical address is a 28-bit address represented by one decimal number.**
3. **Number is the only form of information.**
4. **A data communication system must transmit data to the correct destination in an accurate manner.**
5. **Routing is the responsibility of Transport Layer.**

Write your answer here:

1	2	3	4	5
F	F	F	T	F

A. What is difference between guided and unguided transmission media.

Guided media, which are those that provide a conduit from one device to another, include twistedpair cable, coaxial cable, and fiber-optic cable.

Unguided media transport electromagnetic waves without using a physical conductor

B. Describe the difference between sky propagation and ground propagation in terms of frequency.

Ground propagation:

Below 2 MHz

Sky propagation:

Between 2 – 30 MHz

A. Find the class of each of following addresses:

i. **140 . 23.120.8** **Class B**

ii. **00000001 00001011 00001011 11101111** **Class A**

B. A block of addresses is granted to a small organization. We know that one of the addresses is 205.16.37.39/22 .

i. **What is the first address in the block?**

32 – 22 = 10
11001101 0001000 00100100 00000000
205.16.36.0

ii. **What is the last address in the block?**
11001101 0001000 00100111 11111111
205.16.36.255

A. Find the error, if any, in the following IP addresses:

a. 11100010.56.045.78
b. 22 .32.7.8.200
c. 075.45.301.14
d. 299.23.14.67

a. A mixture of binary notation and dotted-decimal notation is not allowed.
b. There can be no more than four numbers.
c. There must be no leading zero (075).
d. Each number needs to be less than or equal to 255.

B. Use the shift cipher with key = 5 to encrypt the message "HELLO."

MJQQT

Match the correct choice of Column A with Column B and Write Answer as Answer.

Column A	Column B
1. symmetric-key cryptography	A. A top level domain
2. This layer is responsible for moving frames from one hop (node) to the next.	B. The same key is used by the sender(for encryption) and the receiver (for decryption).
3. Point-to-Point WAN	C. Data in the physical layer
4. Bits	D. The combination of an IP address and a port number is called a socket address
5. .com	E. Connects two communicating devices through a transmission media (cable or air).
6. Socket Address	F. The data link

1	2	3	4	5	6
B	F	E	C	A	D

Question 4: Select the correct answer(s):

1. **A protocol suite (a set of protocols organized in different layers) used in the Internet today.**
    1. **TCP/IP**
    2. Networks
    3. Internet
    4. Email

2. **Refers to the way in which a network is laid out physically:**
    1. **Physical topology**
    2. IOS
    3. Data
    4. IP

3. **An IPv4 address is:**
    1. 64 bits long
    2. 128 bits long
    3. **32 bits long**
    4. 512 bits long

4. **The IPv4 addresses are (choose that all apply):**
    1. **unique**
    2. not used anymore
    3. local
    4. none of the above

5. **An IPv6 address is:**
    1. 64 bits long
    2. **128 bits long**
    3. 32 bits long
    4. 512 bits long

6. **A dedicated connection called a circuit, is always available between the two end systems; the switch can only make it active or inactive, this type of network is called:**
    1. Star topology
    2. Mesh topology
    3. Packet switched network
    4. **Circuit Switched Network**

7. **The layer that is responsible for movements of individual bits from one hop (node) to the next is:**
    1. Data link layer

2. Network layer
3. **Physical layer**
4. Application layer

8. **The layer that is responsible for providing services to the user is:**
    1. Data link layer
    2. Network layer
    3. Physical layer
    4. **Application layer**

9. **A hierarchical decentralized naming system for computers, services, or other resources connected to the Internet or a private network.**
    1. Email
    2. **DNS**
    3. SMTP
    4. none of the above

10. **Which error and flow control mechanisms is the most efficient:**
    1. Stop-and-Wait
    2. Go-Back-N ARQ
    3. **Selective-Repeat ARQ**
    4. piggybacking

11. **A a standard for specifying any kind of information on the Internet and defines four things: protocol, host computer, port, and path:**
    1. **URL**
    2. Email
    3. SMTP
    4. None of the above

12. **A a message-oriented, reliable protocol that combines the good features of UDP and TCP.**
    1. WWW
    2. **SCTP**
    3. TCP
    4. DNS

13. A Socket Address is the combination of:

1. **IP Address and Port number**
2. Error control and flow control
3. Multiplexing and Demultiplexing
4. Ports 80 and 81

14. UDP packets are called:

1. **User Datagrams**
2. Segments
3. Bits
4. Ports

15. It enables a user to have a large set of addresses internally and one address, or a small *set of addresses, externally.*

1. IOS
2. **NAT**
3. Checksum
4. None of the above

16. It coordinates the amount of data that can be sent before receiving acknowledgement:

1. **Flow control**
2. Error control
3. Error correction
4. MAC Address

17.Which one of the transport layer protocols is a connectionless protocol?

1. HTTP
2. HTTPS
3. **UDP**
4. TCP

18.The physical path between transmitter and receiver:

1. **Transmission Media**
2. Port number

3. IP Address
4. Routing table

19. A type of electrical cable that has an inner conductor surrounded by a tubular insulating layer, surrounded by a tubular conducting shield.

1. Twisted pair
2. **Coaxial cable**
3. Optical fiber
4. None of the above

20. A software(program) that provides service to the user to make the process of sending and receiving a message easier.

1. Flow control
2. Internet of Things
3. IPv6
4. **User Agent(VA)**

Question 5: Answer the following questions (Any two):

A. What are the types of data flow in data communications?

Communication between two devices can be simplex, half-duplex, or full-duplex.

B. What are the advantages of TCP/IP?

1. ***It is not controlled by any single company.***
2. ***It is compatible with all operating systems, so it can communicate with any other system.***
3. ***Compatible with all types of computer hardware and networks.***

c. **What are operations performed by UDP? (Write any three)**

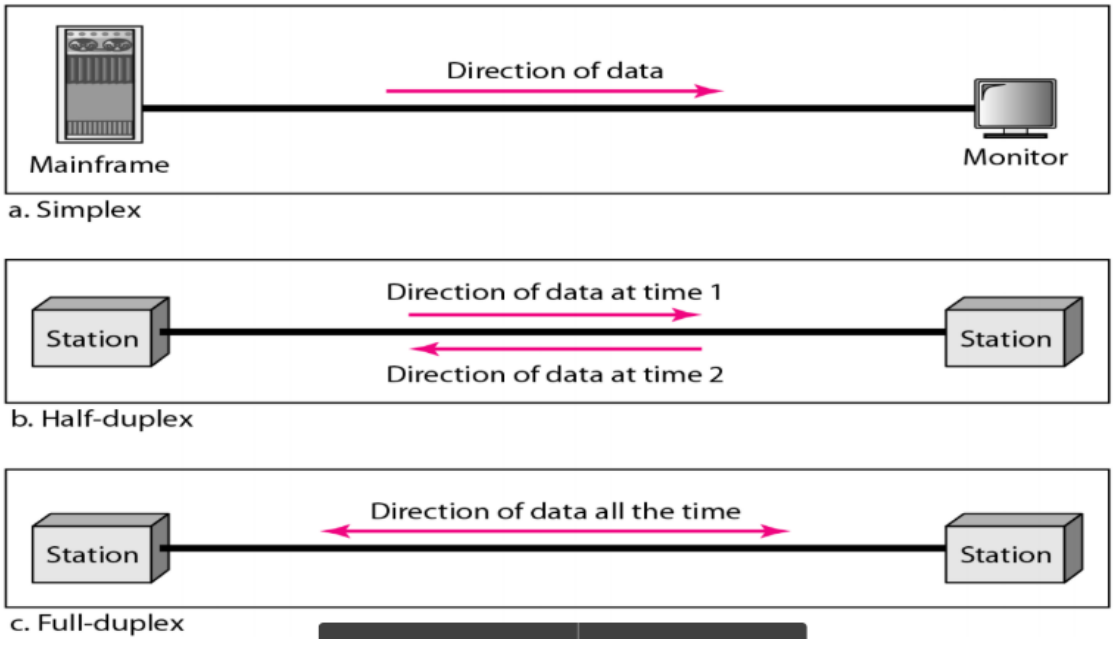
1. Connectionless Services
2. Flow and Error Control
3. Encapsulation and Decapsulation
4. Queuing

Find the class of each address.

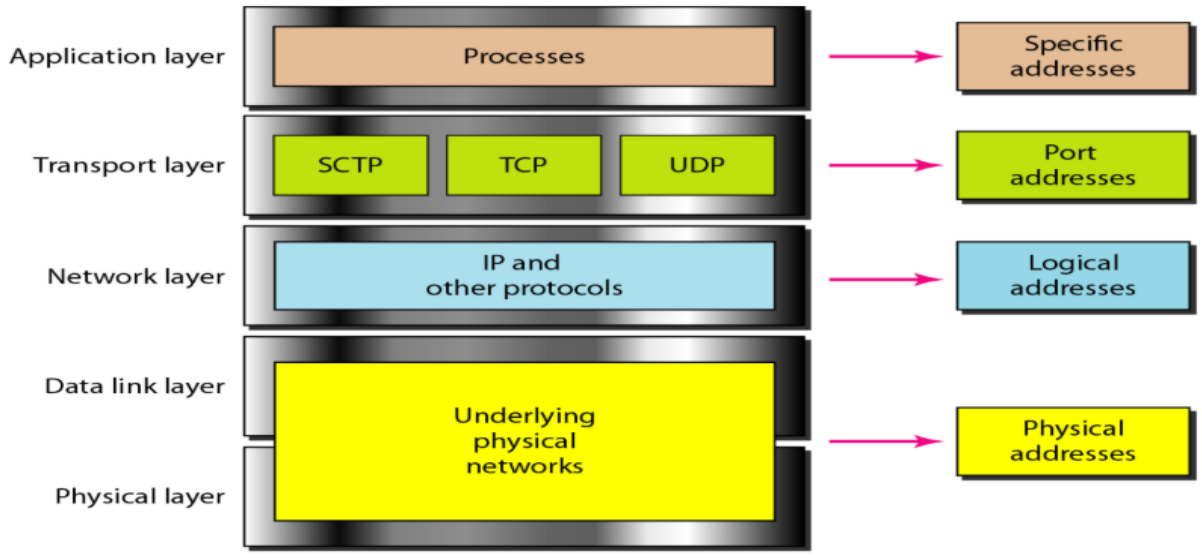
a. **110**00001 10000011 00011011 11111111
b. **14**.23.120.8
c. **0**0000001 00001011 00001011 11101111
d. **252**.5.15.111

a. The first 2 bits are 1; the third bit is 0. This is a class C address.
b. The first byte is 14; the class is A.
c. The first bit is 0. This is a class A address.
d. The first byte is 252; the class is E.

A. There are three types of data communication between two devices. Name the data flow type in the following figure by filling in the box.



B. There are four types of addresses, fill in the blank space with the correct address.



C. Write the two ways in which digital signals can be transmitted.

- **Base band Transmission**
- **Broadband transmission**

D. Referring to transmission impairment, define Noise. Also write any two types of Noise.

Noise:

Noise is the external energy that corrupts a signal.

Types of Noise:

i. **Thermal**
ii. **Induced**
iii. **Crosstalk**
iv. **Impulse**

A. Choose the correct option from the following:

1. **A _____ cable consists of an inner copper core and a second conducting outer sheath.**
   A. Twisted-pair
   B. Shielded twisted-pair
   C. Coaxial
   D. Fiber-optic

2. **A beam of light moves from one medium to another medium with less density. The critical angle is 60°. We have reflection light for which of the following incident angles?**
   A. 40°
   B. 60°
   C. 80°
   D. 30°

3. **_____Propagation relies on the ionosphere and the surface of the earth to refract waves back-and-forth.**
   A. Ground-wave
   B. Sky-wave
   C. Line of sight
   D. All of the above

4. **In _____, resources are allocated on demand.**
   A. Circuit switching
   B. Packet switching
   C. Frame switching
   D. Message switching

5. **In a _____ network, two types of addressing are involved: global and local**
   A. Datagram
   B. Virtual-circuit
   C. Circuit-switched
   D. Packet Switching

Write your answer here:

1	2	3	4	5
C	C	B	B	B

6. **In _____ switching, the paths in the circuit are separated from one another spatially.**
   A. Time-division
   B. Two-dimensional
   C. Space-division
   D. Three-dimensional

7. **Circuit switching takes place at the _____ layer.**
   A. Physical
   B. Data link
   C. Network
   D. Transport

8. **If a label is not terminated by a null string, it is called a _____.**
   A. PQDN
   B. FQDN
   C. SQDN
   D. NQDN

9. **In a _____name space, each name is made of several parts.**
   A. Flat
   B. Hierarchical
   C. Organized
   D. Sequential

10. **A host with the domain name pit.arc.nasa.gov. is on the _____ level of the DNS hierarchical tree. (The root is level one.)**
    A. Third
    B. Fourth
    C. Fifth
    D. Sixth

Write your answer here:

6	7	8	9	10
C	A	A	**B**	C

B. Write True/False for the given statements.

1. **A Secondary server loads all information from the primary server.**
2. **A Domain Server is a server whose zone consists of the whole tree.**
3. **A parabolic dish antenna is a(n) omnidirectional antenna.**
4. **Infrared waves are used for short-range communications like Bluetooth, wireless keyboard.**
5. **In a one-stage space division switch, if N = 200, the number of crosspoints is 20,000.**
6. **A multistage switch combines crossbar switches in several (normally three) stages.**

Write your answer here:

1	2	3	4	5	6
True	False	False	True	False	True

A. Consider following routing table in a virtual circuit network.

Incoming		Outgoing	
Port	VCI	Port	VCI
1	14	3	22
2	71	4	41
2	92	1	45
3	58	2	43
3	78	2	70
4	56	3	11

Find the output port and the output VCI for packets with the following input port and input VCI addresses:

Packet	Incoming Port	Incoming - VCI	Outgoing Port	Outgoing - VCI
1	3	78	2	70
2	2	92	1	45
3	4	56	3	11
4	2	71	4	41

B. Find the number of crosspoints in a three-stage , 300×300 switch (N = 300) with k = 4 and n = 30 .

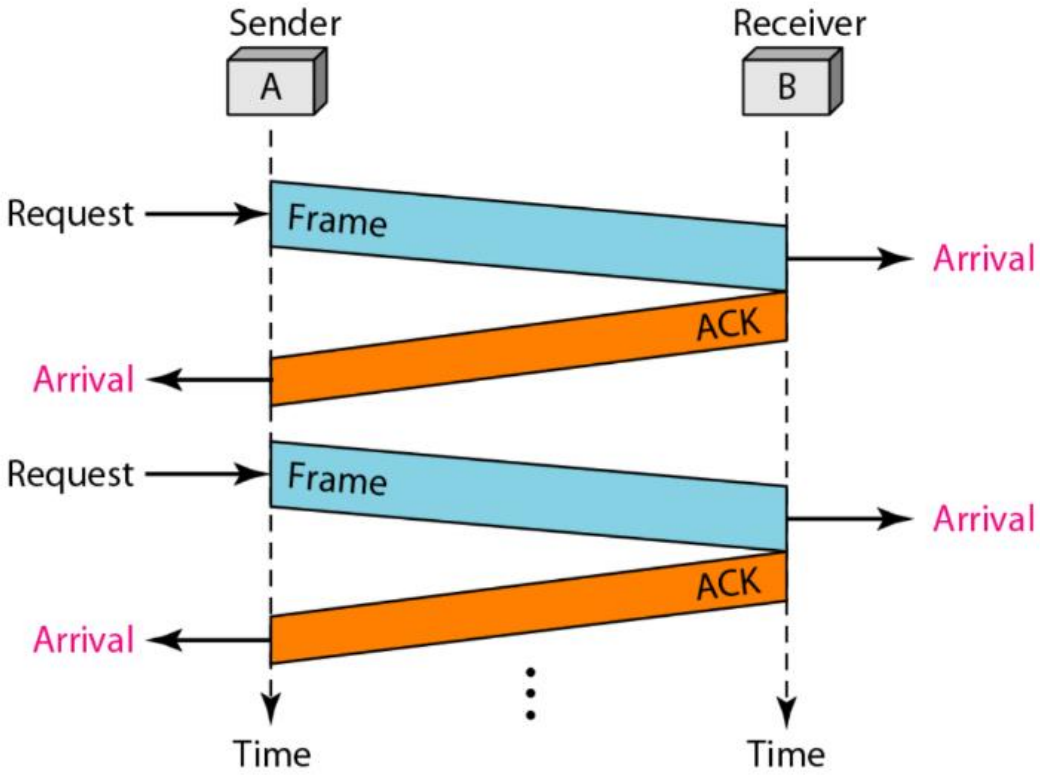
The total number of crosspoints :

$$2kN+k(N/n)^2$$

$$=2(4)(300) + 4(300/30)^2$$

$$= 2400 +400 = 2800$$

A. Answer the given questions considering following flow diagram for Stop and Wait protocol.



i. How many frames are transferred from sender to receiver?

2

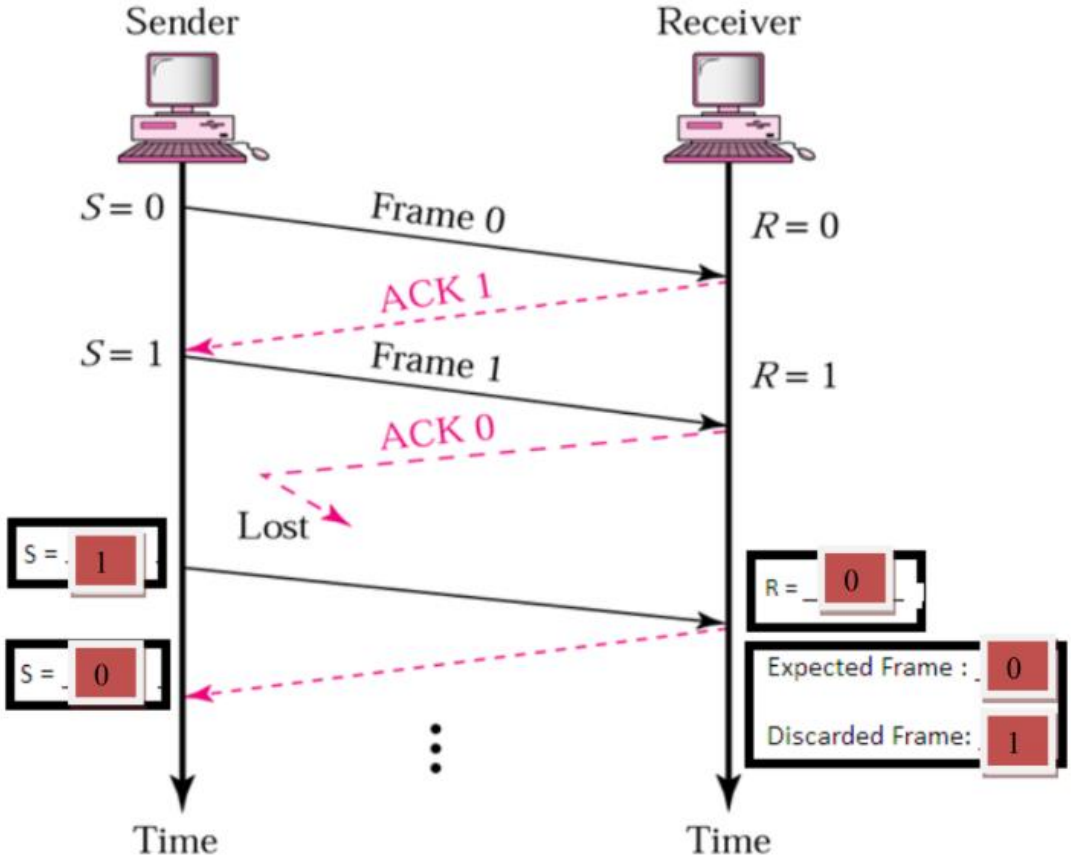
ii. How many events are for sender?

4

iii. How many events are for receiver?

2

B. Consider sequence of frames to be sent as 0 1 0 1 0 and complete the following flow diagram by filling in the blanks for Stop-And-Wait ARQ – Lost ACK protocol. (1*4=4 marks)



A. A block of addresses is granted to a small organization. One of the addresses is 206.17.38.39/26. Find the total number of addresses?

Number of addresses = 2^{32-n}
= 2^{32-26}
= 2^{6} = 64 addresses

B. Show the shortest (most abbreviated) form of the following IPv6 addresses.

i. 2340: lABC:119A:A000:0000:0000:0000:12AB

2340: lABC:119A: A000:: 12AB

ii. 0000:00AA:0000:0000:0000:0000:119A:A231

0: AA: : 119A:A231

C. Find the class of the following IP addresses.

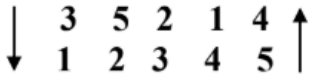
i. 208.34.54.12 ___C_____

ii. 238.34.2.1 _____D_____

iii. 11110111 11110011 10000111 11011101 _____E_____

iv. 10101111 11000000 11110000 00011101 _____B_____

A. Encrypt "INTERNET" using a transposition cipher with the following key:



Plaintext: INTER NET**ZZ** **// ZZ are two bogus characters**

ciphertext: TRNIE TZENZ

TRNIETZENZ

B. Write the correct type of given encryption as Monoalphabetic or Polyalphabetic.

i. Plain Text : Meet me
Encrypted Form: ABBCAB

Answer: _____MonoAlphabetic_____

ii. Plain Text: Meet me
Encrypted Form: ABDCRK

Answer: _____Polyalphabetic_____

C. In RSA, given are two prime numbers p =19 and q =23.

i. **Find n.**

Answer: $19 * 23 = 437$

ii. **Find Φ.**

Answer: $(19-1)(23-1) = (18)(22) = 396$

iii. **Use e =5 to encrypt plaintext: 3.**

Answer: $3^5 \bmod 437 = 243 \bmod 437 = 243$

Question 6:

Find the class of each address.

e. **110**00001 10000011 00011011 11111111
f. **14**.23.120.8
g. **0**0000001 00001011 00001011 11101111
h. **252**.5.15.111

e. The first 2 bits are 1; the third bit is 0. This is a class C address.
f. The first byte is 14; the class is A.
g. The first bit is 0. This is a class A address.
h. The first byte is 252; the class is E.